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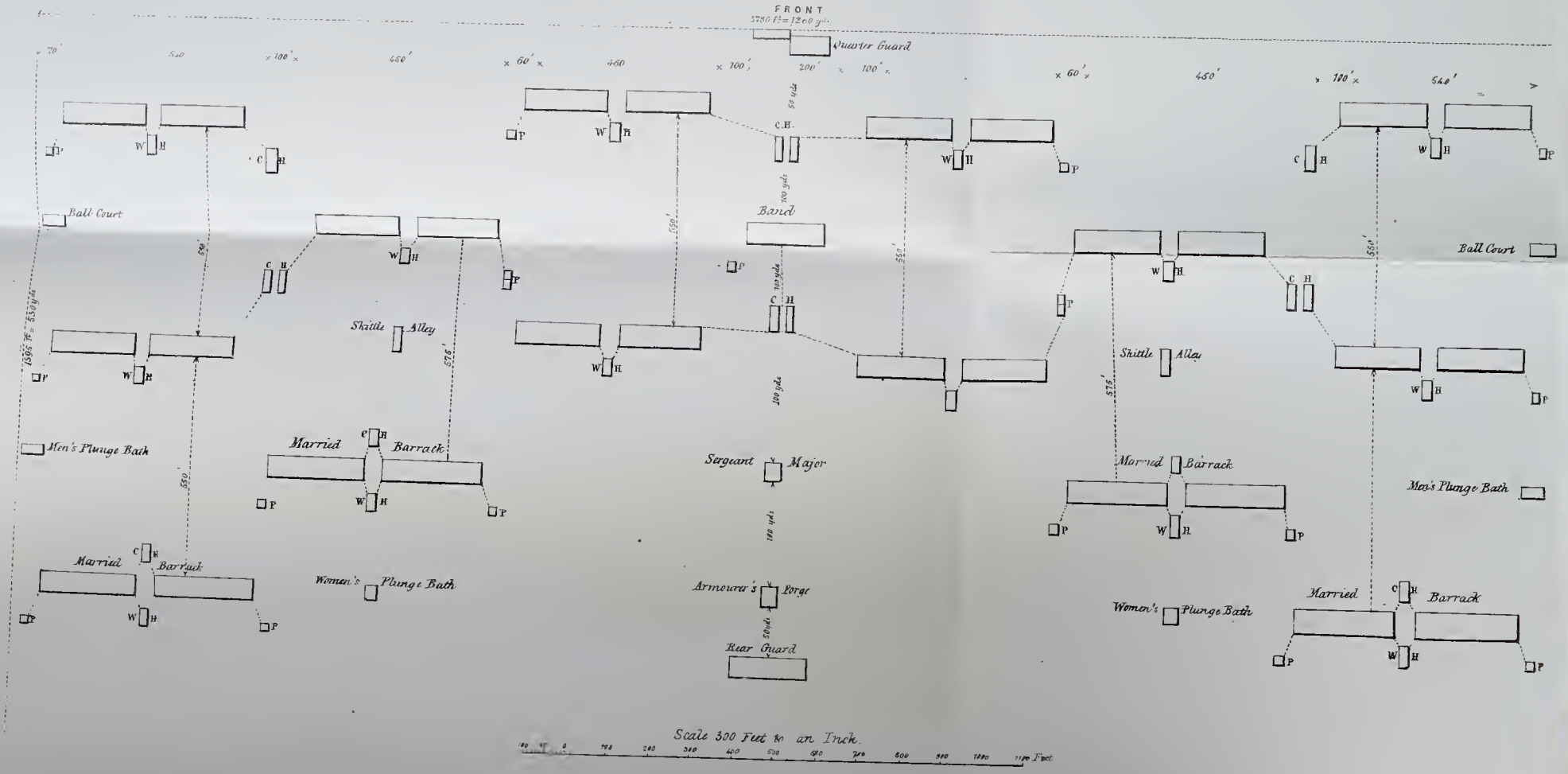
PROPOSED ARRANGEMENT OF THE BUILDINGS FOR A REGIMENT OF INFANTRY IN INDIA.



ARMY HYGIENE

BY

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PREFACE.

Among the numerous works that have of late years treated of Hygiene, there are none devoted solely and entirely to the subject, as it refers to troops in motion and on service. Forty years have elapsed since Dr. Millingen published his work on what he called the duties of army medical officers: but as the circumstances under which he wrote have long since ceased to exist, so have his instructions been long obsolete.

In the following pages I endeavour to express concisely, the measures that are necessary to preserve the health of the British soldier, and to add to his personal well-being during the varying circumstances of his active military life. It has not however been considered necessary to repeat what has been said by numerous previous writers in regard to many points connected with his barrack life; there being indeed, little of any thing in his circumstances under these conditions that is not equally applicable to bodies of men in civil life, massed together.

It is however, but a very partial view to take of the circumstances of a soldier's life, to consider them as requiring no further measures to maintain him effective, and to provide for his necessities while suffering from the casualties incidental to his profession, than what are applicable to, and sufficient for, the conditions of civil life. This will, it is believed, be clearly shown in the present volume; and it will I trust, be rendered equally apparent, that while to meet these requirements, a knowledge of the ordinary subjects that constitute modern Hygiene is no less essential to the army medical officer, than to the private

practitioner,—the former, in order successfully to provide for, and meet the requirements of armies during times of war, must be endowed with a knowledge of dealing with masses in motion and power of rapidly devising measures to meet emergencies,—as well as a capacity for organization, that in the latter are never required.

The great importance of the duties of an army medical officer cannot be correctly judged of by the routine of these in an ordinary garrison town in the United Kingdom. There in fact, they in but few and unimportant respects differ from those of his brother professional man in civil life. His patients, be they soldiers—their wives and children, or officers and their families, only suffer as a general rule, from such diseases or injuries as are liable to affect the population generally. Should a "case" of more than ordinary severity or importance take place among the former classes, the opinion or assistance of a brother medical officer or a private practitioner is easily obtained; and if among the latter, they can readily proceed to any of the capitals, and there consult their own family physician or surgeon.

It is far otherwise however, on foreign or on active service: and inasmuch as these constitute what may be looked upon as the normal circumstances of the army, we have a right to assume that all arrangements connected therewith should be established with special reference to them. It is accordingly in such conditions that the degrees of scientific knowledge, readiness of resource, and capabilities of army medical officers manifest themselves; either to the unspeakable benefit of individuals as well as the masses generally,—or it may unfortunately be, to the loss of life of the one, and utter disorganization of the other. Thus then, while upon the one hand it is the direct interest of the State to obtain for its armies the greatest possible amount of talent; it is no less the imperative duty of young professional men who

enter this branch of the public service, sedulously to qualify themselves for the faithful and efficient discharge of the important duties that fall to their share.

In the pages of works consulted while preparing the present volume, numerous instances have been noted in which the efficiency of an army before the enemy has been maintained solely by the exertions of its medical officers; and throughout the published accounts of the Peninsular War, the attentive student will not fail to note some in which the decision of a commander to accept or refuse battle, was based upon circumstances connected solely with the medical department.

It would add needlessly to the length of these remarks, were extracts to be given from such accounts. There is one illustration however, which in duty to the army medical department, it is but right that I should chronicle, in a work devoted as this is intended to be, to aid its officers in their important duties: it is this:—

Sir James McGrigor gives a remarkable example of the extent to which an efficient medical staff may conduce to the success of military operations. He states that "it was said with much truth by an eminent individual that he thought the extraordinary exertions of the medical officers of the army might be said to have decided the day at Vittoria; for their exertions had undoubtedly added a full division to the strength of Lord Wellington's army, and without those 4,000 or 5,000 men, it is more than doubtful if his lordship with all his unrivalled talents could have carried the day" (Autobiography, p. 331.)

Nor is it alone in times of war that the great influence for good, of a well administered medical department becomes apparent. If we refer to the works that have from time to time been written by army medical officers from that on gun-shot wounds, of date 1563, by Thomas Gale, who seems to have been the first systematic British writer on matters connected with

military medicine and surgery—down to the present day, it will be seen that they have not been behind hand in suggesting those improvements in diagnosis and treatment of disease, which have rendered the present state of medical science so greatly in advance of what it was three centuries ago.

But it is not in the published writings alone of army medical officers that the fruits of their labours are apparent. There are many of their suggestions made verbally to their superior officers, which being acted upon, conduce in most important degrees to the improved condition of the troops, although the public never become aware either of the nature of the suggestions or of their author. Reports are also made to departmental superiors bringing to notice defects in arrangements, and suggestive improvements. Sometimes the recommendations contained in these reports have been tacitly set aside; sometimes they have been adopted and acted upon; but seldom indeed, has the name of their author been made public.

It is elsewhere shown that to the representations of army medical officers towards the end of last century and beginning of the present, we owe many of the improvements that have been effected in barracks for troops: as well as of other improvements now in contemplation. It was to Dr. Robert Jackson that the soldier is indebted for the introduction of a system of dieting while sick in hospital, different to what he received in barracks. To him also it is due that soldiers when sick have separate beds, instead of being permitted to lie in twos and threes upon the same one:—and it is to Sir James McGrigor that the soldier is indebted for the luxury of a bed to himself in barracks.

It was also to the authorities of the army medical department that we owe the withdrawal of several abuses, in regard to the manner of supplying medicines to the forces. In 1747, a warrant of George II. created an Apothecary General, perpetual

furnisher, with remainder to his heirs, of all medicines necessary for the service of the land forces of Great Britain. It was on the recommendation of the Army Medical Board, first established towards the end of last century that this monstrous monopoly was withdrawn, as well as the scarcely less monstrous system of surgeons of regiments being permitted to purchase medicines for the use of their sick; obtaining a pecuniary allowance on that account.

It may well surprise the reader to be informed that prior to 1814, in which year Sir James McGrigor became Director General no regular statistics were kept of the sickness and mortality among our troops. The Medical Board as then constituted, had numerous returns and other checks upon the expenditure for the use of the sick, of articles of diet and of what are called extras : the expenditure of meat, of bread, and all other articles that directly cost money was watched and most carefully noted; but no account was taken of the loss of soldiers, although as we incidentally learn, the rate of the latter was what would now be considered appalling.

Medical officers had, it is true, urged upon the authorities during the half century that preceded this time, such measures as their professional knowledge taught them, were necessary in barracks to improve the condition of the men, and lessen the great mortality that raged among them. It was not however, until Robert Jackson (then a medical officer in *The Buffs*) published his memorable work on the organization and discipline of armies, that the attention of the military authorities became fairly roused to what of late years has been called the sanitary condition of the soldier.

This remarkable work was published in 1805, and we learn that the first improvement thereafter effected, and suggested in it, was the greater attention inculcated in recruiting:—a measure which of itself brought speedily about a diminution in the rates of sickness and mortality.

At the time when Sir James McGrigor, as Deputy Inspector, was stationed at Beverley and in charge of the troops in the York district, he discovered that surgeons of regiments, doubtless with a view to keep down their sick lists, were in the habit of discharging men who had suffered from typhus, which was then *the disease* of the army, before perfect recovery had taken place. Relapses were in consequence not infrequent, and the mortality by secondary attacks very high. More strictness in discharging men was inculcated, and the death-rate thus underwent a further decrease.

Here then we have a valuable lesson afforded to us; we learn that it is not by maintaining a numerically small sick list that we really preserve a regiment in the highest state of efficiency; but that this is most effectually done by permitting a soldier who has been prostrated by disease to make perfect and complete recovery, before resuming the fatigue and exposure incidental to military duty.

It appears to me desirable that I in this place offer a few remarks in regard to the object with which the present volume is published, and the circumstances under which it was written. With regard to the former it has long seemed to me that army medical officers labour under the disadvantage of possessing no manual, in which directions are contained, relative to details of their duties under the varying circumstances of service. No doubt the published regulations contain ample directions as far as they go; but I believe there are few medical officers in the army who, were they called upon to organize a department for an expedition about to proceed to a distant point, would be able readily to do so; neither are there many who have not practically learnt the lesson by actual experience in the field, would be in a position to conduct the duties connected with bodies of troops under such circumstances. If the present volume be found useful in this respect, my object in offering it to my brother medical officers will be gained.

With regard to the circumstances under which it has been written, I may mention that my attention, as member of the Sanitary Commission for Bengal, was specially directed to the suggestion of improvements in the condition of our troops in that country; my necessary reference to works connected with this and allied subjects, led me to take notes,—and these notes, together with the results of my own experience being thus collected, it became a task of comparative ease to arrange them into their present shape.

Considering the great variety of subjects embraced, I felt that unless dealt with in a concise manner, there would be considerable risk of reaching such dimensions in the present volume, as would render it inconvenient as regards portability, Hence, the style adopted is at times somewhat laconic; moreover, from the nature of my subjects, the work has been meant more as a foundation, a sketch as it were, upon which it may be possible to erect a more complete fabric hereafter, than, as in itself, an exhaustive treatise.

It is also right to mention that so numerous and great are the improvements instituted in matters connected with Army Hygiene, both by the authorities in the United Kingdom and those in India, that during the printing of the present volume, it became necessary to interlard some paragraphs, and to modify others, so as to include a notice of what was actually being done.

CALCUTTA,
1*st March*, 1866.

C. A. GORDON.

The following is a list of the works and authorities to whom the Author is indebted in the preparation of this volume, namely :—

Systeme des Ambulance, par M. Boudin.
Review of Dr. Hammond's Military Surgery, in the Dublin Quarterly Journal.
Aide Memoire á l'usage des officiers des artillerie.
Sir George Ballingall's, Military Surgery.
Proceeding of Lord Herbert's Commission.
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Brande and Taylor's Chemistry.
Fownes' Chemistry.
Queen's Regulations.
Hospital Regulations.
Admiralty Regulations.
Proceedings of Sanitary Commissions.
Dr. Chevers on the Means of Preserving the Health of European Soldiers in India.
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Martin on Tropical Climates.
Pickford's Hygiene.
Orme's History of Hindostan.
Jackson's Formation and Discipline of Armies.
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Medical Times and Gazette.
Weale's Warming and Ventilation.
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Edinburgh Medical Journal, 1865.
Hennen's Military Surgery.
Health and Disease, by L. J. Beale.
Paris's Pharmacologia.
Hygiene of the Army in India, by S. Clark.
Dr. Chevers on Public Health.
Practical Hygiene, by Dr. Parkes.
Proceedings of the Sanitary Commission for Bengal.
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Works and Purposes of ditto ditto.
Dr. Aitken's Science and Practice of Medicine.
Outlines of Lectures on Medical Jurisprudence, by Dr. Trail.
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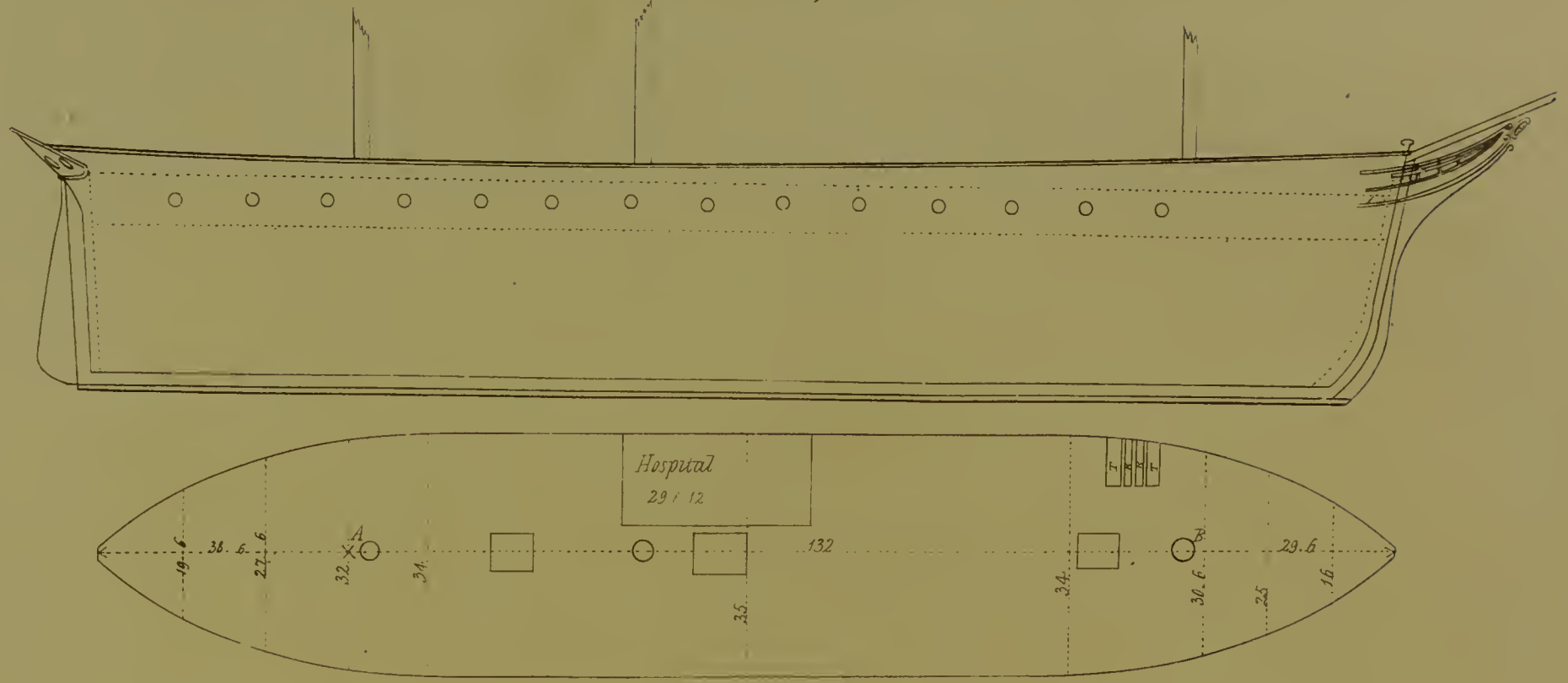

Aft Portion.

Breadth	32 . 0	
	27 . 6	
	19 . 6	
	3 / 79 . 0	
Mean	26 . 4	
Length	38 . 6	
Area	1013 . 10	

Deductions

Main Hatch	48
Fore "	30
Mizen "	36
For Masts	12
" Capstan	16
Total	142
For Hospital	348
Total	490

Middle Portion AB

Breadth	55 0	
	34 0	
	34 . 0	
	3 / 103 0	
Mean	34 4	
Length	132 . 0	
Area	4532 . 0	
Aft Portion	1013 . 10	
Fore "	703 . 1	
	6248 . 11	
Deductions	490 . 0	
	10½ / 5758 11	

Allowance for each person

10½ Sq feet

Area of hospital 29 × 12 or 348 Sq feet.

Forward portion

Breadth	30 . 6	
	25 . 0	
	16 . 0	
	3 / 71 6	
Mean breadth	23 10	
Length	29 . 6	
Area	703 . 1	

CHAPTER I.

INTRODUCTORY REMARKS.

Sanitary science as separate from Medical—History of Hygiene—Among the Greeks—Origin of State Medicine—Progress of Hygiene—First barrack in England—Dr. Nash—Sir J. McGrigor—Dr. Millingen—Dr. Jackson—In India—Army Hygiene a Speciality—Duties of Army Medical Officers.

Sanitary science as separate from Medical.—Within the past few years an evident tendency has sprung up to deprive the science of medicine of whatever pertains to the prevention of disease, and to curtail its province to the management of persons suffering from maladies, the mitigation or prevention of which were beyond its power or its proper sphere.

This is unjust towards the medical profession in civil life, but doubly so towards that portion of it connected with the army, the principal part of whose duty is to devise measures for the prevention of disease; and by suitable arrangements to reduce to their minimum, the evils to health that arise from moving masses of men under the varying circumstances of military life.

History of Hygiene among the Greeks.—It is, perhaps, unnecessary, to remind the reader that among the ancient Greeks, so important was the so-called science of Hygiene considered to be, that a deity was specially set apart in their Pantheon to watch over it. Among this people, the prevention of disease was deemed of as much importance as its cure. Hippocrates taught that the art of prolonging life was to breathe pure and free air—frequent friction and

moderation in all things—very excellent rules in their way, but perhaps scarcely complete enough for more recent views.

Plutarch says, keep your head cool—your feet warm, and instead of taking medicine, fast a day, and while attending to the body, neglect not the mind,—all of which precepts are most excellent, but like the preceding rules, scarcely sufficient for all purposes,—especially those of troops.

Origin of State Medicine.—Descending to more modern times, we trace the establishment of State medicine from the 12th century, when the *assizes* of Jerusalem gave certain rules for drawing up exemptions from civil and military duty.

Progress of Hygiene.—In 1320, Smithfield had become a nuisance. The butchers in the neighbourhood were then in the habit of digging pits to receive the offal of slaughtered cattle. The disease known as the black death seems, in 1349, to have raged in that locality with singular violence. Plague again attacked London in 1361, on which occasion its ravages were mainly attributed to the corruption arising from the slaughter of cattle, sheep, &c., within the city. In consequence of this, the practice was forbidden by Edward III.

In 1423, Quarantine originated at Naples,—Regulations for performing it were passed in England, in 1710, and those at the present time in force, enacted in 1825.

According to Dr. Chevers, a Commissioner was, in 1531, appointed to survey the " wells, streams, ditches, banks, gutters, sewers, bridges, trenches," &c., &c., of London, and this seems to be the first occasion upon which sanitary measures of a public nature were adopted.

In 1552, John Cay recommended, as sanitary measures against the Plague,—a good and wholesome diet,—keeping the atmosphere pure, letting in open air, not stirring nor opening evil breathing places, &c., &c.

In 1577, three hundred persons who had attended the assize court at Oxford, together with the Judge and Sheriff died by malignant fever propagated from the filthy cells of the prison.

In 1602, a Royal proclamation warned the people against the evil effects of living in small ill-ventilated rooms.

In 1603, Henry IV. authorised his physicians to appoint persons, skilled in medicine and surgery, to make judicial inspections and reports in all cities and Royal jurisdictions.

In 1627, the steeping of flax in the canals and streams of Flanders, was considered to give rise to fevers. The King of Spain, therefore, in that year prohibited the practice.

In 1663, all ships arriving at London from Amsterdam, where plague was raging, were placed in quarantine, and during that and following years various sanitary measures were adopted; the prevalence of that terrible scourge having roused the attention of Government and of individuals to the necessity for them.

In 1692, Louis XIV. created a body of hereditary* physicians and surgeons for the same purpose that his predecessor had in view fifty-nine years previously. The venality and corruption of the order soon became notorious however; and in 1792 the office was suppressed, a fact which is viewed with pain, but then, venality exists among other orders than "hereditary physicians and surgeons,"—did so, long before 1792, and will, long after 1865.

In 1705, an epidemic fever having occurred several years in succession in Etruria, from the peasants steeping their flax, this practice was prohibited, and thenceforward the disease ceased to appear.

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* This was but a revival of the custom which prevailed in ancient Greece. There, arts and sciences often descended from father to son: Hence we hear of the family of the Asclepiads (physicians in Cos and Cnidos.) Herodot: by Rawlinson, vol. III. p. 455.

In 1744, Armstrong's poem on the art of preserving health, was published.

Previous to 1748, the deaths in the Savoy prison amounted yearly to 50 and 100 by the infectious "jail distemper." In that year, however, the ventilators, by Dr. Stephen Hales, were introduced, and the result was, that in the four years succeeding, only four persons died there,—none by jail fever.

In 1750, the poisonous effluvia issuing from the narrow, and, for years, surcharged dungeons of Newgate, destroyed the lives of about fifty persons who were attending the assizes at the Old Bailey.

From this time onward, improvements in prisons and Lazarettos were urged forward, but it was not till 1777 and 1778, that the exertions of Howard succeeded in bringing about the erection of these establishments on an improved principle.

First Barrack in England.—It reads strangely now, that only about 1739 were barracks for soldiers first built near London, an innovation which, to use the words quoted by Dr. Chevers, "excited a great deal of angry suspicion in the public mind." Now, popular opinion has so completely veered round that barracks can scarcely be built upon a scale sufficiently luxurious to gratify it.

Dr. Brocklesby, an Army Surgeon of eminence, who wrote in 1764, condemned some of the barracks then existing at Chatham as being low and ill-ventilated, and describes the hospitals into which sick soldiers were taken, as calculated rather to generate than cure diseases. "These, and the barracks," he says, "sweep off the men like a perpetual pestilence."

Dr. Nash.—"If," says Dr. Nash, "it be meritorious to save the lives of soldiers by skill and attention in the field, why should it be thought less so to preserve them by skill and attention of another kind in a march or encampment," and this author strongly urges the necessity, not only upon grounds of expedi-

ency, but upon those of moral duty and philanthropy, that medical officers on service repair to the tents and huts of their men, and "attend to everything which reason and convenience tell them are necessary for the preservation of their health and lives."

Sir James McGrigor.—The great administrative talents of the late Sir James McGrigor are acknowledged, and the great care bestowed by him upon the efficiency of the army is still spoken of with admiration. One of the measures adopted by him is precisely that, which some recent writers would seem to have but just discovered. For instance, wherever, during the Peninsular war, a general hospital was established under his orders, separate wards were set apart for particular diseases, and separate buildings for surgical cases. Not only had each hospital its wards for convalescents, but the convalescents were removed weekly to a convalescent hospital which for the most part was at some distance in the country.

Dr. Millingen.—Even the formation of an army medical school is no new idea, for in 1818, Dr. Millingen published a proposal that one should be established. As regards professors, he suggested "the expediency of appointing professors of the following branches of the medical sciences to be selected from the most able medical officers; namely, theory and practice of Medicine, theory and practice of Surgery, Military hygiene, Morbid Anatomy; and Botany."

Dr. Jackson.—"The preservation of the health of soldiers in the field and in quarters;" so wrote Robert Jackson in 1824, "is attained to a certain extent by a rigid observance of those forms of discipline and economy which are under the direction and surveillance of military officers."

The forms of discipline and economy thus alluded to were collectively known as constituting what in those days was termed medical police; the extent to which they were carried out or neglected, depending more upon the personal views entertained regarding

them by commanding officers, or the personal influence of the medical officer, than upon any principles recognised in reference to the subject.

In India.—With regard to India, it may here be noted, that an administrative officer of the Army Medical Department, was first sent to that country so as to arrive early in 1826.

In May, of that year, the Inspector General, with reference to the great rate of mortality among newly arrived troops, made all possible inquiries into the probable causes of this, so far as they could be traced to defects of clothing, food, lodging and discipline.

In November of the same year, the Commander-in-Chief in India, with a view to establish one uniform system of clothing, dieting, and exercise for troops in the country, called upon the principal medical officer to furnish him with a report on these various heads.

By a circular, medical officers of regiments were then called upon to express their opinion regarding the issue of spirits as a part of the ration,—as to the proposed plan of substituting for it an equivalent in money, and for establishing canteens in which men might be supplied under strict regulations with certain quantities of wine or malt liquors.

In 1828, a circular was by the P. M. O. addressed to all army medical officers in the country, containing many most valuable directions in regard to the manner of proceeding on the occasion of cholera appearing as an epidemic.

The advantage of early treatment of the attack was strongly inculcated; a medical officer was directed to reside in the hospital, daily inspection of the men was directed, and the concluding sentence of the circular so precisely prefigures the most recent recommendations, that it deserves to be noticed here.

It is dated 1st May, 1828. "The occasional local origin of the epidemic must be particularly watched and attended to. In some instances lately it has been

traced to originate and been present in one wing or in two or three companies, or at one end of a barrack as more exposed to the influence of miasma, or the air from foul drains, ditches and stagnant water; upon the removal of the men from which places there was an immediate cessation of the disease."

It will thus be seen that the prevention of disease has throughout all ages been carefully attended to, and the annals of the British army prove how active and important a part in this matter army medical officers have ever taken from the time that a standing army was first formed. That this was very often under great discouragement is the experience of the whole generation of army medical officers, whether on full pay or in retirement: and there are many who can still relate acts of harshness to which they have been subjected for persistently and fearlessly representing matters which, although considered conducive to military discipline, were grievously injurious to health and life of the troops.

Army Hygiene a Speciality.—It must not be supposed, however, that such a system of Hygienic rules, as would be sufficient for communities in civil life would be equally so for an army. The latter, so long as it is stationary, in barracks, and performing merely the ordinary duties of home service is little, if at all, removed from the condition of a body of civil population of equal numbers. On active service, however, all this is changed; an army then becomes an animated machine, the component parts of which, individually and collectively, require special management in order to maintain their efficiency.

Thus, all arrangements for transport by sea and by land have to be made; means have to be matured for providing and keeping up an ample supply of medical officers and all Hospital establishments: for the conveyance and comfort of the sick and wounded and for the disposal of non-effectives. Lastly, medical

officers must have a knowledge of military economy and organization, in order that arrangements which might otherwise be made by them may not be incompatible with these: hence army medicine in all its branches must be ever looked upon as a speciality.

Duties of Army Medical Officers.—However much, in theory it may be considered that the functions of medical officers should be confined to professional details, it will be found, as it always has been on actual service, that the nature of their duties assumes a very different aspect from the idea formed of them from observation of what is the case in civil hospitals, or even in military hospitals of a stationary character. It will be, in fact, discovered that the mere attendance upon the sick and wounded becomes but a part of the duties to be performed.

The higher the rank of a medical officer becomes, the more purely administrative become his duties: and on field service, it may be fairly stated that they become solely administrative.—A short resumé will explain.

The general officer in command, it is almost needless to observe, is the responsible head on all matters connected with the force placed under his orders. It is his province so to arrange the general organisation of all departments as to facilitate the effectual performance of the operations to be executed.

The various details of arrangement and organisation required for a large army are however, so numerous, that the experience of war has from the earliest ages demonstrated the necessity of subdividing that army into smaller portions, each of which has an organisation of its several departments within itself. Thus divisions, brigades, and regiments come to be constituted, and in the latter, wings, companies, sub-divisions and squads.

For certain duties particular training is required; thus, the forces come to be divided into different

branches, such as infantry, cavalry, artillery and engineering. So also special officers have to be trained for special duties, as for example those of the Adjutant General, and Quarter Master General's departments.

The Quarter Master General's department organises and superintends the equipment, the march, encampment, the disposal and the transport generally of the troops. It pays no attention to the wants of individuals, however.

The Medical department organises and superintends the equipment, supplies of all kinds for, and manner of disposal of the sick and wounded of a force. It moreover, watches over and suggests measures for the protection of health of the whole : and, in addition to these important functions, ministers to the wants of every individual when necessary. It is, therefore, illiberal and unfair to endeavour to depress the position of a department which performs any one of the above-named functions to a lower social level than another. Each conduces in its own way to the success of the whole, and while each is ever ready to perform the particular duties for which its members have undergone particular training, it is invidious and detrimental to the interests of the service that duties of equal importance should obtain different degrees of recognition and be held in different degrees of estimation.

I challenge any man who has been in a position to entitle his opinion on the subject to weight, to disprove the assertion that the duties performed by medical officers, during active service, are in importance quite equal to those performed by any purely military officer of their own rank.

CHAPTER II.

THE CIRCUMSTANCES OF A SOLDIER'S LIFE.

TRAINING of the Soldier—Example from the racer—Spartan simplicity not necessary—The present views on the subject—Petty causes of worry—Military Officers—Medical Officers—Drills and Parades—In Hot Countries—In temperate climates—Instances of exposure of Troops—Confinement of men to Barracks in India—Rest and Sleep—Causes of Sickness and Mortality—Night Duty—Campaigns—Tropical Service—Wet Clothes—Funeral Parties—Recreation—Coercion to be guarded against—Marriage.

TRAINING OF THE SOLDIER.—The whole military existence of the soldier is considered to be a continuous system of training against the day of battle. Whatever hardships or discomforts he happens to undergo are looked upon as forming a part, and a very salutary one of this system; the usages among the Spartans and ancient Romans being adduced to illustrate the benefits that are believed to arise from continuous toil and adversity.

EXAMPLE FROM THE RACER.—In considering the means by which a system of training may be best effected, an example may, with advantage, be taken from that pursued in the case of race horses. They are carefully tended; they are even carried to the scene of their triumph or defeat, and during the intervals between their times of contest have every care bestowed upon them. They are exercised just to that extent which is sufficient to keep them in health and "condition"; but not exposed to changes of weather, nor deprived of their regular periods of rest.

SPARTAN SIMPLICITY NOT NECESSARY.—That Spartan simplicity, or, in other words, scanty food and bodily fatigue are not essential, if indeed desirable, to

obtain efficiency in military service, and to fit a soldier for undergoing the fatigue incidental to service against an enemy, was first disproved in the early part of the present century. When the troops of the Household Brigade were ordered to the Peninsula, there were few who saw them march through London to embark, who did not entertain forebodings that officers who, like those of that Brigade, had been reared in the lap of luxury, were but ill-suited to undergo the fatigues which all then knew lay before them. Soon, however, it was found that none bore their hardships better than these officers; and so it has over and over again been demonstrated since; the last illustration as concerns the Guards being the Crimean war: but as refers to many other classes equally delicately nurtured, the numerous campaigns in India down to, and including the Sepoy mutiny.

The present views on the subject.—With these facts before us then, and the more enlightened views in regard to the Hygienic management of troops that have of late years been accepted, the conclusion we arrive at is, that in order to preserve as much as possible, health and physical energy in the men, we ought as far as practicable to avoid inflicting upon them unnecessary duties, or harrassing them by petty interference with matters connected with their every-day manner of life.

Thus, men are needlessly harrassed by a larger number being employed upon what is called orderly duty than are actually necessary. Guards are undoubtedly, in some instances, detailed to posts where the sentry furnished by them is to all intents and purposes useless, except for appearance. Officers holding commands have at times more soldiers on duty as orderlies than there is actual necessity for, thus bringing round each soldier's tour of duty with a frequency that is needless and injurious.

Soldiers may be harrassed in ways inconceivable to men who have no practical knowledge of them. It

is probable that commanding officers do not always consider the full effect of their orders in these respects upon the men who must obey them. It ought also to be borne in mind, that continuous duties of a trivial nature, not only are to soldiers a greater source of worry and ultimate fatigue than are those of a nature more severe in themselves, but between which the man is by usage permitted to enjoy an uninterrupted rest of greater or less duration.

Petty causes of worry.—Among what may be called the petty causes of worry to the soldier and actual injury to his health, the system which prevails in some regiments of maintaining excessive and purposeless neatness and "order" in the barrack room is not by any means the least. It is by no means infrequently the case, that this is carried to an extreme, and soldiers having no day-rooms to go to are so harrassed by their non-commissioned officers, in the desire of the latter for extreme neatness, that the men are driven to irregularity and excess, so that they may be away from rooms which to them are the realisation of discomfort.

To prevent men from appearing outside their barrack rooms, except completely dressed as if for parade, from going to places of amusement as, for example, a racket court or ball-alley, or from visiting the Institute or library unless they are in uniform, may in themselves appear matters of little importance. Yet they become in reality so intolerable as to prevent the men from seeking that recreation, which it is the object of these places to supply.

In India repressive measures such as these are especially objectionable. Soldiers will not make a parade of their amusements, and it is needless as it would be injurious to insist upon their doing so. They need for purposes of health, no more parades than they already have, and they may well be permitted to cast aside their trammels in the interval between these.

It may fairly be questioned, if the soldier would not in reality be much more healthy, as he most assuredly would be happier, were he much more left to his own devices than he is. Soldiers who have taken their discharge, invariably state that one of the great sources of their dislike to the service was the constant state of surveillance in which they felt themselves to be,—a state of what they considered perpetual bondage, and restraint while their engagement lasted.

Military Officers.—Directly harsh treatment of soldiers by their officers is now-a-days extremely rare. It is an undoubted fact however, that no great sympathy exists between officers and soldiers under them, except during times of active service and for a time subsequent thereto, when dangers and fatigues mutually undergone, and good offices mutually rendered, create a bond between them which, under no other circumstances exists. As a general rule however, there is little interchange of feeling between officers and soldiers.

Doubtless this arises from the great social gulf which lies between them, but the fact remains. Good offices are in a kind of a way done by officers to soldiers, but in a very different manner from that by a friend; while as a very frequent case the manner of an officer to a soldier has a coarseness and want of consideration, that he would not dare to assume to a person in civil life, however low his social standing.

Medical Officers.—Nor are medical officers, by any means, free from a similar allegation. It is beyond doubt that in some instances, the sick soldier does not receive from his medical and other attendants that amount of attention to small wants, and that sympathy which by their moral effects do much towards his recovery; nor can it be denied that some few medical officers address and act towards sick soldiers as if the fact of these men being ill-depended upon themselves, and was intended as an insult or injury towards their officers.

Such conduct, besides being calculated directly to drive men to the commission of crime, exerts a most pernicious effect upon the bodily condition of the men. Two army medical officers have in their writings strongly condemned it; thus Dr. Cutbush observes that "rough treatment of men is a predisposing cause of disease. They despond and become inactive and," he adds, "every advantage will arise to the service from good treatment."

Dr. Hamilton asks "what can add more to the distress of a poor sufferer than roughness of behaviour in him from whom relief is expected."

It is by no means contemplated that soldiers are to be treated like so many children. They must be treated like men as they are, but this neither implies continual supervision on the one hand, nor rough and harsh behaviour on the other.

Drills and Parades.—Drills and parades are a fertile source of discomfort and of disease to the men of a regiment.

The time the men are considered to be on parade ought to reckon from the moment they "fall in," and any duties required of them on the ground prior to this, must be looked upon as injurious in a sanitary point of view as they are needless. There have been commanding officers, who made a point of putting the men through various movements before falling them in for regular parade, consequently the latter, which in the official diary may have appeared to last only one hour, may in reality have done so two; needless fatigue and chagrine, and often illness was the result.

In Hot Countries.—In India and other hot countries, it is of importance to bear in mind that continued high temperature produces relaxation of the tissues, langour, and weakness of the system; an excessive waste of the body by rapid transmutation of its elements. All these are increased and accelerated by severe exertion. Hence the salutary order which directs that in the hot season in India, parades

and drills be held only so often as is required to maintain military efficiency, ought to be strictly observed. When they are held during that period of the year, the men should be " formed up" in as open an order as possible; it being well known that attacks of heat apoplexy and of syncope are of more frequent occurrence the closer men are massed. This has over and over again been demonstrated in India, and is now a recognized fact.

In Temperate Climates.—In temperate climates it matters little at what hour of the day parades take place; not so in the tropics however, and more especially in India and China in both of which it is absolutely necessary that they be held either during the early morning, or in the evening after the sun has approached the horizon.

Instances of exposure of Troops.—In India most severe consequences have time after time arisen more especially in the case of newly arrived regiments, from parades being held and marches taking place at hours, and with the men dressed as in the United Kingdom. Soldiers have under such circumstances dropped from syncope or from heat apoplexy. Notwithstanding the oft-repeated fatal results of such measures, these recur in many regiments on first arrival in the country, and it is feared will continue to do so until the measures are authoritatively prohibited.

It is not to be understood from this, that soldiers may not under certain circumstances withstand exposure to a tropical sun.

We know that planters and others in India are exposed to the sun at all seasons. So also in the West Indies, but in these instances they are so as individuals, not in masses.

Confinement of Men to Barracks in India.—Dr. Jackson mentions the fact that among the planters in the West Indies in his day, those, especially the younger ones who spent the greatest part of

the day under a scorching sun superintending field labourers, were remarkable for their degree of healthiness. Soldiers, says this author, who remain in barracks, who pass the hours in indolence and ease, or in drunkenness, invariably suffer severely and die in great numbers.

These remarks are quite as apposite to the East as to the West Indies.

Prior to the Revolution of 1789, French soldiers, natives of France, formed all the great roads and constructed all the aqueducts in St. Domingo. They were exposed to the sun the whole day, and while thus employed experienced little sickness.

In 1803, the Royal Scotch regiment then at Tobago set to work to drain a swamp situated to windward of their barracks. The work was done in a short time, and health suffered nothing by it. The labor was then suspended, the barracks ordered to be shut during the day, and soon the hospitals were filled with sick.

The measure so often adopted in India of confining the men of a regiment to their barracks is one which demands grave consideration. It is not practised in all regiments, but in those in which it is, the soldiers are subjected to enforced confinement to their barrack rooms, during some eighteen or twenty hours per day.

It must be apparent, that however well ventilated the rooms may be, and it is not always that they are so, the walls and furniture, as well as the bedding, must under such circumstances become saturated with organic matter exhaled from the surface and mucous membranes of the occupants. The men have the feeling of being in a manner imprisoned; they suffer, in addition from all the ordinary effects of overcrowding and deprivation of light, of which cachexia, anœmia, and phthisis are known to be among the most common. Among other results, is that tendency to fatty degeneration of the viscera and muscular system, which is of frequent occurrence in India.

It is always found that the men of a regiment who enjoy best health, are those whose habits are active, and who are partial to out-door amusements; those who are so constituted as to be incapable of resisting the effects of exposure, will avoid it without having the feeling of coercion. Nor must it be forgotten that in India, the occurrence of heat apoplexy is more to be dreaded among men confined in hot, close, and imperfectly ventilated apartments than in those who are directly exposed.

Rest and Sleep.—We should bear in mind, that in the case of soldiers as with other classes, excessive labor demands excessive rest. This was a maxim of Napoleon, and daily experience confirms it. On a campaign, it may be difficult or impossible to obtain for the soldier that amount of rest which sanitary requirements demand. In ordinary circumstances, however, it may be attained by diminishing night duties as far as is practicable.

Duties that involve deprivation of the night's rest, exert more than any others a pernicious effect upon health; the physical powers having thus insufficient time to recover their tone after severe exertion or arduous duty undergo decay, and thus the soldier while yet a young man, becomes what is called "worn out."

On home service a soldier ought not, as far as sanitary considerations are concerned, to be on night duty oftener than one night for four he is in bed; nor in India oftener than one night in seven at least.

In the French army, the arrangement of placing four men on guard to each sentry furnished, gives each only six hours on duty in the twenty-four; whereas in the British army, there being only three men to each sentry, each individual is eight hours on duty during his tour, and his period of rest or sleep is so much diminished. By this system however, the duties are more rapidly brought round than in ours, and thus what is gained in one respect is lost in another.

But it is not enough that in India and other hot countries, where parades are held in the early mornings, that soldiers be permitted as far as possible to enjoy nocturnal rest. It is necessary, that during the hot period of the year at least they be permitted to have a period of rest during the day, and by recent orders on the subject, they are then allowed to do so between the hours of 11-30 A. M. and 1 P. M.

Causes of Sickness and Mortality.—It is often assumed, that there is in reality nothing in the circumstances of a soldier's life, which of necessity renders him more liable to disease, than men of corresponding rank in civil life.

Doubtless by care and good management, sickness and mortality may be kept down to a much lower rate than they have hitherto been. But the circumstances of a soldier's life are such as to render him liable to suffer from disease in a considerably larger degree than his corresponding class in civil life.

Whether at home or abroad, he undergoes in that discipline, which is necessary for his military efficiency, a degree of constant occupation which, although not necessarily severe, is monotonous, and to him uninteresting,—hence its effects are in reality greater upon his physical system than would be that of a more severe nature, if the person had a direct interest in it.

Night Duty.—The wearing-out influence of night duty has been already alluded to. This is in reality one of the chief causes of the prematurely old look acquired by sailors and soldiers. There is also the crowding of masses together, for even when the maximum cubic and superficial space is allowed, the fact remains that men breathe to a pernicious extent, the same atmosphere contaminated by their exhalations.

Campaigns.—The casualties in battle and by sickness during campaigns to which soldiers are liable, are but the chances incidental to their profession, but in the service they undergo in tropical latitudes, they become

subjected to all the causes of disease incidental to conditions that are to them unnatural.

Tropical Service.—True, there are theorists, who would place the increased sick and death rates of soldiers in tropical countries down, solely to the habits these men pursue. That this may to some degree be true is granted, but that it is only so to a small extent is indicated by the fact of a similar rate occurring among lower animals brought to a tropical from a temperate climate.

Wet Clothes.—There are two circumstances, which, more especially in tropical countries, combine to occasion disease among soldiers, and yet are seldom alluded to; one of these is exposing them to the effects of wet, whether merely of their feet, or of the body generally. There are many officers, who yet remember the practice common among the infantry of the Guards, of applying damp pipeclay to conceal spots upon their white trowsers, and the great extent to which phthisis and rheumatism prevailed among these men.

In India, officers of practical experience know that among the fertile causes of dysentry and remittent fever among soldiers, are their being permitted to sit or remain in damp clothes, or with wet feet. Hence, all who study their well-being are at all times, but especially during the rainy season, careful that they do not parade on damp grass. At some stations, so great is the attention bestowed upon this point, that raised path ways exist between the various barracks and their out-houses.

Funeral Parties.—The second circumstance here alluded to, is attendance of soldiers at funerals of their comrades or officers.

The Regulations very properly demand, that due respect be paid to the remains of these. Yet there are occasions, when the observance of this respect is fraught with risk to those directly concerned, and is not by any means free from injury to those who are so, only indirectly.

Even in temperate climates, evil results are not infrequent to men who for some time have to stand over an open grave, in a crowded cemetery. In the tropics however, they are sometimes fatal. After an exhausting march to the grave yard, exposed as they sometimes are to the sun or to rain, they stand, it may be in damp ground, exposed to the sickening emanations that arise therefrom.

It is notorious that in seasons of cholera, whole parties of men, thus exposed, become the subjects or victims of the malady, while the pomp and music attending funeral processions, by no means infrequently by depressing the minds of men sick in hospital, render them thus more prone to succumb to disease prevailing among them as an epidemic.

The obvious remedy against these evils is to avoid their causes as much as possible, and the officers who best consult the well-being of their men, are those who reduce to their minimum, duties of this nature, as well as others, the performance of which is attended by risk to health.

Recreation.—Among the usual means of recreation provided for soldiers are the following, *viz* :—

1. *Gymnasia.*—These for tropical stations should be in the form of a large covered shed like a Railway Station, raised on a basement, with a high roof, and their vicinity well drained.

2. *Ball Courts and Skittle Alleys.*—These should be covered so as to admit of their being used during rainy weather ; as well as in the tropics to protect the men against the sun.

3. *Work-shops.*—In these, the men may with profit and advantage to themselves be employed in tailoring, shoe-making, printing, saddle and harness-making, carpentering, &c.

4. *Libraries.*—In some regiments, there is a general one for the use of the whole. In others, there are ones for individual companies. The latter plan does not appear to possess many advantages, on the

contrary by its sectional and exclusive character, it is open to many grave objections.

5. *Reading Rooms and Lecture Rooms.*—Prior to the date of the inquiry into the condition of the soldier, which followed the Russian war, little, if any thing, was done to provide them with reading rooms, and direct opposition was shown to the plan of delivering lectures to them. Now, however, and for some time back all this has been changed, and every encouragement is held out to the men to avail themselves of them. In the plans for Barracks recommended by the Home Commission, it is intended that accommodation of this description shall be provided upon the ground floor.

6. *Institutes.*—At some stations both at home and abroad, soldiers' Institutes exist. In some instances these are for the garrison generally, in others for individual regiments, and the success of the latter may, as a rule, be taken as an indication of the amount of interest taken in the men by their officers. In these, it is usual to have a Library and Reading room, Games, and a Coffee room, where men may for a small sum obtain tea, coffee, and non-intoxicating drinks.

Among the ordinary out-door amusements of the men are leap-frog, quoits, putting the stone, and long bowls. The latter is a very favorite one in India, and during the hottest period of the year, when the hot winds are most intense, soldiers, if so permitted, may often be seen indulging without danger or risk to themselves in this amusement.

Cricket is throughout the army a favorite game, and there are few regiments in the service that do not boast of their "eleven."

Soldiers' Gardens.—Much has of late years been done to encourage gardening among the soldiers, especially in India. It must be confessed however, that hitherto the success which has attended the measure, has not been in proportion to its intrinsic merits.

Coercion to be guarded against.—It may be well to remark that, however desirable it is to

encourage soldiers in the various amusements provided for them, care must be taken that no means be employed which would to them bear the semblance of coercion. It may be well also to bear the fact in mind, that there are circumstances under which it becomes matter for serious consideration, how far the ordinary, means of amusements are applicable. Thus, when military duties are unavoidably severe and harassing, when the spirits of the men are depressed, whether this be from the existence among them of great sickness and mortality, or from inconsiderate conduct towards them by their commanding officers, they become desponding or sullen. They would then look upon active endeavors to induce them to follow these amusements in the light of interference, or coercion : and as at all times discontent rapidly spreads among masses, much tact is often necessary in times like these to lead away their minds, from the cause of depression whatever it be, without their being aware that this is being done.

Marriage.—The subject of marriage in the army has of late years been much discussed, and its importance acknowledged. It is a question regarding which regimental medical officers have really little, if any, power to interfere, because on home service where only six per cent of men are permitted to marry as many more do so without such permission as have inclination,—bringing upon their wives and offspring a degree of wretchedness that requires to be actually seen to be adequately appreciated : and on some foreign stations, as for example Bengal, where twelve per cent are permitted to marry, the casualties among white children are so fearfully numerous that a sufficient number of girls do not attain womanhood to provide wives for all who would thus be allowed to marry. The great majority of soldiers have but little desire to contract marriage with natives of the country, whether pure or half caste, nor is it desirable on social grounds that they do so, the issue

of such marriages being deficient in all that constitutes manliness.

Abstractedly, however, it is beyond doubt that the extension of marriage among soldiers would on mere sanitary principles be a most beneficial measure, tending to the almost complete destruction of a class of diseases by which the period of military efficiency is much shortened; thus, if the results of calculation made with reference to one regiment, be taken as an indication of what is the case in others, the result is that for every two days' duty performed by an unmarried soldier, he who is married performs three. This extended over a number of years assumes proportions of very great comparative magnitude. It may be also observed that precisely similar results as these were obtained in reference to officers.

When troops proceed on active service, the wives of soldiers do not accompany their husbands; some provision was certainly made for the subsistence of those of men who proceeded to the Crimean—Indian—and China expeditions, but a scheme has yet to be devised for the proper disposal of women and children under similar circumstances.

CHAPTER III.

CRIME, VICE, PUNISHMENT.

CRIME in the army and in civil life—Drunkenness—Armies of ancient Rome—Rum in the army of Britain—Effects upon soldiers—Officers—Temperance—Spirits and malaria—Use and abuse of spirits—Numerous cases of Drunkenness—Remedies—Beer—Light wines of France—Tobacco—Venery—Punishments—Nomenclature of offences.

CRIME IN THE ARMY AND IN CIVIL LIFE.—That offences of all degrees of turpitude are committed throughout the army is unhappily true. It is difficult to draw a comparison between the frequency and degree of crime among soldiers and the corresponding class in civil life; but there seems every reason to believe that in regard to crimes against property or individuals, the soldier is, by reason of the strict surveillance he is under, prevented from entering into combinations such as are practicable among civilians.

It is also fair to assume that this discipline conduces to the formation in the soldier of habits of order and of respect to constituted authority, which seem to regulate their conduct after they have ceased to be soldiers, for it is not often that pensioners and men, who have taken their discharge from the service, are concerned in serious crimes against the public. Indeed, it was made subject of remark at the time that among the large numbers who were discharged at the conclusion of the Peninsular war, there was scarcely a single crime imputed to them.

Some men, undoubtedly bring with them into the army habits of crime or vice in which in civil life they had been nurtured, or into which they had fallen; others, there is reason to believe, seek in the

indulgence of these an excitement not afforded by the ordinary routine of military life; and some undoubtedly endeavour to find, while undergoing the just punishment for offences, an existence more congenial to their tastes than is realised by them in the steady performance of a soldier's duty.

There do occur cases among soldiers of men committing crimes, with a view that they may themselves be put to death, and thus escape from an existence which to them has become intolerable. These however are rare.

Drunkenness.—The most prevalent vice among British soldiers is, beyond all doubt, that of drunkenness. It has decreased to an immense extent compared to what some years ago was the case: Sir George Ballingall related how, in his day, soldiers having swallowed large quantities of spirits were in the habit of averting with more or less success the indications of intoxication, by drinking large quantities of vinegar or solution of acetate of ammonia.

Armies of ancient Rome.—In the armies of ancient Rome spirituous liquors were unknown: the canteen of every soldier was filled with vinegar, and as remarked by Dr. Rush, "it was by frequently drinking a small quantity of this wholesome liquor that the Roman soldiers were enabled to sustain tedious marches through scorching sands without being subject to sickness of any kind." Vinegar was to them indispensable: and we find that during the arduous campaigns of Napoleon against the Arabs in Egypt, vinegar was mixed with the brackish water found scantily in the desert, and the latter thus rendered palatable.

Rum in the Army of Britain.—Britain, however, instead of declaring, as the Romans did, that vinegar should be issued on foreign stations in order to render bad water palatable, directed that a ration of rum should be issued; this was at first merely sanctioned to soldiers as a privilege, but soon came to be considered both at home and abroad as a right.

Effects upon soldiers.—The immediate and remote effects of over indulgence in intoxicating liquors are discussed in every work that bears upon Physiology or Hygiene. A few remarks, therefore, seem all that are necessary in this place in order to show briefly what is the nature of their effects upon the soldier.

An important effect is the liability to become attacked with any epidemic that may at the time prevail; the habitual drunkard has a tendency to fatty deposit externally and in the viscera, impairing the functions of the latter. He has loss of muscular power, anœmia, dropsical affections, loss of memory, impaired intellect, and periods of mental depression, leading him at times to commit suicide.

During actual intoxication he is liable to suffocation, and in India to heat apoplexy: phthisis is not an infrequent result of exposure during fits of drunkenness; as are injuries and accidents to himself and to others with whom he may come in contact. Doubtless much of the venereal disease, that prevails to the fearful extent it does in the army, is contracted when the soldier is more or less intoxicated.

It is not often that a soldier comes under observation suffering from those secondary effects of indulgence in spirituous liquors that constitute alcoholismus. The punishment which follows one debauch enables the system to recover to a great degree from it, before another comes to be indulged in.

Officers.—Among officers, however, circumstances are not always so: in them complete saturation of the system with the poison is by no means rare: a larger number than is generally supposed die or are sent home from abroad from this cause.

Temperance.–An argument not infrequently brought forward in regard to the use of spirits is, that a moderate quantity fortifies a person against fatigue—that when he has been exposed to wet and cold, it decreases his chance of suffering therefrom, and even that it is a protective against malaria.

In practice however, it is found that the power of undergoing exertion and fatigue out of doors is much diminished even in temperate climates, but particularly in tropical. Sportsmen everywhere eschew the use of spirits before going in search of game, and during the campaign in India in 1857-8, it was found that when cases of heat apoplexy occurred on the line of march, the subjects of the attack were for the most part men who had come fresh from a debauch.

There are many medical and military officers, who with this knowledge before them strongly advocate that soldiers in India should, as regards drink, be restricted to tea, coffee, and non-intoxicating beverages generally.

That temperance in drinking as in all other indulgences is essential to health, is a mere reiteration of an acknowledged fact. This is very different however, from running into the opposite extreme of complete abstinence: but the difficulty always experienced in dealing with soldiers is to restrict this and their other indulgences to limits of moderation. Let us hear what Dr. Moore says on this subject. "Where," says he, "the quantity of solid food is not sufficient to supply the waste of tissue and repair the wear and tear of the body—which it certainly is not during the exhaustion and loss of appetite occasioned by intense heat, certain effects arise from the imbibition of alcoholic drinks"—"these effects are an additional tone and impetus imparted to the physical powers." It further retards the metamorphosis of tissue.

To have these effects however, the alcohol ought to be diffused in the form of beer or wine, for except under special circumstances, as for example, continued exposure to wet or cold, soldiers are most unquestionably better without alcohol in the form of spirits.

Spirits and Malaria.—With regard to the issue of a spirit ration as a prophylactic against malaria, there is much reason to believe that it really does exert considerable influence as such. In bye-gone times an

allowance of spirits was under such circumstances given to soldiers in the early morning, but more latterly was interdicted as being not only unnecessary but pernicious. Among the native Indian troops employed in Bhootan however, and at the very time these remarks are being committed to paper, this measure has actually been adopted, and according to testimony received, with good results.

Use and Abuse of Spirits.—It seems desirable to introduce these remarks in this place, with a view to show the more clearly that the abuse—not the legitimate use of spirits—is what is to be condemned, for in the outcry that has of late years arisen and very properly arisen against the vice of drunkenness in the army, a tendency has been manifest to carry the restriction of them to absolute prohibition.

Numerous cases of Drunkenness.–Thus, for example, the assumed prevalence of habitual indulgence in spirits among soldiers generally, instead of among a comparative few, as is actually the case, has been accepted as a sufficient reason, and one ever at hand for all the diseases to which they are subject, whether at home or abroad. The evil has been deplored in many a terse and epigrammatic sentence, and many has been the device suggested by philanthropy for its suppression.

Some writers will have it that indulgence in spirits is alone the cause of the vast mortality among our troops in India as compared with home: others attribute this partly to the same cause, and partly to an assumed over-indulgence in animal food. Sir Charles Napier however struck out a theory of his own, assuming in the first place that India is in reality not an unhealthy country,—and in the second, that climate is made to bear the sins of gin, and *crowded barracks*.

Similar causes to these, either singly or combined, exist in the United Kingdom, and even to a greater extent than they do in the latter country, exerting

upon numerous men the baneful effects that have been already alluded to. Granting that in India an equal effect results, there is still a large debtor account against the country in sickness and mortality, and this can only be satisfactorily explained by referring it to those influences which together constitute climate.

Nor is this increase of mortality in India confined to the habitually drunken. The sober and abstemious among all classes of occidental foreigners in that country are affected by it, as are persons in every position in life—both sexes and all ages; the rate of mortality among children being notoriously higher than among adults. Domestic animals, imported from Britain or brought to the plains of India from the higher Himalayahs, have also an increased rate of mortality than they were liable to in their own natural climate. Hence the conclusion is fair that whatever be the actual amount of sickness and mortality that are directly and indirectly attributed to spirit drinking among our soldiers in India; and that it is considerable is at once granted—is but a portion only of what they are subject to, while serving under the conditions incidental to that country.

The numerical cases of drunkenness among soldiers as indicated by regimental statistics give, as is well known to the initiated, an exaggerated impression of the actual prevalence of the vice, inasmuch as one man being intoxicated four times during the year appears there as four cases of drunkenness. Thus, if there be one habitual drunkard in each company, the "cases" of this vice will appear as if forty persons had been punished on that account, whereas there would in reality have been but ten.

Again, soldiers have very seldom the opportunity of "sleeping off" a debauch without detection, as have artisans and many others in civil life, and hence the difficulty of instituting a fair comparison between the two classes. Hence also a palpable injustice

to the soldier in assuming in the absence of proof, that the vice of drunkenness is more prevalent among his class than it is among corresponding grades of of persons in civil life.

These remarks are not intended in any way to discourage the very laudable endeavours now being made to elevate the condition of the soldier generally: to withdraw and wean him from drunkenness and other vices by which he is beset. The sole object in view is to say a word in his favor, and to point out to persons interested in his well-being, that in reality he needs their good offices, in this particular respect perhaps less than many a poor labourer and artisan.

Remedies.—In endeavoring still further to lessen the prevalence of drunkenness among soldiers, it would be well to consider what measures are practicable rather than those that are theoretical. Thus the kind of men who form the bulk of the army should be considered; as should also their natural tastes and failings—the existence among them of a certain amount of recklessness of character, and the fact, that a soldier must and will have excitement of some kind; if not in one shape, he will in another.

In India much has already been done to diminish drunkenness, among the soldiers, and with very considerable success. Restrictions have been placed upon the issue of spirits in regimental canteens, and by the establishment of Institutes, gymnasia, reading, and coffee-rooms, endeavours have been made to wean them from such indulgence.

Beer.—The issue to the soldier of excellent beer at a moderate rate, has also been designed with a view to diminish the taste for rum: and assuredly there has been of late years great decrease in the quantity of the latter consumed. In a sanitary point of view, however, the complete success of the measure is open to question; a soldier may obtain at noon or soon thereafter a pint of beer, and an equal

quantity in the evening: probably he is not thereby rendered intoxicated in the sense he would be by spirits; but that he is more or less "muddled," especially in the hottest part of the year, is made manifest by his suffused heavy eye, flushed face, perspiring surface, and unintellectual stare. The man has probably eschewed spirits, but in avoiding Sylla, has he not been wrecked upon Carybdis? Let his liability to congestive disease be the reply.

Light wines of France.—We learn that when Britain's standing army was first put upon that footing, an allowance of light wine of France formed part of the soldier's daily ration. This doubtless ceased to be so when by enactment, the wines of Bordeaux had to give place to those of Lisbon and Oporto, nor would it now be easy, if practicable at all, to re-establish a taste for the former. The experiment is one however which well deserves a trial, for if soldiers could be induced to partake of these, especially in the tropics, not only would the evils of intoxication be obliterated, but wines of this description would be a most grateful beverage, and be found refreshing without having the heating effect of spirits or semi-narcotic effect of beer.

Tobacco.—That over-indulgence in tobacco is among soldiers a fertile source of disease is readily admitted. Irregular action of the heart, general "nervousness," and impaired activity of intellect are all more or all less produced by this vice or habit, whichever it may, with greatest propriety, be called.

Much may and has been done to lessen the vice of drunkenness. In respect to this one however, coercive measures must eventuate in failure; perhaps advice and argument may have some influence, but it is to be feared the practice must, for the present, be looked upon and accepted as a condition natural to the soldier.

Venery.—Venery is, beyond all question, the vice which destroys the military efficiency of the greatest number of men, while it brings the sufferers

themselves to premature death, or embitters years of their existence.

In England the soldier is everywhere exposed to its allurements: whether in garrison towns, he stroll a little distance from his barrack gate—visit the tap-room in the nearest street—or enter the temperance coffee-room,—for under these and other forms of disguise do brothels exist.

On foreign service, and especially in India, the liability of the soldier to disease from this cause is so great that the most wary often become its subjects. There, by recent calculations, out of the British force by which the country is held, it is found that the equivalent of two regiments is constantly non-effective from this cause.

At home and in India however, measures have been enacted with a view to diminish the disease among soldiers: in the United Kingdom little, if anything, can be individually done with this object by the army medical officer: not so abroad however. There he can in concert with his commanding officer devise measures to place in quarantine the women who propagate the disease; and this is the shortest as well as the surest means towards its suppression.

Punishment.—In considering from a Hygienic point of view, the punishment of soldiers, a very few remarks only seem to be necessary in this place.

"If Laws," says a writer on the subject, "are not enforced, it would be far better that none were promulgated," what can be more farcical than to threaten daily when the soldier is convinced at the time, that it is but a threat. Hence he proceeds day after day in irregularities which ultimately lead him to the commission of the graver offences, and to the penalties that follow thereupon: or if he happen to escape either of them, his own health or perhaps life is made to suffer from his persistence in a course that might at the outset have been checked, had strictness been exercised at the fitting time.

While the degree of punishment awarded should be in strict proportion of that of the offence committed, the soldier ought to be made to know that the punishment is certain; perhaps no circumstance tends so much to the prevalence of crime in a regiment as caprice or uncertainty on the part of commanding officers in awarding punishment. For under these circumstances soldiers will and do fall into crimes on the mere chance of escaping punishment; whereas, the certainty of being punished would make them hesitate before giving way to their desires.

Nomenclature of Offences.—In the nomenclature of offences committed by soldiers, there exists much room for improvement: thus offences against persons or property, and those that merely involve the individual himself are alike in military phrase designated crimes. Hence what is called the military character of a soldier is no criterion of his moral worth.

A soldier who is a certain number of times convicted of being intoxicated—being slovenly in the ranks or inattentive on parade, and another who, although none of these, has been guilty of violence to others, of theft, or other offence against society, are alike described as men of bad or indifferent character.

CHAPTER IV.

RATIONS.

QUANTITIES of Food required—Nutritive values—Evils of underfeeding—The present ration—Extra messing—Variety necessary—Meals—Vegetables—At home and in tropics—Food of Natives—Alimentary constituents—Means of cooking—And food on line of march—Salt—Meat consumed in London—By army in India—Size of Cattle—Signs of good meat—Of bad—Diseases produced—Diseases of animals—Meat-ration—Bread.

QUANTITIES REQUIRED.—According to the latest writers on the subject of food, each pound weight of the body requires about 0·15 ounce of water-free food, and 0.5 ounce of water; these being equivalent to 1-105th of the person's weight; or, for an adult daily, about 5 ounces of flesh forming, and 35 ounces of heat giving food.

According to chemical ingredients, he requires 275 to 280 grains of nitrogen, 3,500 to 4,500 of carbon, and 400 to 600 of salts; or, of albuminates 4·587 ounces, of olaginous 2·964 ounces, of hydrocarbons 14·257 ounces; and of salts one ounce.

As regards absolute quantity, a healthy man, between 20 and 30 years of age and about 150 pounds in weight, during ordinary work, requires 40 ounces of solid food; that is, containing its water of composition; the range being from 34 to 46; and, in addition 50 to 80 ounces as water, tea or beer: the whole being equal daily to about 1-23rd or 1-25th part of the weight of the man's person.

If exertion be great, he requires much greater quantities than are here noted; so he does also if the food be indigestible.

As is well-known, the articles of food most relished are very different in different individuals. One of the necessities of military life however, is that the

food of the mass has to be considered rather than the tastes and desires of individuals.

Nutritive values.—It is but repeating a truism to observe that not only does the amount of actual nutriment differ in different kinds of food, but their value as food depends in a great measure upon their capability of undergoing assimilation.

In some instances the readiness with which assimilation takes place, depends not so much upon the nutritive value of the article itself, as upon the bodily condition of the person using it. In others, the assimilation of it is accelerated by intermixture, perhaps, with other articles, neither of which singly is more readily assimilated than itself.

Various illustrations of this are readily given. It is said, for example, that in a temperate climate, a man working steadily eliminates 8 to 10 ounces of carbon daily. The source of this carbon is chiefly the muscular tissue and fat. Hence, a ready explanation of the increased quantity of food required under such circumstances, and of the immediate relief from fatigue obtained by using a carbo-hydrate as beer ; that being one of the most readily assimilated articles of diet under such circumstances.

So again, oleaginous, saccharine, and starchy elements, which are themselves readily converted into fat, are rendered still more so by the addition of alcohol in some form to them in the stomach. Hence, also the fact mentioned by Dr. Jones, long ago, that two ounces of suet would afford more nourishment than eight or ten of lean meat. He very naturally, therefore, recommended that troops on long marches take with them fat pork, biscuit: and that under certain circumstances, they be allowed a small quantity of spirits.

Truly, therefore, there exist scientific reasons for the preference shown by the English hard-worked labourer for his bacon and his home-brewed ale. He, as is well known, practically finds his pork more

satisfying and therefore more economical than beef or mutton.

Whatever theories may be entertained in regard to the quantity of food that a soldeir ought to have, the principle which should guide the army medical officer is to run no risk of enfeebling them by insufficient food, whether as regards quantity or quality.

Soldiers must not be under-fed.—On active service, very disastrous results may follow upon insufficient supply of food, of which numerous illustrations occur in the annals of campaigns. Dr. Jackson gives one. He states that the attack by the Americans, on Canada, in 1813 failed, the sickness on that occasion amounting to 1,800 men in a force of 2,500. The nature of the disorder is stated to have been gangrenous, or probably more correctly scorbutic; the cause of it having been damaged grain and damaged beef.

According to Mr. Alcock, the men of the British Legion, under Sir De-Lacy Evans, were literally starved on their rations, nominally a pound and half of bread and a pound of meat; but which, when served out was often not more than four or six ounces of solid meat. This, he states, formed a very prominent cause of a startling mortality.

The present Ration.—Not only are soldiers who are under-fed rendered incapable of severe exertion and liable to become attacked by disease, but it is now well known that deficient food induces a desire for tobacco, and what is worse, for strong drinks: and yet it was not till 1845, that he was permitted to have his present evening meal, insufficent although it be. Previous to that he breakfasted at 8 a. m. dined at 1 p. m., and had nothing in the interval, save what he himself purchased.

But, with the ration of the soldier improved, as it has of late years been, it is still insufficient for the requirements of his system on active service, and the quantity of meat contained in it too small for the

requirements of the young recruit while undergoing his drill.

On Service, the quantity of food is increased, but this is not practicable under other circumstances; so that soldiers have to purchase from their own resources, articles of food that they requre beyond their rations, and if they happen to be in debt, as is often the case this may be impossible, in which case they absolutely undergo partial starvation.

Extra Messing.—The system of extra messing is now encouraged as much as possible, and no doubt it is better for a soldier to expend whatever spare money he has in this manner, whether it be in providing himself with articles of delicacy in his own barrack room, or at the coffee-room attached to the regiment, than in drink, tobacco, or excess. Yet, it seems to me that the soldier's ration ought, under all circumstances, to be rendered sufficient for him without the necessity, on his part, of purchasing articles that he can ill afford; and, if in debt, he absolutely cannot.

Variety necessary.—Not only is abundant quantity and good quality of food necessary, but so also is variety. "Health," according to Dr. L. Beale, "cannot be long sustained on any one elementary principle." "Animals, after a time, become so disgusted with being limited to one article that they prefer starvation to such food."

We see this exemplified in all dietaries adopted by those of the poorer classes who have the power of choosing for themselves; and Dr. Parkes would add to the ration of the soldier precisely the articles that experience has taught the poorer artizans are most necessary for health; namely, bacon, butter, cheese, a large use of fat or oil in cooking, and the use of beans or peas.

In India, the best means of obtaining for the soldier variety in diet has for a considerable time back occupied the attention of the authorities, and various bills of fare framed with this object have been prepared.

According to one of them the soldier's round of dishes would consist of soup and boiled beef on one day. Next day, pies and curries; the third—baked joints with potatoes under them; the fourth—soup, salted meat with "dhall" or peas pudding.

According to another and more ambitious carte, he might have, *a*, a ration of beef, onions, rice and pumpkins; *b*, beef, onions, rice and sweet potatoes; *c*, beef, onions and yams; *d*, beef, rice and yams; *e*, salt beef and yams; soup or puddings being superadded.

We see with what readiness French troops can obtain various materials for a meal and in America, the soldiers of the civil war were able to pick up wholesome weeds whereof to make savoury dishes. In India this might also be done, but to render it practicable would require a certain amount of scientific knowledge.

Meals.—It is now considered advisable that in tropical countries, where soldiers have to go on duty in the early morning, they have a cup of coffee before going out. Under some circumstances also, a midnight meal of coffee and bread may, with advantage be given to men on guard. This was done in 1860, at Hong-Kong, and with the best results as regards health.

Until very recently, the principal meal was given in India to soldiers at 1 p. m., and in some regiments the soldiers were permitted to have immediately after, their ration of spirits. The results were fatal: heat apoplexy was of frequent occurrence. By recent orders, however, it has been directed that the men have breakfast at half-past 8 a. m., dinner at half-past, 2 p. m., and tea after evening parade.*

Vegetables.—The importance of vegetables, as part of the dietary of the soldier is much insisted upon by the American sanitary commission. "We find," says

* While these pages are passing through the press, this order has undergone some modification. The hour at which soldiers in India dine has been left to the discretion of commanding officers. This change is to be regretted.

the Commission, " in the absence of a vegetable diet, a cause for a great part of the mortality of our troops ; both after the receipt of wounds and from disease. Indirectly it may account for suppuration, gangrene, dysentry, fever, rheumatism, &c., and we fully believe that one barrel of potatoes per annum is, to the Government, equal to one man."

One of the Commission's Inspectors suggests that when neither fresh potatoes nor onions can be furnished the troops should be supplied with pickled onions and cabbage; and also with potatoes cut in slices and packed in molasses, to be eaten raw, as is the practice of sailors.

Very many instances are given of the improved health of the troops and disappearance of incipient scurvy as soon as vegetables could be procured, aided by increased attention to cooking and to improved arrangement for sleeping.

This is valuable testimony, and with other evidence in the same direction should show how necessary it is that soldiers on service be supplied with sufficient quantities of vegetables : this however, should be done by the Commissariat as is the case in India. In the Crimea and elsewhere the soldier was left to get vegetables as best he could, or not at all.

In many parts of India, at the Cape of Good Hope, and at other foreign stations, it is found that a scorbutic diathesis is engendered in consequence of the deficiency of vegetables ; and, in America so grave were the evils that arose from want of vegetables, that those farmers who had no other means of aiding the belligerents, were urged to cultivate and send to the front, cabbages and other anti-scorbutic vegetables.

At stations in India where the supply of fresh vegetables failed, it was customary to give, as a substitute, an allowance of ground lentils. This, on account of the albumen contained in it, was

doubtless to some extent a substitute; but only to a small extent. More recently, however, various suggestions have been made in regard to the best plan to secure for the soldiers fresh vegetables throughout the year; or, when that is impracticable to enable them to obtain preserved or pickled vegetables, or Lime juice.

Every encouragement has been held out for soldiers and others to cultivate gardens, and Government even goes so far as to promise various kinds of seed gratis for people who do so.

Theory of nations at home and in the tropics.—It is a favourite theory among some eminent writers that the quantity of food consumed by the soldier in a temperate climate is altogether too large for a tropical one, that the food used by the natives may be considered as being that which is best adapted to their conditions, and that the rations of the troops living in that climate should be suited to that standard as much as possible.

With regard to the first of these assumptions, it may be asserted in the words of the President of the Sanitary Commission for Bengal, that all that has been said on the subject is purely theoretical,—and has no value for practical purposes. We know also that hepatic disease—one of the results usually believed to arise from supposed over-feeding soldiers, occurs among herbivorous animals imported into India,—although no over-feeding is ever assigned to them.

Food of natives.—As regards the food of natives—we find that Aborigines of similar latitudes partake of very different descriptions of food. Thus, in tropical Africa and China they are large eaters of flesh; in tropical India are more or less completely restricted to rice and melons. We find, moreover, that religious prejudices—capabilities of soil—agricultural requirements and financial circumstances of a people have more influence in deciding the nature of their food, than mere degree of latitude.

Nor can we adopt the theory that the food used by the aborigines is that most suited for their own sanitary requirements—far less for the requirements of foreigners in the country; thus while it is stated that thousands of Irish live upon potatoes and milk and millions of Hindoos on rice, we learn that the former are of low stature—have pot bellies and bow legs, whilst their open projecting mouths, prominent teeth, exposed gums, advancing cheek bones and depressed noses bear barbarism on their very front.

In reference to the latter, those who are restricted to the diet named soon become diseased, acquire pot bellies,—and show the signs of starvation in every feature, so that from neither of these examples do we gather encouragement to adopt the diet of the natives. On the contrary we know, that so soon as either can afford better fare it is speedily adopted.

But whatever theory may say on the subject, the fact is that the soldier will not change his habits, and perhaps when it is borne in mind that having these habits, whether good or bad, he maintains his physical superiority over Her Majesty's enemies, there ceases to be any strong reason on this ground for change were it otherwise practicable.

Alimentary Constituents.—It is important to note the differences in the relative proportions of alimentary constituents of the diet of the soldier at home and in India. This is accordingly done in the following tables compiled from Dr. Parkes's work: thus the ration consists of—

	At home.	In India.
Water ...oz.	38·88	oz. 30·07
Nitrogenous sub-stances ...	3·86	4·36
Fat ...	1·30	1·38
Carbo-Hydrates ...	17·35	14·47
Salts	·80	1·54
Total	62·19	51·82

Consequently, the ration of the soldier in India is nearly one-sixth less, as regards nutritive elements than it is at home.

To render this still more clear, the following table has been compiled from the same source :—

Articles of Ration.	Water.		Nitrogenous.		Fat.		Carbo-Hydrates.		Salts.	
	Home.	India.	Home.	India.	Home.	India.	Home.	India.	Home.	India.
Meat	7·2	9·6	1.44	1·92	·8	1·07	—	—	·154	·2
Bread	9·6	6·4	1·92	1·28	·36	·24	11·73	7·8	.312	·2
Potatoes.	11·84	—	·24	—	·02	—	3·75	—	·020	—
Other Vegetables ..	7·28	13·6	—	·96	·04	·04	·46	·93	·050	·11
Rice	—	·4	—	·20	—	·03	—	3·33	—	.02
Milk	2·92	—	·1	—	·08	—	·13	—	·016	—
Sugar	0·04	·075	—	—	—	—	1·28	2·41	·006	·012
Salt, ...	—	—	—	—	—	—	—	—	·25	1·
Total ozs. ...	38·88	30·075	3·86	4·36	1·30	1·38	17·35	14·47	·808	1·542

Thus we observe that the ration is slightly more nitrogenous in India and less rich in starches than at home.

Means of Cooking.—Until very recently there was but one method of cooking soldiers' rations adopted in the United Kingdom,—namely that of serving them as boiled beef and soup; nor are there wanting officers who affirm that the excellent soup prepared in former days compensated for many so-called improvements of the present. Napoleon had an idea that good soup "made" the soldier, and Sir George Ballingall coincided.

Only in India, however, do the means remain still defective. There they are of the rudest order, the kitchen is a small square out-house often without a chimney and by no means clean. Boilers and ovens there are none; or if any of the latter exist, they cannot be used by reason of their construction, being

on a plan which must necessitate too great consumption of fuel.

Until recently in all, and even still in some regiments, each man's dinner was cooked separately,—and served up in the vessel in which it had been prepared. Men did not necessarily dine together, but now they must do so. The practice indeed which existed in the Roman army under Titus, of the troops messing together, is being introduced among the Indian forces in the latter half of the nineteenth century.

Food and Cooking on the March.—The most convenient method of cooking on service, and specially during active operations, is to make a stew of the meat with such vegetables as are procurable: rice, barley, flour or even bread can be readily mixed, and thus a wholesome and even savoury meal be at all times available for the men. In Indian warfare this is especially applicable, and was in fact the plan adopted in some forces at least, during the mutiny campaign.

If under any circumstances a soldier has to carry his own food, he can, if provided with material prepared for the purpose in a concentrated form, take with him sufficient for seven days. In such a case the material ought to contain 250 grains of nitrogen and ten ounces of carbon; to obtain which, 20 to 30 ounces of concentrated food are necessary; that is, water-freed food.

With the means available in India of feeding troops under almost the most adverse circumstances, measures that are absolutely necessary under certain conditions in European or American warfare are not likely to be required in that country, where, as was actually practised during some of the operations connected with the Sepoy mutiny, cattle and sheep were driven along in the rear of columns, and killed during the short daily halts that were necessary.

Breakfast on the Line of March.—Dr. Jackson strongly urges the propriety of breakfasting before

commencing a march. His experience was however confined to countries where it is not necessary that the march be got over so early as in India. One of his suggestions however, might be readily adopted in that or any other country where men either on active service or on ordinary marches become faint and exhausted from fatigue. It is that before starting, they take in their haversacks, a piece of bread, and a bit of cheese. Cheese has indeed not been usually issued as a ration for troops. A quantity was sent out to China for the use of those engaged there in 1860, but it was never given to them. There is no reason, however, why a certain quantity preserved in tin should not form part of the stores for an army.

Salt.—A very indispensable article to comfort to have on a campaign is salt; a very valuable suggestion once given to the writer by an old officer who had seen much service in the Peninsula, was always to have in the haversack while in the field a small phial of salt. Thus at any time any morsel obtained may be rendered palatable and fit for food: and if, as has actually happened, the supplies should accidentaly fall into the hands of the enemy and it becomes necessary to kill meat for use, he who is provided with salt may enjoy his stake or chop with comparative relish.

Meat consumed in London.—Some idea of the enormous quantities of animal food consumed in England may be obtained from the recorded number of animals slaughtered in London alone. Thus in the latter half of 1863, we learn that London devoured 3,127 cows—761,070 sheep and lambs—14,822 calves—and 17,550 pigs.

Twice these numbers would represent the consumption for the whole year.

The number of cattle required for Calcutta and its environs amount to about 80,000 annually.

By Army in India.—The average strength of the army in Bengal may be taken at 42,000 including

effectives and men in hospital ; or 39,000 effectives. According to the Commissariat Commission, the annual requirements of this force are 11,009 head of cattle, and 195,590 sheep ; and it may be interesting to note in this place a few particulars with reference to the expense to Government, incurred on account of this one item of food.

The entire stoppage on account of ration in India, amounts to Rs. 6-5-4 per month, while Government actually pays Rs. 9-5-5⅓ or about £175,000, on account of the British force in Bengal alone ; a proposal was made by the Commissariat Commission that oxen intended for soldier's beef, and sheep intended for their use, should be stall-fed for a period of six months. To effect this improvement, however, would subject the Government of the country to an extra expense of upwards of £18,764, making an aggregate for beef of £362,674, or about £ 9-6 per man per annum.

Size of cattle.—It is to be observed, that a very great difference exists between the size of cattle and sheep in England and in India, thus a

bullock in England weighs ...	lbs.600	to	lbs.800
In India	„ 100	„ „	150
A cow in England	„ 400	„ „	700
In India	„ 100	„ „	150
A sheep in England	„ 60	„ „	90
In India*	„ 25	„ „	35

The animal to be slaughtered should be in good health, have a proper proportion of fat; the muscles should be firm and elastic, the skin supple ; the hair in good condition ; the eyes should be bright, the mucous membrane of the nostrils red and moist, the muscle moist ; the tongue not protruding.

In England, cattle are carefully fed for the Shambles. It is not so in India however : and in that country, strict measures are necessary to ensure that the animals intended for food are themselves carefully fed.

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* The above refers to the Presidency of Bengal : in that of Madras the sheep are still smaller.

Signs of meat.—In good meat the quantity of bone should not exceed 20 per cent ; the fat should be in streaks, in moderate quantity. That of beef should be of a yellowish white or straw color, firm and without spots; the muscle of good color. In very young animals it is pale, flabby, and moist, in old it is dark, dry, and hard. The marrow of the bones should be light and consistent; the lungs and liver healthy.

Bad meat.—If the meat be black, lean, putrid, or flaccid, it should be condemned; if it contain small white dots, these are in all probability Cysticerci. Yellowness, serosity, air-bubbles, flabbiness, discolored spots, denote inferior meat.

Diseases produced by unwholesome meat.—The following are some of the affections which are the more frequent results of the use of unwholesome meat, namely, vomiting, purging, depression, head symptoms, typhus and typhoid fever. In India, cholera is often attributed to eating shell-fish, and among the native boatmen, blindness is believed to follow the use, as food of the river-turtle ; meat in a state of incipient decomposition as, for example, in the form of sausages and bacon often gives rise to dangerous symptoms.

Meat containing Cysticerci whether it be that of the ox, sheep, or pig, gives rise to tœnia : nor is this affected by cooking, salting, or smoking, although doubtless either of these processes diminishes the likelihood of the disease being thus propagated.

Pork.—The use of pork by the soldier is everywhere dangerous, but especially so in India, where the food of the animal is often of the most loathesome nature. The Sanitary Commission for Bengal has lately had before it evidence of the most unquestionable nature, that at certain military stations the contents of public latrines are sold to contractors for the purpose of feeding pigs. It is, therefore, no matter of surprise that tœnia has of late years increased among the troops to a great extent; for soldiers, it is well

known, consume large quantities of pork either fresh or as bazaar-cured bacon.

Trichina.—Trichina has not yet been extensively observed in India; its existence, however, has been demonstrated by Dr. Fayrer, and there is every reason to anticipate that research will show it to be of as frequent occurrence at least there as it is in Germany. This entozoon has been found to be propagated in the flesh of the pig, and this affords another reason why the use of that animal as food should in India be absolutely interdicted.

It is stated that the trichina does not withstand a heat of more than 144° Farenheit. There should, therefore, be no danger from this cause in eating well-cooked meat. It seems clear, however, that the desire always shown by the soldier for prepared meat, such as bacon, sausages, and other seasoned kind of it arises from a want on his part, that fresh rations have not satisfied. Wherever an occasional salt ration is served out to troops, it is highly enjoyed by them, and in India we may fairly believe that one reason why the men purchase in the bazaar such loathesome matters as have just been described, is that they are unable to obtain better. It is therefore to be desired that in that country an occasional ration of good salt pork or beef should be given to the soldiers, according to the custom adopted throughout our other foreign possessions.

That meat in a state of decomposition is capable of producing dangerous symptoms or even death in persons using it is beyond doubt; that such is not the case under all circumstances, however, is also undeniable: thus no result of this kind follows indulgence in the fashionable taste for "high" game; according to Dr. Macadam, the natives of the Faroe Isles consume their food in a decayed state, concluding their meal with a tit bit full of maggots. The force of this authority is undoubtedly affected by the circumstance related, that

these people are subject to intestinal complaints ; but we know that the natives of the coast of Guinea eat largely of decomposing fish, and that they are, as a race healthy.

Diseases of animals used as food.—The most common diseases of oxen would appear to be pleuro-pneumonia, aphthæ, typhoid fever, malignant pustule, tœnia, and dropsy from diseased heart or kidneys.

Sheep suffer from braxy (splenic apoplexy), small pox, red water, phthisis, rot (caused by distoma hepaticum in the blood which is identical with tœnia in the dog), and sturdy, caused by the presence of cœnarus cerebralis.

Meatration.—Elsewhere than in India, the meat ration consists of beef. In that country however, mutton is given on one day per week. It is customary with all officers, whose experience is principally confined to that country, to uphold the meat as being of excellent quality, the fact being that from poor feeding of the animal it is extremely thin and tough. It wants aroma, is defective in gelatinous material and is "poor" in nutritive properties, as is at once shown in the quantity required to make good soup.

Hitherto, the cattle have been killed in so barbarous a manner that their carcases show marks of bruises ; and so little attention has been paid to the condition of slaughtering yards, that meat may well be supposed to have become more or less unwholesome during the few hours it is permitted to hang in these filthy places.

This subject therefore demands strict attention by the regimental medical officer.

Bread.—In the United Kingdom, and in our older colonies, no difficulty is experienced in obtaining excellent bread : in the latter it is prepared under the superintendence of the Commissariat Department, by bakers belonging to that corps. These men acquire an aptitude for preparing it under difficulties which secures for the soldier an allowance of good quality.

It would be needless to remark that in the colonies, bread is made from flour, were it not that such is not the case in India, where it is prepared from soojee or the glutinous part of the wheat. Hence it may be considered more nitrogenous than it is at home. Many improvements have of late years been introduced into its manufacture in India, and others are contemplated.

Of these an important one is that it be prepared as elsewhere under Commissariat superintendence, another, that proper mills and bakeries be introduced, for the present manner of grinding wheat and baking bread are not only primitive but extremely filthy.

Note.— The subject of slaughter houses has recently been under the notice of the authorities: and some degree of improvement already effected in the condition of these places.

CHAPTER V.

MOVEMENT OF TROOPS BY LAND.

Evils from marching in heavy marching order—Rate of the march—The pace—Period of the day—Forced marches—Food—Periodical halts—Marching in India—In cold season—In the hot—Kits not carried in India—Fatigue when greatest—At attention—At ease—Close and open columns—Starting—During the march—Weakly men—Halts—Water—Minor matters—Arriving—Epidemics on the line of march—Conveyance by carriages—By rail.

Evils from Marching in United Kingdom.—The long and severe marches that troops had formerly to make in the United Kingdom were in themselves a fruitful source of disease and invaliding among them.

Soldiers equipped in heavy marching order, and carrying the heavy pack supported as it was by straps and belts across the chest so as to impede respiration—had in former days to make marches of fifteen, twenty miles, or even upwards daily for several days in succession; often along roads that traversed hilly districts. It was then also the custom for bands to play in passing through towns. This necessitated a regular pace on the part of the soldiers, and the result was, that at each half-yearly inspection of the regiment a considerable number of men were brought forward for discharge on account of heart disease, asthma, hernia, or hæmoptysis, that owed their origin to these marches.

Rate of Marching.—The usual marching rate is three miles per hour: unless, however, the length of the individual march is so long as to cause fatigue, the troops usually attain a pace towards the end of

it very considerably greater than this, and after a time, when all have become "seasoned" usually perform the entire march at a more rapid rate.

The Pace.—The length of pace in the British Army is in slow time 30 inches—75 paces are taken per minute—thus the space travelled per minute is 187 feet 6 inches.

Quick time, 30 inches—110 paces=275 feet per minute, or 3·1 miles per hour.

Double—36 inches—150 paces per minute=450 feet per minute—5 miles per hour.

What is an easy length of step for a person of one size is not so for one of another,—hence some persons must suffer inconvenience on the line of march and on parade, where all have to step precisely alike; when practicable, however, it ought to be borne in mind that a long steady step is the easiest, the limbs and body being allowed to move freely in correspondence with the feet. This may not be in accordance with an appearance of smartness, but what it lacks in that respect is compensated by the ease afforded to the men, and the greater efficiency thereby caused on long marches.

Period of the March.—The period of the day selected for performance of the march, must necessarily depend upon the nature of the climate and nature of the circumstances under which the troops are being moved. Dr. B. Rush, whose experience seems to have been entirely confined to America, is of opinion that during the summer season, marches should be performed in the cool of the morning and of the evening.

Dr. Millingen, whose experience was gained in extratropical countries recommends that if optional, the march be begun so as to avoid the chill of the morning in cold climates, and the heat of the day in hot. He moreover considers that when the march is long, it is a good plan to perform one part of it in the morning, and the other in the evening,

There is, however, one great objection against thus distributing the march over a great part of the twenty-four hours; it is that the men are not permitted to enjoy a sufficiently long continuous rest to enable them to overcome the fatigue arising from one march before they have to start upon another.

Forced Marches.—In case of forced marches, this becomes the smaller of two evils. In such a case military considerations become supreme, and the end that is sought to be attained is paramount to all other considerations. That end once attained however, the troops should be permitted to fall back to the ordinary march.

Halts on one day per Week.—It has been found necessary for the well-being of troops themselves, that during long marches they should be permitted to halt on Sundays; not only is this seemly and becoming where military requirements admit of it, but it is in practice found to be a necessity. Men obtain one day of complete rest, they attend to various little matters of their own personal convenience and comfort, and recommence the work with renewed energies.

In India, similar halts are not only found necessary for the well-being of the troops, but also for the cattle employed in conveying the camp equipment. Petty repairs are also made in the different conveyances, or those that are unserviceable are exchanged. Hence the Sunday halt is directed in general orders to be observed.

Food of troops on the march.—Arrangements for providing troops with food during the march, are made by the quarter masters of regiments or by the commissariat officer. In civilised countries and in ordinary times, arrangements are readily effected to have the soldiers supplied with their rations. In other countries at all times, however, and even in civilised countries during war, provisions for an army must invariably accompany the force.

In India the facilities that attend the arrangements of the Commissariat Department are such as probably exist in no other country. Hence, during the most arduous campaigns it is seldom indeed that difficulty is experienced in this respect. Neither is it necessary on starting upon a forced march for troops to load themselves with cooked provisions which soon become stale and uneatable. The live-stock intended for the food of the men are made to follow them. Camels or elephants are laden with cooking utensils and fire wood,—the soldiers have in their haversacks merely their bread; and when they halt for an occasional rest, the native establishments speedily transform what had shortly before been live stock into savoury stews and steaks.

Marching in India.—In marching in India the evils to be guarded against are chiefly exposure to malaria, excessive heat, damp, thrist, and exhaustion. How this is to be effected must, under all circumstances, whether of active service, or ordinary moves of troops, be the study of both commanding and medical officers.

Most suitable time.—Various authorities have expressed different opinions as to the most suitable hour in India to begin a march; medical officers of personal experience in that country, however, are tolerably unanimous in recommending that the march be undertaken at such an hour as shall enable the men to be upon their new ground, and have their tents ready pitched by eight o'clock in the morning.

No doubt, in marshy districts, malaria is in powerful operation during the hours in which the greater part of a march is thus performed; against this fact, however, has to be considered the scarcely less important one that insolation and fever are prone to affect bodies of troops during the heat of the days. It then comes to be considered how far one of two evils is to be avoided.

But if actual experience can be considered to weigh against mere theory, we have the important fact that troops on the march, performing their daily journey in the early morning, and retiring to rest early in the afternoon, enjoy a degree of health unknown to them under any other circumstances.

March in India in cold season.—Ordinary marches are usually performed in India during the cold season of the year. The operation of malaria is then at its minimum; and when circumstances arise of a nature to render it necessary to undertake a march at other periods of the year, the urgency of the emergency is usually such as to supersede all other considerations.

In the hot season.—It is not to be looked upon, however, even during the hot season that the exposure and fatigue to which the men are subjected are necessarily very prejudicial to health; on the contrary, there were numerous examples during the mutiny campaign in India, where regiments that were in the field, marching at different periods throughout the twenty-four hours enjoyed a degree of health far beyond what those did who had no occasion to leave cantonments.

During that campaign, when marches had to be performed in the day time, the men usually started as lightly clothed as possible; generally with no other uniform than cotton trowsers and shirts. Beyond their arms and amunition they were unencumbered by weight. During the intensity of the hot winds, men and officers were obliged literally to *souse* themselves with water carried for the purpose in skins on camels and elephants, and having done so, to start again and so continue until the work of the day was accomplished.

Kits not carried in India.—The troops serving in India are permitted to enjoy one great advantage over their comrades on other stations, in being exempted from carrying their kits on the march; their own capabilities for work are thus greatly increased, and although the system at present in

force of conveying all their clothing and bedding, wherever the soldiers themselves proceed is carried to excess, there is no question that the health and efficiency of the men individually gain thereby. How far the efficiency of the force as a military machine is interfered with, is a totally different question.

Fatigue greatest in rear of a column.—Experience speedily teaches men and officers that fatigue is much greater in the men marching near to or at the rear of a column than in those near its front. Confusion and crowding also often take place at the former place, while in front the men are marching at a regular pace and at their proper distances from each other. The commanding officer, therefore, by the amount of tact he displays in regulating the pace, exerts a powerful influence in rendering a march lightsome or fatiguing. If he who rides, does not restrict the pace of a fast walking horse at the head of the column, the part of the regiment that is farthest in the rear, cannot be otherwise than fagged and jaded ere the march is nearly over.

At attention.—Fatigue is also much greater while marching at "attention" with or without music, than when marching at ease. In the former case, the pace and attitude of the men are constrained. The rearmost portion of the column imperceptibly gains upon the front; causing crowding and demanding frequent re-adjustment of the pace, thus increasing still further the constraint of the men.

At ease.—Marching at ease or "easy" ought on sanitary grounds to be as much encouraged as possible: while troops are permitted to adopt it, the pipe, the song, the joke and repartee among them not only enliven, what would otherwise have been a tedious journey, but enable them to get over it with comparative comfort and freedom from fatigue.

Close and open column.—In India, the evils arising from marching troops in close column are many. Perhaps, the greatest of all is the increased liability thus

induced to attacks of heat apoplexy, and fever: there are several others, however, although no doubt of less grave import, as, for example, the greater heat created by men being close together, and the offensive emanations that arise from their bodies. Hence, it is desirable that although on account of military reasons, straggling should be avoided, the men be allowed to retain as great an amount of space between individuals as is compatible with these.

It is not only in India that the evils which arise from marching in close columns are evident; they are so in climates less extreme in their temperature. Even in temperate climates, when the weather is hot or dry this is understood. It was long since by Dr. Millingen deemed advisable to move troops in as small bodies as possible, with intervals between regiments and brigades.

According to this author, while the system of keeping the ranks of infantry close while on the line of march is objectionable, he rather approves of this being done in the cavalry as in this way they become the less incommoded by dust. It would appear, however, that the circumstance of being incommoded as here mentioned is of very trifling importance as compared with free perflation of the column, and that this can only be attained by maintaining an open order on the march.

Coffee prior to starting.—In India the time required to strike and pack the tents of a regiment, and get the men ready prepared to commence their march is about 40 minutes. At home, and in the colonies, 30 minutes.

In this interval the medical officer should take a general look at the sick, unless they have been already sent on with the hospital establishment the previous evening. It may usually be arranged to let the sick have a cup of hot tea prior to commencing their journey; men who report themselves sick should be prescribed for, and, if need be, have conveyance apportioned to them, or, if necessary, attendants.

It is always desirable if possible to enable the men to have a cup of coffee prior to falling in for the march, and those of them who are steady and accustomed to the march, have usually little difficulty in heating up a little in their mess tins over the camp fires.

During the march care should be taken not to exceed the pace already stated. If a soldier desires to fall out, every consideration should be shown to him; much injury is often caused to the men by harshness on the part of their officers in respect to this.

Weakly men.—The means of conveyance for sick and weakly men should be held at all times available for use, and men who complain of fatigue be permitted as far as possible to make use of them. It should be recollected that a man who has this indulgence may often recover from an attack of faintness or weakness, while, on other hand, were he deprived of it he might suffer then a severe attack of illness, and thus be rendered non-effective as a soldier for a considerable time.

During the Peninsular war, each man who fell out during the march on account of illness or weakness received a ticket. In this way the men who really were considered entitled to conveyance were readily distinguished from those who under the strictest regulations will occasionally obtain indulgences clandestinely. A similar plan could be readily adopted in India, where the hospital sergeant and his assistants, who are usually old soldiers, superintend the transport of the sick.

Halts on the line of march.—An occasional halt is necessary under whatever circumstances a march is being performed. Some commanding officers have a short one, say ten minutes every hour, others prefer one tolerably long one midway in the march.

In India the latter is the plan more generally adopted; coffee is then distributed, and there are few soldiers or officers who at the time do not appreciate

these pleasant halts, and in after years look back to them as some of the most agreeable episodes connected with their service in that country.

During marches in the United Kingdom, it was customary, whenever practicable, that these halts should take place in the neighbourhood of a roadside inn and then the officers who cared for their men exerted their vigilance to prevent indulgence in any stronger potation than beer.

Water.—A free supply of water, is of the most essential use on a march; in fact it is so even in a temperate climate, but in a hot one, as for example in India, it is indispensable. In the latter country, each man is by regulation provided with a soda water bottle with leather cover and sling from the shoulder. These ought to be filled before commencing the march, and from the purest possible source. Water carriers invariably accompany troops in that country, and in addition, there are often camels, elephants or bullocks laden with "skins" of water. These vessels should be themselves carefully examined, and the greatest care taken to prevent their being filled at objectionable places.

The precise place from which the water is taken should be seen. Each man should be, if possible, provided with his full supply, and it is stated that when no better filtering apparatus is procurable, a piece of flannel makes a tolerably good substitute.

If practicable, water should when of impure quality be boiled with tea, and this carried with the men: each of them should in addition have with him a portion of alum.

Small Matters.—Some very excellent hints in regard to what may be considered small matters are given by Dr. Millingen.

Among others, he observes, that during a snow storm, and in fact during very cold weather, great comfort will be obtained from smearing the face and ears with oil or grease.

During a thunder storm, care should be taken that men march with arms reversed.

On arriving at the bank of a river or stream to be crossed; if the men must wade, they should be halted and made to take off their boots and socks, or it may be their trowsers. On crossing the stream they should be again halted to re-dress: but under no circumstances that can be avoided should troops on the line of march be permitted to neglect these precautions.

Arriving on the Ground.—The system adopted in India of sending on the commissariat the previous evening is an excellent one. The men are thus enabled to take their breakfast within a very short time after arriving upon the new ground. In the infantry this interval should not in ordinary cases be more than an hour, as if the means of transport be good, their tents should be up and pitched within that time. In the cavalry and artillery however, the interval must be somewhat longer, as not only have the men of these arms to pitch their tents, but they have to clean and otherwise attend to their horses.

At each new encampment select different places for supply of water for men, horses and cattle, as well as washing and cleaning; that is, if it can be done: The latter should be farther down the stream than the others, and the men should not be permitted to go where they like, as by so doing they would spoil all the sources of supply.

Epidemics on the March.—Troops are as a rule remarkably exempt from epidemics during a march. Instances occur however, especially in India where either from their coming in contact with bodies of pilgrims who are infected, or from encamping on infected ground, disease in this shape breaks out and spreads among them. There are also some tracts of country through which it is notorious that bodies of troops seldom pass without suffering more or less extensively from cholera.

The question comes in such an emergency to be, what had better be done?

In case of troops going into camp to avoid cholera in cantonments, the instructions are that in the event of the disease following them, they are to make a succession of marches at right angles to each other until the malady ceases among them. In the case of troops on the march from one station to another, or engaged in active military operations however, this would be impracticable.

In the latter, the object to be attained must be gained at all hazards ; when, for example, the small force under the late Sir Henry Havelock that started from Cawnpore for the relief of Lucknow became still further weakend by cholera, and was even threatened with anihilation by that terrible scourge ; there was no attempt made to abandon the enterprise. The force, too weak to go on, was halted until reinforcements were obtained, but no sooner did these come up than it pushed on again, and so it should be whenever the disease attacks a body of troops : they should push on.

It is obvious however, that infected men should not enter a cantonment: on approaching therefore, they should, if marching past it skirt the place at a considerable distance, or if destined for it, be put in the same position as if they had gone into camp on account of the outbreak of an epidemic. They should be broken up into small parties and encamp at different points in the vicinity.

Conveyance by Carriages.—During 1857 and 1858, troops arriving at Calcutta hurried up-country by carriages made hurriedly for the purpose and drawn by bullocks. There were two sizes of these carriages : In one, four men *told off as a guard* were accommodated. The whole started in the afternoon, and halted at one of the rest houses during the heat of the day. Each rest house was at a distance from the other of about 40 miles. There commissariat and medical arrangements awaited each detachment.

From sun-set to sun-rise one of the four men in each cart, was intended to walk ; the whole number doing so in rotation at intervals.

The larger sized waggons accommodated six men, one-third of whom were obliged to walk.

Transport by Railway.—There are several points which should be borne in mind in transporting troops by rail, and become of far greater importance in hot countries than in the United Kingdom, although even there they cannot be neglected without detriment to the men.

Of the most important, the following are a few :—

If possible, no more than a regiment should travel by one train, and in fact it is seldom that the arrangements of Indian railways permit so large a number, even as this, to proceed at once.

Troops should not be sent by night trains unless under circumstances which supersede all sanitary arrangements,

When starting, at least three hours of day light should be allowed for them to prepare and arrange such part of their baggage, as had been kept back until then, and to enable them to have breakfast : a similar time is required by them on arriving at their final destination.

It should not be forgotten that the fatigue caused by sitting close together with belts on, and arms by one's side, is much greater than occurs in the case of second class passengers generally ; and that therefore in India especially, six hours should, except under special circumstances, be considered the maximum that soldiers travel in one day.

Arrangements are generally made by pitching tents or making huts at particular stations along the line of railway for this purpose. Soldiers who may have been seized with illness should be left there, and no man should re-commence his journey until after he has had a good meal.

If military exigencies render it necessary, that the troops push on as rapidly as possible, the men

should have their rations ready cooked in their haversacks,—and under such circumstances it is desirable that their water-can or bottle, instead of being filled with water only, should be so with weak rum and water.

CHAPTER VI.

SHIPS.

SHIPS employed as Transports—Iron and Wooden ships—Proper number of troops—Tonnage per man—Profits to Owners—Selection of Ships—Prohibited cargo—Space for persons by Admiralty Rules.—Hospital space—Ditto in Crimea—Short voyages.—By Calcutta Regulations—By Bombay Regulations—Rules for allotting space, and examples—Standing berths—Cooking Galleys—Issuing Room—Prison—Latrines—Ships' water—Water Condensing Apparatus.—Lime to purify water—Victualling Troops—Admiralty and Indian Scales—Rum and Beer—Emigration Scale—Medical Comforts—Indian Scale—Admiralty and Indian Scales compared—Scale in China—Lime juice—Bedding and clothing—Admiralty and Indian Regulations relative to—Ventilation—Ventilating space—Fumigation—Ships' well—Live Stock—Inspections—Admiralty Transports—Hired ships—Instructions to be given—Embarkation of troops—Duties of Medical Officer on board—Infectious diseases—Epidemics on board ship—Hospital ships—River Steamers—Space—Rations.

DIFFERENT KINDS OF TRANSPORTS.—The different kinds of vessels usually employed for the conveyance of troops by sea are the following, *viz* :—

1*st*.—Men-of-war Transports, that is, ships officered and "found" in every way by the Admiralty, specially filled up for the conveyance of troops, but ready at any time to receive guns and ammunition, and thus become fitted for fighting purposes.

2*nd*.—Ships hired at so much per month per ton, liable to be sent wherever required. These are fitted up and provisioned by the Admiralty. A Naval agent is on board to see that no unnecessary delay take place in the passage from place to place. The master and crew, however, are paid by the owners of the vessels. During the late expedition to China, many vessels were hired upon these terms; the ships

being regularly numbered upon the bows and quarter for the sake of more ready reference.

3rd.—Ships, the property of private owners, on board of which passages are engaged for so many officers, men, women, and children at so much per head, for conveyance from any one to any other port; fittings of all kinds, provisions and water being found by the owners: bedding and medical attendance by the State.

Of the latter description of vessels are those almost entirely employed in the conveyance of troops between England and India, although there is every reason to believe that within a short time a line of transports of the first-named class will be in operation.

Between England and the other colonies, the three kinds of ships are made use of apparently as may, at the particular time, be most convenient.

Wooden and iron Ships.—Of late years iron has come much into use in the construction of all descriptions of ships. As a rule, however, wooden vessels are much more comfortable than those built of this material, and especially so for the conveyance of invalids. They are not so readily heated as the iron ones, nor is their motion when at sea so great.

Experience has long since proved, however, that unless the wood employed be old and well seasoned, ships built of timber are liable to become unhealthy; and this circumstance demands the closest attention on the part of the authorities employed in the selection of hired ships as Transports.

Best size of Ship.—It is considered that the most comfortable vessel, and that where the requirements of health, as regards troops embarked, are best carried out, is a ship of about 1,000 tons burthen, with one troop deck and a poop.

Proper number of troops.—It is not desirable, on sanitary considerations, that more than 300 to 350 soldiers, including their wives and children, proceed on long voyages in any one ship, such as is

here described. Nor should, under any circumstances, more than 150 invalids proceed by one vessel.

Tonnage per man.—According to the Queen's Regulations, ships engaged as Transports should measure not less than 270 tons per every 100 men put on board. Those from India should be even more, say 300 tons per 100 men.

Profits to owners of ships.—It is to be borne in mind that the owners or agents of ships, in offering their vessels to Government for the conveyance of troops from abroad to the United Kingdom, do so with the object to thus secure a larger profit than they would obtain from the carriage of ordinary freight. Hence they take into account the rate of freight which prevails at the time; the probability of the ship making a more rapid passage when carrying troops, as compared with what she would if laden entirely with merchandise. They have also to consider the expenses likely to be charged by contractors for rationing the troops and fitting up the vessel, and strike the balance between the probable profits after all these have been considered, and those that they might expect were no troops on board.

Let us take an example. A ship, say the "A.—" "V.,—" having a tonnage of 1,184 tons tenders at Calcutta for the conveyance of troops to England. The calculation may be made somewhat thus:—

Were no troops to be taken, the vessel could carry 1,700 tons of cargo, which at the rate of £3 per ton would net £5,100. Being taken up for troops, the vessel can only take 950 tons of cargo; and, as a considerable portion of that quantity is in the shape of dead weight, the value of the freight of the whole may be valued at £2-10 per ton, or for the whole £2,375.

The number of persons to be conveyed in the ship is in all 326 adults, that being the usual way of calculating the persons to be embarked. It is calculated that after paying an average amount of £15-10

per head for fittings required for them, and for rations and water for 140 days, the estimated net profit to the owners will be £11 per head, or 326=£3,586. Thus the profit per head may roughly be valued as equivalent to that of 2½ tons of freight.

There is, however, another source of profit from the conveyance of troops; thus, the profit from the freight on board, *i.e.*, £2,375; that from the troops as above, *i.e.* £3,586=£5,961, or £861, more than would accrue from cargo alone. In addition to this, the balance of rations and the fittings become the property of the ship: and the sailing time of a ship carrying troops is generally accelerated during a voyage by several days. The expenses of pay, and rationing the crew thus are saved.

The wear and tear of the ship is not taken into account, as this would be taking place alike under any circumstances.

Selection of Ships.—The representatives of the Admiralty are properly held responsible for the sea-going qualities of a ship taken up for the conveyance of troops, for the condition of the hull, rigging, spars, and of the machinery of a steamer.

The 'tween-decks' of a ship selected should be of good height—not less than 6 feet, 4—should have the means of good side or deck ventilation, and be clean. The state of the hold should be such that offensive odours do not arise, and the whole of the space should be what is called sweet.

The nature of the arrangements on deck, although only second in importance to those between decks, as regards the comfort and well-being of the troops to be embarked are it is feared, too often but little considered.

In vessels with deck-houses, not only is the space which should be available for the men much curtailed, but the means of stowing away their hammocks and bedding during the day are much restricted; and

there is often insufficient space thus left for the live stock required for the messing of the officers.

Prohibited cargo.—Very strict rules are enacted in regard to the nature of articles taken on board, as cargo or otherwise, by ships taken up for the conveyance of troops from India to the United Kingdom. The following extract from the official orders on this subject, by the Controller of Marine Affairs, contains an enumeration of these, *viz.* :—

"That the said Master will not take on board the said vessel more than two dogs, nor carry or place on board as cargo any raw hides, molasses, bones, camphor, ethers, collodion, fire-works, gun-powder, lucifer matches, naptha, essential oils, phosphorus, quicklime, rock oil, spirits, turpentine, spirits of turpentine, arsenic, orpiment, corrosive sublimate, cotton, ghee, butter, fixed oils, pitch, tar, dammer, quicksilver, rags, sulphur, tallow, wax, chlorate of potash, nitre (nitrate of soda), saltpetre, jute or any other article or substance whatever of an inflammable or combustible nature, unrefined sugar or sugar of any other description than the following, *viz.* :—Sugar, vacuum pan white, vacuum 2nd quality, vacuum pan yellow, fine white, good Benares, fine date, good Gurputta, without the previous consent in writing of the Government of India: and that after the survey and inspection hereinbefore mentioned, no such article shall in any case, be put on board, or form part of the cargo."

Space.—The regulations, in regard to the amount of space on board ship authorized under different orders, differ considerably.

Officers.—Thus, according to the Admiralty rules, each officer on board a Transport is only allowed 30 superficial feet, or if there be two officers in one cabin, 42 feet each.

Troops have 9 feet × 1 foot 4,—including the hammocks and beds.

Women and children.—Women and children to be accommodated in standing bed-places each 6 feet × 3. One woman, and two children under ten years of age, or two women to be in each. The berths to be 3 inches from the ship's side to keep the bedding from getting wet. This space, however, is much too small for the purpose. In India the allowance is 16 inches, that being a much more reasonable amount.

By the latest Admiralty orders, petty officers of the Navy, and staff serjeants of the Army and their families, are to be accommodated in cabins placed between decks, or in the deck-house, and are to have the same superficial or deck space as commissioned officers.

Hospital space.—The Admiralty directs that the hospital space be abreast of a hatchway, when practicable on the port side, fitted with standing bed-places in two heights, and provided with a proper screen. In Transports, hospital accommodation for 3 per cent. embarked is provided; in troop-ships for 2 per cent., except in voyages to the tropics, and then for 3.

Space for Sick provided in the Crimea.—In the published rules by the Admiralty, there does not appear to be any mention of the amount of space per person in the hospital; but from other sources we learn that the space allowed for sick and wounded on board Transports in the Crimea was fixed by a Board of Officers at 6 feet × $2\frac{1}{2}$ for sick, and 6 feet × 3 per wounded; the height between decks varied from 6 to 8 feet. The mortality in some of them was at the rate of 74·50 per 1,000 in 8 days and a half.

For short voyages.,—The Admiralty regulations direct that in sailing ships troops are always to be accommodated below; and that in steamers, all shall be accommodated below on voyages exceeding three weeks in duration. For voyages of less duration, accommodation below need

only, according to those regulations be provided for all, during the months of November, December, January, and February. During the remaining part of the year, one-fourth of the number embarked are to form a watch on deck, care being taken that shelter for them is provided in bad weather; thus, if a ship can berth 300 men below, 400 may be taken on board.

The Indian regulations, however, are much more liberal: except when a few men are sent by coasting steamers, and are paid for as deck passengers, all considerable bodies of troops are berthed below, when ships are chartered even on so short a voyage as from Calcutta to Madras. The discomforts of a short voyage under Home regulations, especially in severe weather, form the theme of many a soldier's tale.

Calcutta Regulations.—

Warrant and medical warrant officers and school masters ... } A screened berth 7 feet × 4=28 superficial feet.

1st and 2nd class serjeants, each 15 superficial feet.

Band master (military)—Screened berth 7 feet × 4 =28 superficial feet.

Troops—10½ superficial feet.

Hospital space—at the rate of 3 per cent. of strength at 21 superficial feet per man.

Dispensary only allowed with invalids for whom no separate hospital space is measured. Space for dispensary is then 22 superficial feet.

Women, whether sick or well 22 superficial feet.

Children, whether sick or well, if over 2 years of age 11 superficial feet. Under 2 years, *no* space.

Invalids, 22 superficial feet each.

The cooking range must contain fixed boilers in proportion to the strength proceeding on board, at the rate of one half gallon per each adult. The existence on board of a sufficient supply of fuel should be ascertained.

When a limited number of men in health proceed with invalids, all are allowed 22 superficial feet each. When many proceed, they are to have 15 feet, the invalids 22; if all are on one deck. If upon two, men in health have $10\frac{1}{2}$, invalids 22; this latter arrangement, however, is upon sanitary grounds objectionable.

Bombay rules.—By Bombay regulations the space per man allowed on board ship is $15\frac{3}{4}$ feet for invalids, and $10\frac{1}{2}$ superficial for men in health. The accommodation for the former is thus, far too limited.

For native troops, a Committee, of which the author was member, decided (8th July, 1863) that in coasting voyages, if not more than five days' duration, the space be $6 \times 1 = 6$ square feet if on steamers, and $6 \times 1\frac{1}{4}$ feet $= 7\frac{1}{2}$ square feet on sailing ships.

That under all other ordinary circumstances on board ship, they should have $6 \times 1\frac{1}{4} = 7\frac{1}{2}$ square feet, except when they proceed on service, or are likely to be long on board. The space should then be $6 \times \frac{1}{2} = 9$ feet.

Native officers to have each a screened berth $7 \times 4 = 28$ square feet.

Rules for alloting space.—By way of an illustration of the different proportions of space required for different classes of persons on board ships, let us take the measurements of a vessel that recently conveyed troops from Calcutta to England, *viz.*:—

The "Roslin Castle."

	Sup. feet.
A Sergeant Major's screened berth,	
1 Man	15
1 Wife	22
1 Daughter over 10 years	22
1 Son between 3 and 8 years... ...	11
Total ...	70

199	Invalids at 22 feet	4,378
1	Boy over 10 years has $10\frac{1}{2}$ feet by right, but with invalids ...	22
15	Women, each 22	330
11	Children between 2 and 10 years, at 11 feet each	121
	Dispensary	22
	Total ...	4,943

Thus, 4,943 (the space actually required) + 142 (the area of hatches, and not taken into account) = 5,085. This ÷ $31\frac{1}{2}$ (the average width of the ships) = the number of running feet to be measured off, namely, $164\frac{1}{4}$.

It will be seen that the space of all hatches and masts, as well as chain lockers is deducted from that to be apportioned to troops. As a rule it is not considered advisable to take up the extreme forepart of the ship, merely because ventilation there is difficult, but as much space aft as possible is selected, because there ventilation is comparatively free.

Two sections of a ship are here given, the second of which illustrates well the manner in which space is measured off: and it is considered that with these to refer to, no difficulty need ever be experienced in performing this duty. The explanations give the precise measurements, and show how the various deductions already alluded to are to be effected.

Standing berths.—When standing berths for invalids are built, they should be in a single row along each side of the ship, or a double row in the centre. The midship row to extend only from fore to main hatchways, with a space between the side and middle rows of not less than 7 feet.

A space of 16 inches to be between the side rows and side of ship; a similar one between the centre rows when these are necessary.

Standing berths for adults to be 6 feet 7 inches × 2 feet 4 inches. This is too broad; they should be at least four inches narrower. They should be raised 2 feet from the deck, and admit of a hammock being swung over them if necessary.

Cooking galley.—The proper place for the cooking galley is midships; when at the side, the latrines must be more or less close to it—an arrangement which, if possible, should be avoided.

The galley should be sufficiently large to cook the meals of all the troops embarked, and there should at least be one spare set of coppers to provide against accidents while at sea.

The later improvements in the construction of these have introduced what was long felt to be a serious want, namely, a small stove, separate and distinct from the principal one, so that little articles of diet or of medical comforts for sick and for children can be prepared without trouble or inconvenience.

The coppers should be capable of holding at the rate of half a gallon per head, and it is a necessary part of the final inspection of a ship to ascertain that they are so. One means of arriving at this knowledge, is to ascertain the entire contents of their interior, and divide that by the number of gallons; namely, $6\frac{1}{4}$ which constitute a cubic foot. Another and the readiest method is to multiply the length by the breadth, then the sum by the depth; bring, the whole to inches, divide by 277·274, and the result represents the number of imperial gallons the vessels are capable of containing.

Issuing room.—On all ships, engaged in the conveyance of troops, it is necessary to have an issuing room for the daily rations. Under some circumstances it is arranged in the hold of the vessel, but as a rule is situated on the troop-deck, and as near as possible to the hatchway by which the supplies are sent up from store.

It is customary to allow a space of 6 feet by 7 for it; this being taken out of, and not given in addition to,

the regulated space per man on board. These dimensions are considered sufficient, whatever may be the number of troops on board. The sides of the room should be built of strong open grating, so as to admit of as free ventilation as possible, and the door should be well secured to prevent unauthorized ingress into it.

Hospital.—In freight-ships carrying troops in health, hospital space at the rate of 22 superficial feet per man for 3 per cent. of the troops embarked is set apart, and in addition, a small compartment of $3\frac{1}{2}$ feet × 7 as a Dispensary. It is usual to combine these two spaces,—to have the whole railed in and furnished with a canvas screen to fall down or fold up as may be necessary.

Light and air are as necessary to the well-being of the sick on board ship as they are on shore, and hence no doubt the order that as a general rule, the hospital or sick bay shall be placed near the main hatchway. The port side is, usually the place chosen for it; and there seems no objection to the arrangement. It is necessary to enquire, however, whether the ship when at sea takes in most water a-midships, and if she does, to have the hospital placed in some part, either farther forward or aft, where the sick have most chance of escaping wet.

Prison space.—A prison having space at the rate of 2 per cent. strength should be erected, but never for more than 8 prisoners. Each cell to be 3 feet broad and 6 feet long. These should be so placed as to get good ventilation from a hatchway or scuttle, and the upper part of their bulk-heads should be open, with iron bars.

Latrines.—Latrines are directed to be erected in the proportion of 5 per cent. of the number of men embarked. A similar proportion for women and children, one half being on either side of the ship. There ought also to be a urinal on either side. Several patent hermetically-sealed water chairs should be put on

board for use by the sick, and by the women when necessary. The water-closet for women down below is useful, but should only be used at night, or by sick, and carefully attended to.

Water.—The allowance of water on board ship is usually calculated at the rate of six pints per person per day in extra tropical latitudes, and eight pints per day within the tropics. For a horse 6 gallons per day.

On long voyages, such as between the United Kingdom and India, Australia, or China, it heretofore was often necessary to touch at an intermediate port to replenish the supply of water. Now, however this should seldom be necessary, as with the improved means of distillation, with which the better class of ships are provided, the daily wants of all on board may be for the most part fully supplied.

Distilling apparatus.—At the present time we cannot but wonder at the apathy which so long prevented ship owners from taking advantage of the invention of these so-called "condensers." So long ago as 1763, an apparatus for distilling water on board ship was contrived by Poissonier, and in 1808, Dr. Cutbush remarks that "by the simple addition of a head and worm to the common boiler, water may be obtained free from salt, and the process of distillation may go on while the victuals are being cooked. Yet as every person is well aware who remembers any thing of the ships of even twenty years back, not only was the water often in a loathsome state of foulness from decomposition of organic matters contained in it, but the danger of an accident occurring to the casks in which it was contained was ever present to their minds, and too often realised; the small daily allowance having to be reduced, more or less, to their great discomfort and personal injury.

Lime to purify water.—In those days the theory was, that the water on board ship went through a process of self-purification. It was considered sufficient

that water from alongside the ship, so long as it was fresh was pumped into the casks provided for it, and these had no other preparation for it than being charred in their interior. It is true that some means were recommended with a view to diminish, if not destroy, the extremely offensive nature of the supply thus obtained and thus preserved. In the early part of the present century, partially slaked lime was used for this purpose, half a pound of it being suspended in a flannel bag in each cask: another and better, although more complicated plan, was to impregnate the water with lime, and then preceptitate the latter by carbonic acid.

With the improvements of late years introduced into the means of preserving water on board ships and of distilling it during the passage, there is not the same necessity for filters that used formerly to exist. Still, however, for sick men, one or two of these should always be available for use, and are indeed put on board by orders of embarking medical officers at our foreign stations, with the exception of India,—and there, custom has not hitherto authorised their being supplied. A filter for hospital use is specially allowed by Admiralty regulations. A simple and effectual means of clarifying and purifying water on board ship, consists in pumping it into iron tanks and allowing it to remain there some days prior to use.

Victualling troops.—The scale of victualling troops on board ship is explicitly detailed in the Admiralty regulations and Queen's regulations on the subject. It would be adding unnecessarily to the dimensions of this chapter: were the different victualling scales to be transcribed, nor would any good purpose be served, as they are regularly produced at the time of embarkation by the superintending officer of the Quarter Master General's department.

The subjoined statement will best show the differences that exist between the scale for a man in

health to or from India, according to the rules which were in force prior to 1864, *viz.*—

Articles.	*Indian scale.*	*Admiralty scale.*
Biscuit ...	lbs. 100	... lbs. 140
Porter ...	pts. 105	... pts. 110
Sugar ...	lbs. $38\frac{3}{4}$ or oz. 620	lbs. 11 or 175oz. including $8\frac{3}{4}$ lbs. for lime juice.
Chocolate ...	none	... oz. $93\frac{1}{3}$
Tea	oz. 52	... 35
Oatmeal ...	none	... pts. $3\frac{1}{3}$
Mustard ...	oz.12	... oz. $6\frac{2}{3}$
Pepper ...	oz. 4	... oz. $3\frac{1}{3}$
Vinegar ...	pts. 10	... pts. $3\frac{1}{3}$
Salt pork ...	lbs. 60	... lbs. 45
Peas ...	pts. 20	... pts. $13\frac{1}{3}$
Salt beef ...	lbs. 40	... lbs. 45
Flour ...	,, $33\frac{1}{3}$	... ,, $22\frac{1}{2}$
Suet ...	,, $5\frac{3}{4}$	... oz. 30
Raisins ...	oz. 90	... oz. 60
Preserved meat	lbs. 15	... lbs. 15
Rice ...	,, 10	... lbs. 10
Mixed vegetables	lbs. $1\frac{1}{4}$	... lbs. $1\frac{1}{4}$
Salt ...	oz. 8	... oz. $7\frac{1}{2}$
Rum ...	pts. $8\frac{3}{4}$	... pts. $3\frac{3}{4}$
Preserved potatoes	lbs. $7\frac{1}{2}$	... none
Pickles ...	pts. $8\frac{1}{3}$	... none
Lime juice ...	,, $4\frac{3}{8}$	... none
Butter ...	lbs. 5	... none

A comparison of these shews us an increase in the allowance of biscuit according to the Admiralty as compared to the Indian scale: the quantity allowed by even the Indian scale was greater than could be made use of. Hence, much will necessarily be wasted or thrown over board by the men.

By the new scale the men receive no pickles, as part of their ration: no preserved potatoes, very little sugar, and no butter; these being the greater portion of the articles of diet that render meals agreeable, and in fact are best calculated

to preserve health. It will also be seen that the proportion of raisins is much smaller by the new rules than by the old, and that the quantity of flour is much diminished; thus curtailing the means of the men to prepare various articles of diet, such as they are known to relish much at sea. Flour is, in fact, now given in only about two-thirds the quantity allowed by former regulations in India.

Spirits are now put on board for 30 instead of 35 days as formerly, and porter for 110 instead of 105; and in these respects are probably to be found the only differences between the new and the old scales of victualling on board Indian ships.

The Admiralty scale of victualling on board ships is not, however, brought into operation for troops proceeding from one port to another, within the jurisdiction of the Government of India. In these circumstances the old Indian scale is still maintained.

The scale of diet for troops on the voyage to India and back was, prior to 1864, as we have just seen, much more liberal than that laid down in the Admiralty rules. In that year, however, the Government of India ruled that the latter should be substituted for the one heretofore in use.

The Admiralty scale, although probably sufficient on short passages, is not so for long ones; as, for instance, to India, China, and Australia. Instances are often recorded of imperfect diet on board ship producing a low condition of health: although perhaps not actual scurvy, yet such as to render them on landing, and especially if service there awaits them, particularly prone to be attacked by disease; nor should the fact be forgotten that much of the voyage between England and India, is along latitudes of a tropical or semi-tropical temperature, in which respect it differs in a considerable degree from voyages between England and her other possessions in the far east; and doubtless it was with especial reference to this circumstance that the old Indian scale of dietary was originally formed.

Beer.—The issue of spirits to troops on board ship is not now sanctioned, except under the orders of the medical officer in charge, and very wisely so. It has long been found that while the latter have no antiscorbutic property, the use of the former has it in a very marked degree. At the beginning of the century writers observe, "it is a fact well established in the British Navy, that the scurvy is found to make slow progress, so long as the beer holds out." Yet only upwards of fifty years afterwards do measures seem to be taken accordingly.

Biscuit.—Biscuits intended for long voyages should be very well baked. The plan now often adopted in merchant vessels of keeping them in bags is not a good one. They easily get worm-eaten and musty when thus kept. So long ago as the days of Captain Cook, it was found that they kept best when packed in casks, and it has been asserted that those casks which have been impregnated with spirits or saltpetre answer best for the purpose.

The commonly adopted plan of exposing biscuit, that has been long kept, to the heat of the oven, should as far as possible be extended to that for troops.

Vegetables.—In India it often happens that preserved potatoes or compressed vegetables are not obtainable in the market in sufficient quantities to meet the requirements of troops. In such cases fresh potatoes, if procurable, are put on board in the proportion of $\frac{3}{4}$ lb. per man daily for a month.

According to the emigration scale of victualling under the Government of Queensland, the articles and in the quantities noted below are put on board for every 100 adults, estimating the length of the voyage at 16 weeks. These include what is called the dietary scale and reserve, but exclude the medical comforts, and in order to bring the proportion down to the allowance per man, a third column containing this information is added, *viz.*—

Articles of Diet.	Per 100 Adults.		Per Adult.	
Biscuits	lbs.	5,500.	lbs.	55
Beef (salt)	,,	2,600	,,	26
Pork	,,	2,100	,,	21
Preserved meats	,,	2,300	,,	23
Suet	,,	1,100	,,	11
Butter	,,	550	,,	5½
Flour	,,	7,500	,,	75
Oatmeal	,,	2,200	,,	22
Rice	,,	1,100	,,	11
Peas	,,	1,600	,,	16
Potatoes	,,	1,100	,,	11
Preserved cabbages	pts.	2,000	pts.	20
,, Vegetables		4,000 pts.	pts.	40
Tea	lbs.	150	lbs.	1½
Coffee	,,	300	,,	3
Sugar	,,	1,600	,,	16
Treacle	,,	1,100	,,	11
Mixed pickles	pts.	525	pts.	5¼
Lime juice	,,	800	,,	8
Mustard	,,	60	,,	6-10ths
Salt	,,	300	,,	3
Pepper	,,	70	,,	7-10ths
Eggs	doz.	18	doz.	2
Condensed eggs in ¼ lb tins	lbs.	14	oz.	2½

The great superiority of the above scale in regard to the allowance of antiscorbutic articles of food, and the various items which tend to render a meal comfortable and enjoyable, must be apparent to any one who will simply take the trouble to compare it with either of the two preceding, but more especially with that sanctioned by the Admiralty.

Medical comforts.—The scale of medical comforts allowed by Admiralty regulations varies according to the length of the voyage: and in the Transport regulations the precise amount of the different articles allowed is noted, according to the destination of the vessel or port from which she sails.

It is only in voyages to or from India that this scale undergoes any modification, for although at the time these notes were being written, the victualling had been altered to the Admiralty one, that of the "comforts" had not, nor was it to be desired that it should be; for in their provision for sick men and women and children of soldiers, the liberality of the old East India Company was most marked.

It may be useful to institute a comparison between the scales of comforts allowed by the two regulations for ordinary troops, on the voyage between India and England; the fact being borne in mind that in either case any additional articles that may, by the principal medical officer at the port, be deemed requisite are supplied on his certifying to that effect.

It is also to be borne in mind that, according to Indian regulations, the lime juice and sugar put on board as "comforts" are altogether in excess of the quantities of the articles supplied or intended to be supplied as part of the daily ration.

Proportion of comforts, (including lime juice and sugar,) for 100 troops on the voyage between England and India, according to Admiralty and Indian regulations, *viz.*—

Articles.	Admiralty scale.	Former Indian scale.	Present Indian scale.
Sugar	lbs 60	,,	lbs. 60
Tea	... 12	,,	,, 12
Scotch barley	... 40	,,	,, 40
Sago	... 18	lbs 100	,, 18
Arrow-root	... 12	,, 75	,, 12
Wine	bottles 36	bottles 200	,, 36
Preserved meat	lbs 36	,,	,, 70
Preserved potato or rice	18	,,	,, 12
Tapioca	... 27	,,	,, 27
Essence of beef, $\frac{1}{4}$	pts. 60	,,	,, 15
Soap	lbs. 14	lbs. 300	,, 14
Lime juice	... 350	lbs. 150	,, 100
Sugar (for the above)	350	lbs. ,,	,, 300
Portable soup	... ,,	,, 100	,, ,,

By Indian regulations, the bedding and clothing are included among the medical comforts. Among the changes in arrangements for troops recently introduced by the Government of India is that noted in the third column of the above scale. The quantities shown in the second column are those formerly allowed, but since the publication of General Orders by the Governor General, numbered respectively 772 of 1864, and 1136 of 1865, the latter are issued; being, as will be observed, not according to the Admiralty scale, and at the same time in some respects very restricted in comparison with the scale formerly allowed in India.

Although, however, the scales are as have just been stated, in accordance to which these articles are put on board; discretionary power is given to the principal medical officer at the port of embarkation; nay, it is made an important part of his duty to make application for whatever other articles of comfort the condition of persons going on board may seem to require.

Thus in the case of invalids: although special rules are laid down for them, yet the nature of their ailments, the length of voyage before them, and the particular latitudes through which the route lies, must all be taken into consideration: as must also be the number of women and children proceeding with them: for of these two classes, women, if nursing, require a full allowance of the more delicate and nourishing articles, and children should have an ample supply of milk, soups, and materials for preparing light puddings for their use.

As an example of the additional comforts put on board for a long voyage, the following is a transcript of the list for invalids embarked at Hong Kong for England in 1860, as prepared by the writer of these notes. There were for 130 invalids sailing towards the Cape and England per ship *Epsom*, *viz*:—

Port Wine	bottles	288
Sherry	,,	72
Preserved meat	lbs	100
Essence of beef	$\frac{1}{4}$,,	400

Seltzer water	bottles	60
Brandy	,,	36
Preserved potatoes	lbs.	56
Sugar	,,	200
Tea	,,	10
Preserved fowls, tins	,,	20
Jelly	pints	24
Sago	,,	50
Arrow-root	lbs.	50
Preserved milk	pints	1,800
Soap, Brown	lbs.	112
— Marine	,,	60
Pearl barley	,,	25
Champagne	bottles	12
Cocoa and milk	,,	36
Ale	,,	360
Porter	,,	360
Claret	,,	24
Preserved vegetables	lbs.	900
Lime juice	pints	144

It is right to mention that this was during the last China war, and that probably more discretionary power is left to medical officers in making arrangements on such occasions, than during a time of peace; yet the scale is given as a guide to what may, under similar circumstances, be obtained.

These stores are in India placed by the Commissariat under the charge of the master of the ship, to be drawn on the requisition of the medical and commanding officers. The latter, however, will be responsible for the payment of any deficiencies that may be unaccounted for at the end of the voyage.

These orders sanctioned by the Secretary of State for India and the General commanding-in-chief, are published in the *Gazette of India*, February 18th, 1865.

Lime juice.—The issue of lime juice has, it is almost needless to say nearly, if indeed not altogether, eradicated scurvy from sailors and troops on board ship; and, as we shall presently see, strict orders on

the subject are given not only in the Queen's regulations but in a separate form, to the medical officers about to proceed in charge.

According to some regulations, as, for instance, the Emigration scale quoted in a preceding page, lime juice is put on board as part of the regular ration. In others, as the Indian, a portion is put on board as an item of rations as well as of medical comforts : while, according to Admiralty rules, it is put on board niether as a ration nor a comfort, but over and above the various items included under these two heads respectively.

The Indian scale for troops, proceeding from that country to England or the colonies, has since 1864 been superseded by the Admiralty one ; it may, however, be still interesting to view the following comparison of the two. Thus, by the Indian scale for men in health, there was put on board—

a. 4½ pints per man as rations, or at ½ oz. per day for the voyage oz. 72.

b. As medical comforts, and in addition to the above 1½ bottle per man, or oz. 36, making a total quantity per man of oz. 108.

By the Admiralty scale, there is put on board as ration for the same voyage *none*. There is put on board under the somewhat peculiar heading of "medical comforts *and* lime juice, oz. 56 per man," so that there is an actual deficiency according to the Admiralty scale as compared to the Indian, to the very considerable amount of oz. 52 per adult.

For invalids the difference is even more marked. Thus, by the Indian rules there is put on board as rations per man oz. 68, and as comforts oz. 96, making a total amount per head for the voyage to England of oz. 164.

By Admiralty rules, there is put on board as rations *none*. Under the heading, above-noted, 350 bottles for 100 men equal to 3½ bottles per head. The bottle is held to contain oz. 24, thus 24 × 3½ = oz. 87,

leaving a deficiency according to this, as compared to the old Indian scale, equal to oz. 84 per person for the voyage.

It is, therefore, not too much to say that among the many points in which the late Company attended to the well-being of their troops in transit to or from their possessions, none was more remarkable than this; and the reward was an amazing degree of health, as a general rule, among the men at sea.

While the proofs of this chapter are undergoing correction, the General Order by the Government of India, numbered 1136 of 1865, has appeared: this order sanctions as *medical comforts* for 100 persons in health, or as invalids lbs. 100 of lime juice; and lbs. 300 of sugar. In addition to these quantities it is directed that there be put on board as ordinary rations lime juice and sugar, in the proportions of oz. $\frac{1}{2}$ of each for person for the first 20 days of the voyage, and oz. 1 per day for the remainder of the voyage; that is, oz. 130 for the entire voyage, or 140 days.

These alterations, however, only refer to troops proceeding from India: for those leaving the United Kingdom for that country, the old scale of victualling in accordance with that in use under the orders of the late East India Company is still allowed, and will, it is hoped, long continue so to be.

Comparative lists of Bedding and Clothing per person on Voyages between England and India, as sanctioned by Admiralty and Indian Regulations.

			Standing berths.	Common mattrass.	Hair mattrass.	Common pillow.	Hair pillow.	Hammock.	Sea-cots complete.	English blankets.	Indian blankets.	Cotton Indian rugs.	Flannel shirts.	Flannel drawers.	Flannel in lieu of drawers.	Stockings.	Socks, pairs.	Canvas frocks.		
			c.		a.		a.		a.											
Troops.	Invalids.	Admiralty.	1	1	1	...	1	1	1	2	...	...	...	...	4½ Yards for a banian per woman and child, for drawers, 8½ per 4 yards (Indian.)	...	...	b.		
		Indian.	1	1	a.	1	a.	1	d.	...	2	...	2	2		2	...	2		
	Healthy.	Admiralty.	...	...	1	...	1	1	d.	2	...	...	...	...		...	2	2		
		Indian.	...	1	...	1	...	1	d.	...	...	...	...	...		...	...	...		
Women.	Sick.	Admiralty.	1	1	1	...	1	...	...	2	...	...	...	...		...	...	...		
		Indian.	1	1	...	1	...	...	...	...	1	1	...	...		2	...	...		
	Healthy.	Admiralty.	1	1	1	...	1	...	...	2	...	...	...	...		...	...	...		
		Indian.	1	1	...	1	...	...	...	...	...	...	...	...		...	2	...		
Children under 10.		Admiralty.	1	1	...	...	1	...	...	1	...	...	...	...		...	...	...		
		Indian. *f.*	1	1	...	1	...	...	...	...	1	1	...	...		...	2	...		

a. In transports only. *b.* Smock-frocks have to be paid in England by the soldier. They are given gratis in India. *c.* Or in whatever proportion for the whole as may be deemed necessary by the medical officer. *d.* Sea-cots for the sick, if necessary, or 8 per 100 invalids. *e.* No flannel allowed by Admiralty regulations. *f.* Children over 10 years of age receive the same supplies, or as adults according to Indian rules.

Note. Three per cent. of Sea-cots are put on board by Indian rules—and 2 per cent. by Admiralty,—and 2 per cent. hammocks and pillows by Admiralty—none by Indian rules.

Bedding and clothing.—A table is given on the preceding page, by which will be seen at a glance the amount of bedding and clothing allowed to different classes of persons on board ship by the Admiralty and by the Indian regulations.

According to Admiralty regulations, the following articles of bedding are allowed to troops, *viz* :—

Men.
- Hammock, 1 per each man.
- Blankets, 2 ,,
- Do. Spare, 5 per 100 men.
- *(Hair beds in transports only, 10 per 100 men).*
- *(Hair pillows in transports, 10 per 100 men).*

Hair bed, 1 for each berth.
Do. pillow, 1 ,, Woman.
Blankets, 2 ,, ,,
Hair pillow, 1 for each child under 10 years of age.
Blanket, 1 for each child under 10 years of age.

A supply of waterproof coats is now put on board troop-ships for use during the voyage for the proportion always on deck, namely, one-third of the whole. By using them in rainy weather the men need seldom become wet: but when they do, their wet clothes should not be permitted to remain below, an hour longer than is absolutely necessary. They should be sent on deck and dried.

Bedding.—The following scale of bedding and clothing is put on board for troops proceeding from Calcutta to England, these articles being over and above the bedding used by the soldiers, and issued to them yearly in India, *viz* :—

For Troops, per man.

Invalid.		In Health.	
Country blankets ...	2	Hammock	1
Hammock	1	Mattrass	1
Mattrass	1	Pillow	1

Pillow ...	...	1	Sea-cots 3 per 100 men.
Flannel shirts	...	2	Canvas frocks 2 per man.
,, Trowsers ...	...	2	
,, Socks	...	2	

	For each woman. In Health,	If Sick.
Blankets *(country)*	... — ...	... 1
Cotton rug *(sutrungé)*	... — ...	... 1
Standing berth ...	... 1 ...	... 1
Mattrass *(common)* ...	... 1 ...	... 1
Pillow *(common)* ...	... 1 ...	... 1
	For each child :	
Blanket	... 1 ...	... 1
Cotton rug	... 1 ...	... 1
Standing berth ...	... 1 ...	... 1
Mattrass	... 1 ...	... 1
Pillow	... 1 ...	... 1

Two pairs of stockings for each woman, and two pairs of socks for each child are also put on board : and 8½ yards of good flannel per woman or child, to be made up into such articles of clothing, during the voyage, as may be deemed necessary.

The authority for the above scale is to be found in *Indian Government General Orders.* No. 556 of 1865.

Ventilation.—In former times ventilation, as indeed, sanitation in any shape was very little considered ; and sad stories may be read in the records of those days, of the fearful stench, state of filth, and consequent disease to which sailors on board ship, men-of-war, as well as merchantmen, were subject.

It would seem that it was not till 1748, that attention began to be paid to this very essential measure ;— a Mr. Sutton appears then to have introduced an improved system of ventilation ; and in reference to it, admiral Boscawen, writing from Table Bay on the 9th April of that year, says: "I cannot help thinking the air pipes fixed in the men-of-war have been of great service by purifying the air between decks, and

thereby preventing the scurvy." It is clear, therefore, that among the circumstances which combine to produce that scourge, want of fresh air was even then acknowledged to be one.

Among the rules laid down by the American Sanitary Commission, there is only a brief notice of this very essential measure, namely, that when troops occupy the lower deck of steam transports, the area for outlet for air should equal four square feet per 100 men. This, with the vessel proceeding at the rate of five knots an hour, would give each person 1,000 cubic feet of air during that time.

The ordinary means for ventilating the decks of troop-ships consist of hatchways with wind-sails, air-shafts, deck-ventilators, and side-scuttles or ports. In some of the more recently built vessels there are in addition to these, timber-head ventilators ; and in some having the latest improvements, a draught of air upward is effected by openings in the iron masts which these possess.

An improvement on the above methods has been effected by Doctor Gavin Milroy, but it is only applicable to steam vessels, namely, ventilation through the funnel by means of openings leading to it.

In steamers, various kinds of apparatus, in the shape of fanners and force air-pumps have been used, and may readily be so ; a long tube guiding the current into any part of the ship where ventilation may be most required ; in sailing ships somewhat similar machines are used and worked by the hand, the most useful of these being, apparently, that patented by Dank, and known as his apparatus. It is very useful for forcing air into recesses or between standing berths, and for ensuring ventilation below, during bad weather, or when from any other cause, the hatches are closed.

Dr. Cutbush, many years ago, recommended that as a means to ensure ventilation of ships at sea, and during bad weather when the hatches have to be closed, a tube for the escape of air should be introduced

next the fore and main masts. An improvement upon this is now coming into common use, the iron lower masts of some vessels containing within them a tube for the escape of air from the troop-deck.

In ventilating the troop-deck of a ship, it should be borne in mind that when the vessel proceeds to sea, the tendency of its natural motion ahead is to *jam* up the air as it were at the after part of that deck : and that under all circumstances it is especially necessary, that this part occupied as it is by women and children, shall have the benefit of the best ventilation that can be obtained. Hence, in all such cases a large air-shaft should extend upwards from the farthest aft part, unless as sometimes is the case, the whole extent of deck has been given up to the troops. In that case the stern ports so long as they can be kept open, ensure a good draught. Even then however, deck-ventilators should be introduced as far aft as practicable, so as to afford escape for vitiated air when the ports have to be closed.

Cowl heads are most useful in effecting change of air between decks, but considerable tact is necessary in so placing the cowl as to produce the current of air that is desired. For instance, if the opening be turned towards the wind, a downward draught takes place, if away from it an upward ; but unless the cowl heads that are to windward, face towards the breeze, and those to leeward are turned away from it, no current of air between decks can take place.

These, and air tubes should be in sufficient proportion to maintain ventilation independently of hatches and ports.

A Dank's apparatus should be put on board all ships carrying troops,—and when more than 100 men embark, a second may, with advantage, be supplied.

Wind-sails should be in the proportion of one to every fifty men embarked ; and, indeed, this is the proportion sanctioned by Indian regulations.

If, however, from any cause, ventilation should be

found deficient, and improvement in this respect impracticable at sea, the suggestion of Liebig may be carried out with advantage. He observes, that it may in some measure be compensated for by the use of hydrate of lime. Eighteen or twenty pounds of slaked lime will, according to this high authority, absorb 38 or 39 cubic feet of carbonic acid gas which would, as a matter of course, have to be replaced by fresh air.

Indian regulations provide that "*booby*" or storm-hatches be fitted on vessels conveying troops. These hatches are intended, and believed to be readily kept open during all kinds of weather, but according to the reports of almost all officers, they are not found to answer in actual practice. They often get broken when not actually required, and thus are rendered unfit for use; the plan, therefore, of having ventilating shafts fitting into the corners of the ordinary hatches is much better, and more generally applicable. In fact, the storm-hatches, as usually supplied, are utterly useless.

It does not appear that any rule exists in regard to the actual ventilating space that each person on board ship ought to have, and yet the point is one of great importance. Considering, however, the large amount of ventilating space that is deemed necessary in barrack buildings on shore, it is somewhat remarkable how little is found to be sufficient in a ship. Few vessels have so much as 65 to 75 square inches per person: and only in very few of the first-class merchant ships and steamers does this space amount to 80 inches.

The means by which the amount of ventilating space on board ship is to be calculated, will be better illustrated by an actual example than by a mere series of formulæ. The calculation of the superficies of square or rectangular openings, such as hatchways is easy, being simply the product of the length and breadth: but that of scuttles and air tubes, the shape of which is circular, is not so readily obtained. The ordinary formula for circular openings

is area = $D^2 \times 0{\cdot}7854$, in which D is the diameter of the opening; but for all practical purposes it will be sufficient to take three-fourths the square of the diameter. Thus a side-scuttle is $8\frac{1}{2}$ inches in diameter: to find its superficies, $(8\frac{1}{2})^2 = \frac{17}{2} \times \frac{17}{2} = 289 \div 4 = 72{\cdot}25$, three-fourths of which $= 54{\cdot}19$ superficial inches, the area of the opening.

In this manner we can readily calculate the ventilating space per person: thus, in the steam ship *Mauritius*, which sailed from Calcutta for England with troops in January 1865, there were 34 side-scuttles, each $8\frac{1}{2}$ inches in diameter. These as shown above:

$=54{\cdot}19$ sup. inches	$\times$ 34	= 12 feet	114 in.	
1 Hatchway 6 feet	$\times$ 8	= 48 ...		,,
1 Hatch or Skylight 3 feet	$\times$ 6	= 18 ...		,,
1 After-hatch 6 feet.	$\times$ 8	= 48 ...		,,
2 Cowls, each 14 inches in Diameter, or area $= 196 \times \frac{3}{4} \times 2 \times \frac{1}{144}$		= 2 ...	6	,,
1 Skylight 6 feet.	$\times$ $3\frac{1}{2}$	= 21 ...		,,
1 After Companion 6 ft.	$\times$ 3	= 18 ...		,,
Total ventilating space, say		167 ...	120	

or, 24,168 superficial inches.

The numbers of troops and their families on board were 294 men, 17 women and 20 children, making a total of 331. Hence 24,168 ÷ 331 gives 73 superficial inches of inlet and outlet space for air per person.

Another example will suffice. In 1860, the ship *Monica* was taken up by the Government Emigration Commissioners for the conveyance from England to India of the wives and children of soldiers. The numbers embarked were as follow, namely:—

Married	women	238
,,	men	20
Single	men	7
,,	women	10
		275

		275
Children from 1 to 12 years of age	Boys ...	155
	Girls ...	132
Children under one year of age		20
	Total	582

The means of ventilation of the ship were as under—

Special Skylight Ventilation.

				feet	in.
No. 1 size	2 feet 7	× 3	feet 2 =	8	26
„ 2 ...	3 ... 9	× 4	„ 2 =	15	90
„ 3 ...	4 ...11	× 5	„ 2 =	25	58
„ 4 ...	8 ...	× 3	„ 0 =	24	00
„ 5 ...	5 ...	× 1	„ 6 =	7	72
„ 6 ...	5 ...	× 1	„ 6 =	7	72
„ 7 ...	3 ...	× 2	„ „ =	6	00
„ 8 ...	3 ...	× 2	„ „ =	6	00
Four stern windows, each					
	2 feet 5	× 2	feet 2 =	20	14
	Total feet			121	32
Ten side-scuttles, each 7 inches diameter =				2	79
Two bowports, each 4 feet 1, × 1 foot				8	24

Hospital Ventilation.

1 skylight 2 feet 11 × 3 feet 1 =	8	14
7 side-scuttles each 7 inches in diameter =	1	78
1 cowl head 11 inches in diameter	0	91

Total ventilating space *sup. feet* 142,30, or 20,274 square inches, leaving out smaller fractional quantities: this divided by 582, the number of persons on board would give only 36 square inches per person: a proportion altogether inadequate, and especially so, when so many women and children were on board.

These calulations taken as they have been from actual measurements will, it is believed, be useful as a guide to medical officers, whose duty may be connected with the transport of troops by sea.

Fumigation.—The ordinary means of fumigation provided on board ship consist of chloride of lime or of zinc: swinging stoves are also put on board with a view to their being used to dry the decks after rainy weather, as well as to fumigate them.

In former times the ordinary means for purifying, as it was then supposed, the air between decks was to thrust a hot iron into a quantity of vinegar. This, it is now almost needless to observe, did not effect the destruction of any morbific miasm that might have existed. It merely renders offensive odors for the time being imperceptible.

According to Indian regulations the proportion of chloride of lime or of zinc required to be put on board for a voyage to or from England is lbs. 20, for every 100 tons' burthen the ship may be: according to Admiralty regulations only lbs. 15 per 100 tons.

The Ship's well.—The state of the ship's well must also claim the careful attention of the inspecting medical officer, during the performance of the primary or final inspection of the vessel. Iron ships should have no water in their well, but wooden ones, unless carefully pumped out while in dock or lying in port, often become offensive from this cause.

It is not sufficient merely to let the sounding rod drop into the well and then look at it; a bucket full of the contents should be brought up, and if found offensive the ship must be well washed out before the troops go on board.

Live stock.—Live stock is usually kept in or under the boats, and in coops, placed wherever these can be so most conveniently upon the deck.

On board the *Malabar*, one of the best class of Indian passenger ships, it was found on measurement that the goose pen, capable of containing twenty-four of these birds, was 7 feet 7 inches long × 2 feet 9 inches high and 4 feet broad = 1 foot 38 inches of superficial space to each.

The coop for fowls (or ducks) being for a dozen of either 4 feet long × 1 ft. 6 in. wide × 1 ft. 10 in. high =6 sq. ft. per dozen.

For pigs, the pen calculated to hold 8 of these animals, was 7 ft. 10 in. long × 5 ft. 7 in. wide × 2 ft. 10 in. high = 5 sq. ft.67 in. each.

For 80 sheep the pen used was 22 ft. long × 8 ft. 6 in. wide × 2 ft. 8 in. high=2 sq. ft. 48 in. each. This was for Indian sheep: for English the regulated space is 4 square feet.

That for an English cow, 7 ft. 6 in. × 6 ft. broad × 5 ft. 2 in. high =45 sq. ft. each.

Two Indian cows, however, were accommodated in it.

Under the above arrangements it was stated that sheep and pigs thrive well at sea, but that among the poultry the mortality during the first month of the homeward voyage is often as high as 20 per cent., notwithstanding that coops are as thoroughly ventilated as possible. From this it would appear, therefore, that the superficial space for them is too restricted, and this should, therefore, be considered in making messing arrangements for cabin passengers.

Inspection of ships.—The duties of the inspecting medical officer of ships engaged as Transports are very important, and demand that whoever performs them shall have had some previous knowledge of what is required of him. A careful perusal of the Queen's and Medical regulations will, no doubt, inform him of the majority of matters to which his attention should be directed, but practical experience is as requisite in this as in others, to render an officer conversant with those upon which much of the health and comfort of the men depends.

In regular Admiralty Transports, the naval authorities are altogether responsible for the equipment and supplies of the troops, all of whom come under naval discipline from the time they embark; hence not only is the inspection by a military medical officer not necessary, but it woud not be allowed. On freight

and hired ships however matters are different. The inspecting medical officer should be present, not only on the occasion of the primary inspection, when the allotment of the space and accommodation is made, but on the final one, when fittings, provisions, comforts, medicines, and instruments should be examined: and, lastly, at the time when the troops embark, when, having at his previous visits made himself acquainted with the points noted below, he prepares the Report for transmission to the Director-General, and records the necessary particulars on the back of the Embarkation Return: a separate Inspection Report containing the corresponding particulars, but in a different form, is prepared by him and sent to the Director-General, *namely*:—

INSPECTION REPORT.

Of the _____ Ship

Dated at _____ this _____ day of _____ 186 .

Tonnage		of
Numbers for whom provision and Accommodation are made.	Officers and Soldiers,—specifying the Corps to which they belong.	
Height between Decks		
Supplies and State.	Of the Ship's Water ...	
	Of the Ship's Provisions	
	Of the Medical Comforts	
	Of the Bedding ...	
Means of Fumigation		
Means of Ventilation		
State of the Well—and of the Orlop-Deck,—or betwixt Decks		
Sanitary condition of Troops, Families, &c.		

Signature of the Inspecting Medical Officer. _____

Signature of the General or other Officer superintending the Embarkation. _____

The Hospital regulations and circulars on the subject from the Army Medical Department, contain strict injunctions in regard to the necessity of making a careful inspection for the detection of zymotic

disease in troops—their wives or children on the eve of embarkation, in view that any persons in whom indications of these may be observed, shall be withdrawn.

If troops have been in a healthy locality, and free from the manifestation of disease for some time previous, we may fairly presume that unless the germs of disease elsewhere exist on board, and if the ship be well fitted and ventilated, they run no special risk of suffering from an outbreak of sickness during the voyage. It may, however, so happen that soldiers embarking, although apparently healthy at the time of doing so, have the germs of disease lurking in them: it may also happen that the germs of disease exist in the ship herself. Under either of these circumstances, the epidemic influence may become lighted up into activity many days after leaving port, and when the ship is away far at sea.

The inspecting medical officer must satisfy himself that a sufficient number of swinging stoves are on board in proportion to the numbers of persons embarked. These stoves are to be used in damp weather for drying the tween-decks, and it will be well to see that a sufficient quantity of fuel for their use is also on board.

Another point of great importance is to see that sufficient means exist on board for maintaining personal cleanliness of all who embark.

Great care is required to ascertain that the water supplied for the troops has been filtered; that it is not brackish, nor contaminated with organic matter.

The medicines and instruments are to be examined and their sufficiency ascertained. At Calcutta, the inspecting medical officer may, on his own certificate, obtain whatever in addition to the regulated allowance he deems necessary.

The state of the Hold should be carefully seen to. If it be damp, the moisture diffuses itself over the

ship, and becomes a source of disease, containing, as it will do, emanations from various decomposing matters.

All arrangements having been made by the military and medical authorities for the embarkation of troops, the inspecting medical officer, either at the time of embarkation, or what is still more convenient a day or two before, gives to the medical officer proceeding in charge such orders as to the nature of his duties on board, as are not provided for in the Queen's and Admiralty codes of regulations.

As an example of the instructions given to medical officers proceeding on long voyages, the following issued to them sailing from Calcutta to England may be here transcribed: premising that, although specially drawn up for the case of invalids, they are applicable with a few obvious modifications to that of men in health, *viz*:—

"With reference to the duty you will be called upon to perform in taking medical charge of the invalids proceeding to England, per the ship———.

"1*st*.—You will proceed to the depôt hospital, and there, in communication with the officer in medical charge, examine the men detailed to proceed under your charge, and select men to act as hospital servants, during the voyage.

"2*nd*.—You will have ready prepared on board, beds and attendants for such men as may have to be carried on board from the hospital, and you will yourself be on board the————at the time the invalids embark.

"3*rd*.—You will consider yourself under the command of the military officer on board, as far as regards the soldiers, and render him such Reports and Returns as he may require.

"4*th*.—A Return will be given you of the cases of the invalids, wherein their diseases and previous medical treatment are stated: this Return which you will be pleased to deliver at the station where the invalids are landed.

"5*th*.—You will keep a Journal of the medical treatment and occurrences on the voyage, wherein will be noted by you the state in which they embarked, and any change that may take place; you will enter the medicines, wine, and medical comforts you may prescribe; and particularly, note the time and cause of any death that may occur. This Journal you are requested to deliver along with the Return of the cases.

"6*th*.—The medical comforts sent on board, are over and above the men's daily rations, they are placed under the care of the captain of the ship, but are at your disposal for such of the invalids as you may think require them.

"7*th*.—The whole of the invalids should be seen by you twice a day, morning and evening: and when the weather is fine, those who are pretty well, should be kept on deck as much as possible, but not exposed to a strong sun. The hammocks should be often taken into the open air, and the berths scraped and rubbed; it being of great importance that they be kept dry and well ventilated.

"8*th*.—Chloride of lime or of zinc is to be frequently used to prevent the deleterious effects of any bad effluvia.

"9*th*.—The men's faces, feet, and hands should be washed daily, their hair combed, and every attention paid to their personal cleanliness, by inculcating bathing whenever practicable.

"10*th*.—At the termination of the voyage, you will hand over to the principal medical officer at the port of disembarkation, Returns of sick during the passage (in duplicate), as per War Office Form, No. 294 B. —You will also furnish him with a Report of the notable medical occurrences during the voyage; stating if the dietary and quality of the provisions contributed to the health or sickness of the troops on board, and whether or not any scurvy appeared among the invalids or crew, with your views as to the probable causes thereof, and of such other points as you may think

useful in tending to the health of the troops, and improvement of physic and surgery.

"11*th*.—You will deliver over this letter of instructions to the principal medical officer at the port of disembarkation, along with the invalids who may be under your care.

"12*th*.—You will furnish weekly, a certificate to the officer commanding the troops, specifying the number of men on the Sick list each day of the week. At the end of the voyage these certificates must be appended (after having been countersigned by the commanding officer), as vouchers to any charge that may be made for orderlies, and which must not exceed 1 to every 10 sick men, unless under very special circumstances, which must be fully detailed and reported.

"13*th*.—You will carefully fill up the Medical History Sheets, which you will receive with the invalid documents.

"14*th*.—You will inspect every man, woman, and child on the day of embarkation, and certify that you have done this and found them free from infectious disease."

The attention of the medical officer is specially directed to the means for prevention of scurvy, and a separate code of instructions on this point is invariably given to him, of which the following is a transcript :—

"*Rules to be observed for the prevention of Sea Scurvy among troops embarked on long voyages.*"

"1*st*.—The use of lime juice on board ships engaged in long voyages has proved to be a certain prophylactic of scurvy, I have therefore to refer you to page 342, &c., of the General Regulations of the Army, on the subject of Medical Comforts, and to direct that you will on each occasion report that the regulated quantity is duly put on board each vessel.

"2*ndly*.—Lime juice should be issued every day to soldiers on long voyages in the proportion of

one ounce per man or ½oz. of each daily; the issue thereof to commence from the date of the sailing of the vessel. To ensure its consumption, this quantity of lime juice should be mixed with three parts water and sweetened with sugar, in order to prevent its otherwise injurious effects, and proper persons should invariably superintend its distribution.

"3*rdly*.—As damp and close air is found to be an auxiliary cause of scurvy, the pernicious custom of washing the lower decks should be restricted according to the state of the weather, and scraping and dry rubbing be almost invariably adopted instead.

"Men relieved from the deck should not be allowed to retain their wet clothing below. The ports should be open in fine weather, and ventilation by wind-sails always employed by night and day.

"4*thly*.—The troops should be moved smartly round the deck for an hour, morning and evening; inactivity and want of exercise being conducive to the production of scurvy.

"5*thly*.—Fresh provisions and vegetables should be procured for the troops whenever practicable.

"I conceive that if these precautionary measures be adopted, the regulated quantity of lime juice will be sufficient to ensure an exemption from the disease; but in the event of scurvy appearing on board in the slightest form, a further supply should be allowed at the discretion of the medical officer in charge of the troops.

"An account of the quantities of lime juice and of the sugar issued in accordance with the above instructions must be kept, and rendered at the end of the voyage separate from that of those articles, which may have to be used as ordinary medical comforts for sick persons."

As already stated, a modification has recently taken place in the order, relative to the issue of lime juice to troops proceeding from India to England. Half an ounce daily for the first twenty days, and one ounce

for the remaining portion of the voyage are the quantities now issued.

The Medical regulations contain ample rules in regard to the nature of the documents required of a medical officer on arriving at a port with troops. Yet from one cause or another it is seldom that these officers have in readiness the documents therein detailed: consequently it may fairly be presumed, have not acted up to them in performing the various duties directed.

The writer of this volume, with a view to point out to those arriving at Calcutta the more clearly the nature of the information they are expected to furnish, drew up a series of instructions: and as these may possibly be found applicable to other places than that port they are here given. They have since been embodied in a *circular*, dated *Army Medical Department*, 15th January, 1865, and are as under, *viz* :—

INSTRUCTIONS TO MEDICAL OFFICERS ARRIVING FROM SEA-WARD IN CHARGE OF BRITISH TROOPS.

"1. You will make arrangements so that you may be in readiness to disembark, as speedily as may be necessary, after your arrival at Calcutta.

"2. You will have any men who are seriously ill held in readiness to be sent to the depôt hospital there, and have abstracts (in duplicate of each case) and their "Medical Certificates" ready.

"3. The following documents will be required from you by the inspecting medical officer, *viz*. :—

"*(a.)* Nominal Return of men to be sent to the depôt hospital.

"*(b.)* Return of Sick on board, as per W. O. Form, 294 B.

"*(c.)* A separate Report on sickness and medical transactions during the voyage.

"*(d.)* A Return of medical comforts, as per page 113, of the Medical Regulations.

"(*e.*) Copies of correspondence on professional points on board.

"(*f.*) Nominal list of women who have been sick during the voyage.

"(*g.*) Nominal list of children who have been sick during the voyage : each of the above in duplicate.

"4. You will also give him the copy of the New Transports Regulations with which you may have been provided for use during the voyage.

"5. The following Books and Forms must be completed prior to your arrival at Calcutta, *viz.* :—

"(*a.*) Admission and Discharge Book, Form "G.," pages 118 and 146, Medical Regulations.

"(*b.*) Medical Case Book, form "L.," pages 121 and 158 of the Medical Regulations.

"(*c.*) Medical Histories Sheet of men, Form "F.," pages 116 and 144 of the Medical Regulations.

"(*d.*) The Requisition Book for Comforts.

"6. You will be prepared to give the Inspecting Medical Officer information upon the following points, namely:—

"(*a.*) Date of departure of the vessel from the port where the troops embarked, and name of the port.

"(*b.*) Length of passage in days.

"(*c.*) State of health of troops on board.

"(*d.*) Whether the ship has been provided with every requisite, with especial reference to the amount and quality of provisions, water, medicines, instruments, and comforts.

"(*e.*) Whether she has been kept in a good sanitary condition.

"(*f.*) Whether the accommodation has been sufficient.

"(*g.*) Whether any defects have been discovered during the voyage.

"(*h.*) The number of officers, of men, of women, and of children embarked.

"(*i.*) The deaths in each class.

"(*j.*) The number of births during the voyage.

"(*k.*) The prevailing diseases on board, and the cause.

"7. The inspecting medical officer will give you instructions in regard to your further movements and requirements, but you will be pleased, in order to facilitate duty, to have ready upon paper the questions which you desire to ask him.

"8. You will, as soon after arrival as possible, report yourself personally at his office."

A few words of caution to medical officers seem necessary in regard to the report of medical transactions they are called upon to furnish at the end of the voyage.

Want of care or of discretion on their parts in preparing reports of this nature, have often rendered these documents so many sources of error instead of, as they should be, guides whereby responsible authorities may judge how far measures in force can be further improved for the advantage of the troops.

The circular, of which the following is a copy, is accordingly given to every medical officer sailing from Calcutta with troops; and it is hoped that its transcription in this place may be found useful to those embarking elsewhere:—It is dated *Army Medical Department*, 25th June, 1863.

"Much inconvenience and extended correspondence, in regard to defective sanitary arrangements, deficiencies of provisions, medicial comforts, &c., for troops on board ships, having been occasioned by the Reports on these subjects by the medical officers in charge being made after the disembarkation of the troops at home, and at a time when the commanding and other officers on duty with the parties were dispersed.—

"I have the honor to request that you will be so good as to instruct every medical officer who may hereafter embark from Bengal in charge of troops, that should he find it necessary on arriving in England to make any statement in the usual "Report of

Sick," or other document, animadverting upon the sanitary arrangements, or the supplies on board, it will be necessary for him to submit a duplicate of such report to the officer commanding, prior to sending the original to the principal medical officer at the port of disembarkation, for transmission to this Department.

"Should his Report contain any subject requiring investigation, it will be immediately submitted by the latter officer to the General or officer commanding on the spot, who will then be enabled to make full enquiries into the circumstances complained of, before the officers or troops leave the ship or port of disembarkation."

Embarkation of troops.—A certain time should doubtless elapse between the embarkation of a body of troops and the sailing of the vessel. The Admiralty regulations provide that this shall be twenty-four hours. During this interval the men, to use a board ship expression, settle down in their places. Any shortcoming that may exist in the arrangement is most probably discovered and rectified in the meantime, and in fact a general security obtained that all arrangements for the voyage are complete.

Under certain circumstances however, it becomes necessary that the troops proceed to sea without even this short delay. For instance at Calcutta, during the months of March and April, at which time the liability to cholera is always great, and outbreaks of the disease are of common occurrence among troops detained in the river,—the rule becomes necessary that ships sail at once, or indeed that the troops to be embarked, are conveyed to a point towards the mouth of the river in a steamer, and being thus embarked, the vessel be at once towed direct to sea.

A similar arrangement would with propriety be adopted in other unhealthy parts of the world, where troops proceeding by ship have to be conveyed a considerable distance down a river.

Under ordinary circumstances troops should be put on board ship as early in the day as possible. They thus not only have the benefit of the entire day before them to make arrangements for the coming night, but being refreshed by their sleep, and the dissipated among them recovered more or less from the effects of their indulgence the previous evening, they are in a better condition to resist that tendency to disease which should always be looked upon as existing in bodies of men crowded together.

Women's berths.—As on shore, so on board ship, the great difficulty in maintaining cleanliness is as regards the quarters occupied by women and children: at sea the most minute inspection of their berths should be made daily. Bedding should be aired as frequently as circumstances permit, but certainly not at intervals beyond a week. Every moveable thing should be turned out of the part of the ship so occupied, the place thoroughly cleaned and well sprinkled with some disinfectant.

It is necessary on account of privacy for the women themselves, as well as the general cleanliness and ventilation of the ship, that the women's berths should occupy the after-part of the troop deck. It is also necessary, in order to permit passages to be left between ranges of berths, and space for their ordinary baggage that the berths should be in double tiers: on mere sanitary grounds however, the arrangement is objectionable; but as women already occupy double the space allotted to a man, it is evident that economy and expediency are opposed to any great improvement in this respect.

Duties of medical officers.—The Queen's and Medical regulations contain every needful instruction to medical officers regarding their duties on board ship, and Dr. Parkes in his valuable book has epitomised these and given such additional directions as his own experience showed him to have been necessary.

With regard to the chief points to which attention is required, they may here be briefly stated as follow, *viz.* :—

The decks should be kept as clear as possible so as to enable the troops to have all available space.

They should be tightly caulked wherever leaks may be discovered.

The quantity and disposal of live stock on board should be restricted, so as not to cause injury or inconvenience to the troops.

The troops to be divided into three watches, one of which is to be always on deck.

A guard to mount daily.

The troops to parade clean, for inspection once a day (cooks included).

Washing every part of the men's bodies frequently, to be enjoined.

Great attention to be paid to the cleanliness of the the privies.

Bedding to be brought upon deck every morning. This applies to that of both married and single.

Washing between the decks is to take place only once a week, and then only when the weather is dry.

The boards of the lower berths to be removed once a week for the purpose of cleaning them.

The coppers to be thoroughly cleaned before and after being used.

Frequent fumigation is deemed very desirable. Windsails should be kept constantly hung up.

The practice of sleeping on deck in warm weather is to be prevented, as being productive of fevers and bowel affections.

Systematic exercise should be encouraged.

When near land the purchase of unripe fruit is to be interdicted.

The married people should rise at 6 A. M. and all screens round their berths to be then folded up.

According to Dr. Parkes the women and children need not be turned out till 9 o'clock, by which time

the men will have washed and dressed. During the first few days of a voyage, when they must be more or less ill, he would not insist upon this.

He thinks that not only is there no harm, but that there is actual good from the men sleeping upon deck. It is believed however that few medical officers, who have had much experience at sea, will agree with him in this respect.

He thinks that for the first three weeks after going to sea, inspections for the detection of venereal should be regularly held, and for the first fortnight that women and children should be regularly inspected for measles and scarlet fever.

The rations, latrines, and cook houses should be regularly inspected.

Doctor Parkes considers that the medical officer should from time to time test the water broached for the troops, and that he should take on board a supply of alum, charcoal and permanganate of potass, so that by the use of these singly or in combination, bad drinking water may be converted into good.

The strictest attention must be paid to personal cleanliness on board. The soldiers during warm weather readily bathe upon the forecastle. For the women and children, a canvas partition should be erected on deck in the early morning: a number of beef casks cut in two will readily supply bathing tubs, and a few men working the pump will by means of a hose supply the requisite quantity of water.

The Queen's regulations and Admiralty regulations are explicit in prohibiting washing between decks, except during dry weather: a moist condition of the air below is prejudicial to health, and therefore, whenever washing the decks is practised, fire stoves should be immediately used.

Scraping and dry scrubbing however, should under almost all circumstances be sufficient to maintain the decks in a state of cleanliness, and therefore should be strictly enforced every day. As well remarked by one

of the authorities consulted, it would be well were some of the labour that is often bestowed upon keeping clean the spar deck divided between it and other parts of the vessel, that although less seen have more to do with the comfort and well being of the troops on board.

Infectious diseases.—Under no ordinary circumstances should troops, affected with infectious disease be put on board ship. It is well however to bear in mind the fact, that with good arrangements on board, a zymotic disease, as for instance small pox, if appearing in one person need not of necessity spread among the body of troops generally.

In such a case, isolation of the patient is to be carefully enforced. When however it is practicable to do so, troops should most assuredly, if starting upon a long sea voyage, be re-landed on the occurrence among them of disease in epidemic form, and the 'tween decks thoroughly cleaned out and purified. In such a case, bedding and clothing used by the troops must also be thoroughly purified.

Indeed, the orders on this subject are explicit: in such a case the ship is to put back, the troops be disembarked and the vessel thoroughly cleaned out and fumigated.

Epidemics on board Ship.—Although, as a rule, troops on board ship enjoy a remarkable standard of good health, yet there are some sad examples where fatal epidemics have occurred among them. Some of them, as for instance, the fever in the *Eclair* are traceable to extension of the disease from the affected. So also in some of the recent outbreaks of yellow fever on board ships of the fleet serving on the West India station.

There are other examples however, where certain diseases, more especially cholera, have attacked troops on board ship, many days after they had sailed, and this too, although in the early part of the voyage, they had been remarkably healthy.

In selecting a ship for the conveyance of troops, the well-known fact should be borne in mind that disease is apt to recur for a long time, in a vessel in which it had prevailed as an epidemic, and this too notwithstanding that the ship may have undergone a considerable amount of cleansing and purification.

Doctor Jackson many years ago mentioned the fact, that infection clings to the interior of ships: and that a transport, even after having undergone complete purification and having remained healthy while employed in the interim in conveying merchandize, has again become unhealthy from the infection having burst forth on her being re-employed for the conveyance of troops.

Among the ordinary causes of outbreaks of sickness now a days on board ships, the following may be enumerated; namely—organic matter whether vegetable or animal in a state of decomposition.

Even at a recent period outbreaks of yellow fever have occurred on board ships on the West India station, in the holds of which green wood had been collected: and the disease having thus been lighted up, it has spread with terrible severity by personal communication between the crews of different ships.

Decomposing animal matter is a very fertile source of disease. In former days we read that the stench from the "head" entering the sick bays of men-of-war, which were near that part of the vessel was a fertile source of fever and diarrhœa. With the improved sanitation of the present time, such an occurrence is, it is to be hoped, a thing of the past: there may however be circumstances under which offensive matters may be on board and affect the health of the troops, notwithstanding every precaution and care by the inspecting officer.

Thus animal matters taken on board as cargo in opposition to the orders on the subject, may by becoming soaked with water during heavy weather be rendered so extremely pernicious by decomposition

as not only to give rise to an intolerable stench, but to occasion among persons exposed thereto, diarrhœa, phlegmonous boils, and fever. The writer of these remarks, together with his family, was on one occasion exposed to them, and suffered severely in the manner stated.

Defective or bad provisions or water, imperfect ventilation, neglect of cleanliness are among the other common causes of sickness on board: and being so, should be carefully guarded against.

The three most terrible diseases that occur in epidemic form on board ship, are yellow fever, cholera, and small pox.

The immediate departure of a ship, the crew of which is affected with the former disease, to a cold latitude is now acknowledged to be as effectual in checking the further progress of that disease, as the breaking up of a regiment in India is in epidemics of cholera.

As already stated, the origin of cholera on board ship is sometimes inexplicable. All that can be done is, in preparing the ship for her voyage to guard against this and other zymotic diseases by carefully seeing that the space and ventilation are ample; that the well and hold contain nothing of an objectionable nature; that cleanliness has been so far attended to, and that the food and water put on board are good.

With the advantages of vaccination now available, the occurrence of small pox among troops at sea, as an epidemic should be impossible. Isolated cases may occur among men embarking soon after leaving a station, where the disease may have been prevalent. As an essential precaution in such a case, the troops about to go on board should be vaccinated. For some time after going on board strict personal inspection of all is necessary; and in the event of the disease occurring, the patient should be separated from the others.

We learn that during the American civil war the fact became apparent, that even on the short voyages

along the coast, the insalubrious state of the ships was localising and extending the prevalence of typhoid fever and dysentery. Hence the Sanitary Commission of that country recommended that transports that have been long in the service should be thoroughly cleaned, and those upon which an epidemic had recently prevailed be thrown out.

It is true that soldiers do not as a rule, suffer from outbreaks of malignant diseases on board ship to the extent that emigrants formerly did: yet an illustration or two of what did happen when sanitary arrangements were not attended to as they have been of late, will suffice to show the dangers which attended a neglect of these:—Thus we learn that of 476 passengers who left Liverpool in 1847, on board the *Virginius*, for Grosse Island, 158 died on the passage by fever, and 186 were ill on landing.

The fact of fatal disease becoming localised in a ship is now ascertained beyond doubt: and therefore it is matter for grave consideration whether under any circumstances, a ship in which disease of this nature is known to have prevailed ought to be taken up again for the conveyance of troops. As far as personal opinion is concerned, I think it ought not; and here is a case in point.

"L' Eclair."—The case of the *Eclair*, although well known, cannot be too prominently kept in view, as showing the terrible effects that may arise from sanitary condition of a ship.

This vessel, having been some eight months on the coast of Africa, and having a crew of 146 officers and men, lost in that time by the coast fever nine men. She sailed from Sierra Leone on the 23rd July, 1845. Four days afterwards one man died with fever and black vomit. From that time till her arrival at Buena Vista on 21st August, eighteen men were attacked with the disease, of whom thirteen died. The disease continued to spread among the crew, and on the 30th they were landed. The ship was then purified

by every practicable means—fumigated, and white washed.

The men disembarked: they continued to suffer from the disease to a fatal extent—thirty one dying between the date of arrival off the island and 13th September. On the latter date they were re-embarked, and on the 28th of that month arrived at Spithead with a loss of sixty one men and officers, and with fever still raging in a fearful manner; only forty one of the crew having escaped the disease.

It will be remembered that one of the Portuguese soldiers who had been housed at Buena Vista with the crew of the *Eclair* died of the fever with which they were effected, four days after the departure of the vessel from that island: and that from him, as a focus the disease spread until upwards of 400 of the inhabitants were destroyed by it.

The whole of the crew had been removed from the *Eclair* in Standgate creek, where after arrival at Spithead, she had been placed in quarantine; the sick removed to one vessel, and the convalescents to another.

In November 1846, that is twelve months after the fever had disappeared, this ship was re-commissioned as the *Rosamond*. While she was being fitted out, four cases of typhus fever took place, that disease being then prevalent. The *Rosamond* sailed in February, 1847. Three days afterwards one of the crew had a slight attack, which when off Buena Vista increased in intensity and proved fatal, the subject of it being then seized with the usual symptoms of black vomit.

At Ascension two more cases occurred, one of the men attributing his illness to the stench from the boatswain's store-room: a hole was cut in the floor, and a quantity of soft mud there discovered, mixed with decaying shavings. The men seem moreover, to have been much crowded on board.

Not only is a practical lesson to be gathered from this narration, of the necessity of seeing that all offensive

matters are carefully removed from vessels and accumulations in the lower parts prevented, but it has an important bearing upon the subject of Quarantine.

Soldiers' Families at Sea.—Severe outbreaks of zymotic diseases on board ships conveying the wives and children of soldiers, are still by no means of infrequent occurrence, notwithstanding the great care bestowed upon the hygienic conditions of these classes: and occasions are common where ships conveying these have to put in on account of sickness, to some intermediate port on the voyage.

Many circumstances combine to render these classes peculiarly liable to diseases of this nature. Thus, they are not as a rule under that strict superintendence in their ordinary dwellings on shore that soldiers are in barracks. Their general habits are notoriously dirty: they live in the poorest and most neglected parts of garrison towns, and from insufficient nourishment and food are, together with their children peculiarly predisposed to disease. In addition to all these, it too often happens that notwithstanding every precaution, some one person,—generally a child, obtains access on board while actually suffering from an infectious desease, or with the fomites of the malady incubating in its system.

Hospital Ships.—Dr. Millingen well observes that it is highly requisite that every distant expedition should be accompanied by a sufficient number of hospital ships, both for officers and men. This conveyance he says, though often overlooked, is of the utmost importance in landing on a hostile shore. They receive the casualties of uncertain operations.

The necessity of ships as part of an expedition has now been demonstrated however, and the principle fully allowed. Nor is it likely that any force will hereafter leave the United Kingdom for active service without being amply supplied with them.

This author too offers a very good suggestion regarding these. It is, that each should carry a

distinguishing pennant, and that ships belonging to particular divisions should be able to make the necessary signals for removal of their sick.

He makes no remark in regard to the equipment and medical staff of the ships, but it is obvious that medical officers, purveyors, and attendants should be attached to them ; and that they should be complete in equipment, altogether over and above what are needed for service on shore.

Dr. Parkes would have one hospital ship for fever, another for wounds, a third for mixed cases. It is difficult to see however, how when hospital ships are required, such an arrangement could be carried out. As stated in another part of these notes, a hospital ship should rather be appointed to each division or portion of an army, to receive such cases of injury and disease as may be sent on board. The cases being classified in the ordinary manner on board the ship itself.

The "America"—The *America* fitted up for hospital purposes in the last China war, was 1,673 tons burthen. She had two decks, the upper 100 feet long, 34½ broad, 6½ high. The lower 200 feet long, 35 broad, 8 5/12 high : both capable of accommodating 200 sick.

For ventilation she had two large loading ports in the bows, and two in her sides, each six feet by four. In addition she had six side ports, four hatchways, eight deck-scuttles communicating with both decks.

The lower deck of the steam ship *Mauritius* was, during the same war, fitted up for the accommodation of 240 sick in standing berths, and eight in cots, allowing to each, 320 cubic feet of air : and the lower deck of the *Melbourne* was fitted up for the reception of 126 sick ; the necessary offices on the two vessels being upon the upper and spar decks.

Transport by River.—Circumstances are not likely for the future to render necessary the transport of soldiers by river route in India. The rail has now taken

the place of all previous modes of conveyance. It may not be without interest however, to note what were the arrangements under such circumstances. On a river steamer for a voyage of more than three days' duration, each soldier, woman or *two* children, *i. e.*, over two and under ten years of age, had a space on deck of six feet by two=twelve superficial feet. Hospital accommodation was provided in addition. This was within a cabin on the troop-boat, or a space equal 5 per cent. of strength at seven feet by two and a half feet each : a small dispensary was also allowed.

Space.—In country boats the allowance in "maunds" of measurement, was as under, a maund being equivalent to lbs. 80, *viz.*—

	Ganges or Jumna Maunds.	Sutlej Maunds.
Per soldier	50	75
Additional per sick man	25	25
Per woman	50	50
Per child	10	15

For dispensary one boat of 500 maunds

This allowance was deemed insufficient. The "tonnage" for sick men should have been seventy five "maunds" each, instead of twenty five.

The above mode of conveyance was awkward, the troops were liable to loss of life by storms and by cholera. The frail boats could not withstand the former, the latter frequently attacked the troops during halts under high banks, or on low muddy ones. It was well therefore, that it was abandoned.

Rations.—A slight modification occurs in the scale of rations given to troops on board river steamers in India, inasmuch as that salt beef or pork is substituted for fresh meat: and instead of salt, each has two ounces of mustard weekly. He has also one pint and a half of split peas, and half a pint of vinegar, weekly.

CHAPTER VII.

ON TENTS, CAMPS, HUTS, BOWERS AND BIVOUACS.

English Bell Tents—Number for a Regiment—English Marquees—Camp space in England—American Tent—French Tent—Bengal—Bombay—Madras—Camp space in India—Ventilation—Tents on service—Unhealthy Tents—Troops without Tents—Camps—Standing Camps—Huts—In Bhootan—Bowers—Bivouacs.

English Bell Tents.—The common English bell tent consists of only one fold of canvas; it has a diameter of twelve feet; a height to the top of its pole of ten feet; contains in its interior, a superficial area of 113 feet, and, is calculated to accommodate twelve soldiers, or fourteen native troops of India: its weight is seventy pounds.

Number for a regiment.—Were a regiment of say 910 strong to be equipped with bell tents in India, the number of these tents required, would be 76 for men, 18 for hospital, 6 for guards and stores, and 3 for subordinate medical staff—total, 107 tents.

These would amount to lbs. 10,700, which, at 5 maunds (400 lbs.) per camel, would require 27 camels for their conveyance on the march; or at two maunds (160 lbs.) per mule—68 mules.

For a cavalry regiment, 14 camels or 35 mules would be required for the conveyance of tents, according to the above description; and for a Battery of Artillery, 7 camels or 17 mules..

English Marquees.—The English hospital marquee consists of two layers of canvas, and is supported by two poles. Its dimensions are 33 feet long, 12 broad; the sides are five feet high, straight; after

which a roof slopes seven feet more to the ridge, making the whole height 12 feet from ground to ridge. The superficial area of the interior is 396 superficial, and 3366 cubic feet. It is intended to accommodate 18 sick. The total weight of this tent, including its velise, is about lbs. 500. The India rubber sheet to put upon the ground, is about 145lbs. more.

Camp space in England.—A regiment of infantry encamped in tents of the English pattern, and according to the plan usually adopted, occupies a front of 230 yards, with a depth of 219. If compressed, the depth is 168 yards, the breadth or front not being affected.

A regiment of cavalry or six troops, has a front of 380 yards, and a depth of 282. For half a regiment of cavalry, a front of 140 yards, and a depth of 202.

American Tent.—The American regulation hospital tent, is 15 feet long × 14 broad × 11 high to the centre, the wall being $4\frac{1}{2}$. This is calculated to contain 8 or 10 sick, at 160 cubic feet; but that amount of space is considered too small.

Tents in France.—The most recent pattern tent in France, is intended to accommodate 15 foot, or 8 cavalry soldiers; its dimensions being 4 *metrés* by 6 *m.* The old pattern tent was made for 8 infantry or 4 cavalry soldiers—Its superficial space amounted to 2 *m.*-60 by 3 *m.*-35.

An interval of 24 paces is left clear, between each two battalions, when several are encamped together: and 30 to 45 between regiments.

The latrines for the men are 150 paces in front of each battalion, an arrangement, which does not seem satisfactory in a sanitary point of view; those for the officers, are 100 paces in rear of the last line of tents or huts.

The ground taken up by the camps of corps in France, is as follows, *viz.*—

For an infantry regiment of three battalions, 15 men per hut or tent.	Front	473·5	*metrês*
	depth	330·0	„
For a regiment of cavalry, or six squadrons (14 men per hut or tent.)		473·5	„
		300	„
A Battery of Artillery on service, 12 men per tent.		82	„
		380	„
A Battery of mountain Artillery, in tentes d'ábris.		66	„
		68	„

The tents used in India, are of various patterns; and those of the same pattern vary in size in the different presidencies.

Bengal.—In Bengal, the ordinary privates' tent is 20 feet long × 16 broad, the height of the *kurnat* or wall, is $5\frac{1}{2}$ feet, and to the poles $10\frac{1}{2}$. The outer "fly" consists of three folds of cotton cloth of a pattern or description used specially for this purpose; the inner fly consists of two more, and the *kurnat* or out rigger of three folds.

Each tent has two poles, and is calculated to accommodate 16 men, allowing a superficial area of 20 feet to each.

Bombay.—The Bombay tent is $22\frac{1}{2}$ feet × 15, and contains 22 men, giving a superficial space to each of $15\frac{1}{3}$ feet.

Madras.—The Madras tent is 21 feet × 15, and is intended to contain 25 men, so that each occupant can only have 12 feet of superficial space.

The sepoys' *pall* is 32 feet × 16 and $8\frac{1}{2}$ high. It weighs lbs 240; has a superficial internal area of 256 feet, consists throughout of three folds of cloth, and is supported by a pole near either end, and a ridge pole.

The total number of the pattern tents now in use in Bengal, required, is for a regiment of infantry 94, for a regiment of cavalry 60, for a battery of Artillery 17.

Camp space in India.—In India, a camp for an infantry regiment or ten companies, covers a front of 210 paces, and a depth of 360, the pace being equal to 30 inches : a cavalry regiment or six troops, a front of 360 paces, with a depth of 400 : a battery of Artillery, a front of 110 paces, and a depth of 300.

Ventilation.—Little or no attention seems to have been paid to the ventilation of tents, until comparatively lately. Various experiments have recently been instituted, with a view to decide upon the most effective means of securing this necessity : and of the methods proposed, that originally brought forward by Dr. Cutbush seems about the most simple. He suggested that the upper part of the poles should be hollow, and have small holes in their sides, through which the vitiated air should escape.

With tents having only one "fly," such as those used in England, the effectual ventilation must always be a matter of difficulty. With those of two flies however, perforations can readily be made in the inner : the circulation of air that naturally takes place between the two producing constant removal of the vitiated atmosphere.

Tents on service.—On a campaign in India during the cold season, the large tents allowed by regulation for the use of the troops, however much they may conduce to personal comfort are not essentially necessary. In the north-western parts of the continent, as the Punjab, heavy rains occur during the winter months, and there, mlitary movements may be seriously interfered with, by "regulation" tents becoming so soaked during these falls, as to render their conveyance onwards inpracticable.

In hot weather campaigns, such as that of 1857 & 1858, the men require that a complete current of air pass directly across them : hence the sides of the tents were whenever practicable left at a convenient place ; all that is necessary in such a case, is that the men have shade. Did military necessities permit the

troops to occupy groves of trees, no tents would be necessary : but to be ready for emergencies, and especially for the safety of a force it is essential, that when it does halt under such circumstances, the place should be as open and free from forest or underground vegetation as possible. Hence an artifical shelter becomes absolutely necessary.

Unhealthy Tents.—Tents for accommodation of sick are in good weather far preferable to a crowded hospital. Dr. Lind specially mentions an instance, where seamen affected with hospital fever, which they had brought with them from England to Port Mahon, recovered when placed in cold tents ; while in houses, the mortality was so great, that scarcely one in three escaped.

Tents may however, be rendered so unhealthy, either by overcrowding, or not being kept clean, as to become a source of danger to those who use them. This has even occurred to such an extent, that according to Dr. Rush, men are most healthy, when the exigencies of a campaign have made it necessary for an army to send off their tents. During the late war in America, certain diseases became epidemic in camps, as for example—measles, which, according to Dr. J. J. Chisholm prevailed to a degree that was hardly credible; some of the recruits for the Confederate army, especially those from the country having been the chief sufferers from the malady.

Troops without Tents.—Indeed, so unhealthy did camps become, that the Confederate troops are said to have enjoyed better health in the bivouac than in tents, so long as the men were able to be provided with abundance of good clothes. That under favorable circumstances of climate, troops may enjoy excellent health when unprovided with tents, we have many examples. Dr. Chisholm remarks that soldiers have lived for months without tents, sleeping under trees, exposed to dews and

rain: and only suffer from colds and catarrhal affections, when permitted under furlough to enjoy a long-wished for visit to their families, with the now doubtful comfort of a close room and a soft bed.

We moreover learn that in America it was found better during forced marches, and with insufficient means of rapid transport, to dispense with tents and sleep in the open air; so also during the mutiny campaign in India, bodies of troops were in some instances sent in pursuit of the rebels, and suffered no injury or inconvenience from their being without tents.

Camps.—Camps, as Dr. Millingen observes, are of obligation and selection. In the case of the former, we must encamp according to the circumstances of service: in the latter, it becomes the duty of the medical officers to consider the sanitary conditions connected with them.

With regard to the latrine arrangements for a camp, Dr. Millingen remarks—"privies should be dug in rear of the camp, of a sufficient depth, and surrounded with banks set with trees"—and he continues—"fresh earth, at least half foot in depth should be thrown every morning upon the soil of the preceding day; when the pit is two-thirds full, fresh ones should be excava ted. Here in fact, a near approach to the system which has very lately been brought forward as something quite new.

Should a stream pass the site of a camp, and its water be fit to be made use of, the upper part should be set apart for culinary and drinking purposes: the next for watering horses and cattle; the lowest for washing.

The American Sanitary Commission, in addition to recommending that the ground in tents should be covered with straw, pine planks, or india-rubber cloth: that good ventilation be secured, and overcrowding avoided, suggest that in fine weather, the tents be struck and re-pitched on new gound: that the bedding

and clothing be exposed to the sun, as often as possible : that on the tents being removed to a new site the old one be sprinkled freely with lime, charcoal, or other disinfectant. The French in the Crimea used sulphate of iron in solution for this purpose.

Such offal as cannot be consumed by fire, should be thrown into pits to leeward of and not less than two hundred yards from camp,—covered with a layer of charcoal, and then with earth. Bodies of animals and of persons should be buried at least three feet below the surface.

After great carnage in battle, the dead should be buried in trenches eight to ten feet deep and covered with lime or other deodorant : as for instance a mixture, one part of peat charcoal, one of quick lime, and four of sand or gravel.

Camps.—Straw should be allowed liberally to form a bedding, and the coarser it is, the better. It should be frequently aired, if the camp be a standing one.

A mud or stone wall should under such circumstances be raised round each tent :—or in the case of the bell tents, these were in the Crimea raised upon a wall of this description with much advantage to the occupants. The floor of the hospital should at all times be well raised.

The use of charcoal filters on the line of march or in camp cannot be too strictly inculcated, and the new patent ones seem best adapted for this purpose.

Standing Camps.—Unless the greatest possible vigilance be maintained, the condition of a standing camp speedily becomes extremely offensive from the accumulation of filth, refuse, and dead cattle. No person who has not had actual experience of life in camp, can conceive how rapidly a locality may be rendered offensive ; and under certain circumstances, as for instance an army encamped near a besieged city, serious injury to the efficiency of the force may speedily occur from disease thus produced.

If therefore, circumstances permit, a standing camp ought to be struck at intervals of at least eight days, and the ground changed; in India there is as a rule, little difficulty in carrying out this measure except during sieges: as for example in the case of Delhi and Lucknow during the mutiny; in these instances, military requirements are pre-eminent, but the evils of the position may be much diminished by strict sanitation.

Huts.—For small parties Dr. Jackson recommended huts; each hut to be capable of accommodating six men and a Non-Commissioned officer. It should, according to him be lofty,—the floor raised upon pillars, covered with a thick roof of thatch—with piazzas in front and rear. He would also have it when practicable erected over a terraced floor.

It is not considered desirable that large bodies of troops should occupy tents during winter in Europe or America; when therefore, accommodation for them has during that season to be extemporised, huts ought to be erected for the whole.

In France, the size of huts varies according to their material, but as a rule the larger are deemed preferable to the smaller.

One for 20 men is $4{\cdot}60m \times 6{\cdot}60m$; for 16 men $4{\cdot}60m \times 5{\cdot}30m$; for 8 men $2{\cdot}60m \times 5{\cdot}30m$.

During and subsequent to the military operations in Bhootan in 1865, our troops, both British and Indian, were accommodated in huts that were hastily run up for their reception. These huts for the most part consisted of split bamboo work interlacing between a series of upright posts to form the walls; in some instances a layer of mud was applied, in others not. The roofs were rendered water proof by bamboo leaves, and a flooring somewhat raised from the ground; consisting of bamboos placed length—ways on uprights, was sufficient to prevent the occupants from suffering from the direct emanations from the ground, and from inundations. A raised

platform of the same kind extended along one side of the hut, similar to a guard bed, and on this the men slept. The space per man in these was 50 superficial and 400 cubic feet.

Bowers.—As Dr. Jackson observes, in countries covered with woods, abundantly supplied with straw and other materials applicable to the purposes of forming shelter, it is upon the whole better to raise huts and construct bowers than to carry canvas.

The natives of some countries are adepts in running up bowers such as have been alluded to, and it may at times happen that military operations are undertaken in districts where from the nature of local circumstance it would be impracticable to carry camp equipage.

On the west coast of Africa, and in Nepaul the natives excel in forming shelter for themselves; a few hours in either case are sufficient to enable them to house themselves in this extemporaneous way.

Bivouacs.—Dr. Millingen recommends that when military circumstances permit, and the General in command does not wish to show an extensive front, fires be lighted in circular clusters and the men lie between them. The men should lie not singly but in squads, spreading two or three blankets on the ground or over straw if procurable; the remaining part of the blankets being put over them. In wet or cold weather, hot coffee or a little spirit ought to be given to them before they lie down to rest, and not more than one half the force ought to be allowed to rest at a time.

The sick must if possible, be put under canvas or in houses; only in very fine weather or mild climate should they be left in the open air.

Bivouacs says Dr. Cutbush, are less dangerous when solderies can lie with their feet towards a fire and their heads upon their knapsacks: but as he adds, this can be rarely practised as the fires would point out to the enemy the situation of the troops.

In very cold weather however, he would recommend that soldiers do not approach a fire but that at

intervals they take sharp exercise. Under such circumstances the application of oil to the exposed parts of the body will be found to protect them,—a practice adopted so long ago as the days of Xenophon and Hannibal.

In the French Army.—The directions for bivouacing according to the French are simple enough.

The infantry having lighted fires behind the line of packs or knapsacks on the position to be occupied by their huts or tents, the different companies arrange themselves; each around their own, and those that can thus find shelter do so.

The squadrons of cavalry break into smaller bodies, and arrange themselves right and left: each forming a line. The horses are arranged as in camp, according to circumstances. If it be permissible to unsaddle, the arms are arranged in stacks by themselves: these are placed behind the horses, the bridles are suspended upon, and the arms rested against them. The bivouac fires for each squadron are 20 metres to the left of the horses, the men placed around and sheltered if possible. The forage is arranged to the right of the horses. The fires and horses of the officers are arranged in rear of the lines of troopers. The advance guard is one *kilometre* in front.

In India.—In the plains of India, during both hot and cold seasons, troops might without any injury to themselves bivouac much oftener than they do. During the mutiny campaign, columns sent in pursuit of the rebels not infrequently bivouaced: and as fires were not required, not only was the locality not revealed to the enemy, but the prosecution of the operations was much facilitated.

CHAPTER VIII.

ON LOCALITIES.

General remarks on sites—Favorable characters—Unfavorable characters—Places to avoid—Woods—Trees—Grass—Changes in the healthiness of stations—Hill stations.

GENERAL REMARKS ON SITES.—So much has of late years been written on the subject of sites, that it now only seems necessary to give an epitome of the principal points that require to be attended to in the selection of positions for the location of troops, whether in camp, huts, or barracks.

According to the American Sanitary Commission, the following are the requirements of a good encamping ground, namely: it should be dry, moderately elevated, have sufficient slope to prevent water stagnating, be near good and abundant supply of water for all purposes: if near a river, that there be no danger of inundation; if from necessity, it be near a marsh, that it be to windward.

If it be practicable to obtain the results of two or three years' experience, before finally determining upon a site, it would be well to do so, for it is by no means seldom, that the opinions formed by the inspection of a site during one season of the year or for a short period, are belied by actual experience. Among the points to be considered, during these preliminary enquiries, are the rain fall at the locality, its range of temperature, the electric phenomena, its facilities as regards water and drainage, the diseases of the population, and their liability to epidemics.

The locality ought to be examined at different seasons of the year; and in India, during the height of the rainy, and during the dry. During these inspections, drainage might be planned and carried

out to some extent, injurious vegetation removed, and excavations made for good water before the troops are placed, even if their occupation of the position is only intended to be temporary.

It was long ago decided by the Americans, that in selecting a site, the appearance of the inhabitants, especially as to their spleen, be taken into account. These characters have subsequently been adopted by Indian medical officers, in selecting sites in the latter country.

It has long been remarked by writers upon such subjects, that fevers are little known in rough hilly countries, where water flows with a rapid course: while the very reverse is the case in those of an opposite nature. At the same time, it must be borne in mind that although a high and dry situation may not contain any thing hurtful in itself, it is by the circumstance of its elevation, more exposed than the parts at its foot—to morbific influences brought from a distance. So well is this understood in China, that the people of that country prefer building their houses in the vicinity of their rice-fields and swamps, to choosing sites for their dwellings on the sides of hills.

Newly cleared wood.—American writers have especially asserted that encampments on lands, the wood of which had just been cut down, are of all others the most unhealthy, and add, "it is, perhaps, from this cause that new countries are generally fatal to the first settlers."

These remarks have a particular bearing upon India; there it may be necessary, as it was from time to time, during the mutiny of the sepoys, to cut down extensive tracts of wood or jungle, in which the enemy may have taken shelter: under such circumstances, the troops should not be encamped upon the newly cleared ground.

Favorable characters.—Among the favorable characters of a site, the following are the principal,

viz.—Moderate height and sunshine. Free exposure to air, provided it be neither malarious nor too cold. A soil over or through which water passes quickly. A gravelly soil is healthy and easy of drainage. Chalk formation is next to gravel in healthiness, it rapidly absorbs water, and sparingly returns it to the atmosphere. The air on chalk soil is dry, tonic, and bracing. Where emanations do not arise from the soil. Where the water is not tainted by organic or other noxious matters. Great permeability of the soil, whether accompanied or not with slope. Primitive granite soils and sandy soils.

In India, select a position some miles from, and to windward of large cities and of large rivers: the summit of a gentle undulation or slope of rising grounds; a light gravelly soil, friable, and without a substratum of heavy, retentive material. Water should be abundant, good, and obtainable at moderate depth.

Stations should be surrounded by a zone of one or two miles radius free from cultivation and irrigation. This should be dotted with clumps of trees and gardens, and be for the most part grass-land.

Unfavorable characters.—The unfavorable characters of sites are far more numerous than the favorable. Among the principal objectionable characters, are the following, *viz.*—Clay or marshy soil. It permits the stagnation of water, and is unhealthy. Stone and sand soils heat and cool rapidly. They also absorb and give out water readily; hence they are unhealthy. Limestone and sandy plains are pestiferous, as indicated in the case of Walcheren.

Depressions below the levels of surrounding hills are unhealthy. So are ravines and portions of plains having a lower level than that of the surrounding country.

Sandy tracts in the vicinity of rivers are to be avoided as places for encampment. However dry the surface may be, the subsoil at a depth of one or two feet, will be found saturated with moisture. Such places were found to be most unhealthy

during the Peninsular war, and there are many instances in India, where very serious results have followed the temporary occupation of places of this nature.

All malarious localities must, if possible, be avoided. These for the most part contain 20 to 40 per cent. of organic matter, consisting of humus, decomposing slowly by admission of a little air. Soils of this nature absorb 15 per cent. or more of water.

As a rule, it may be considered that all low grounds covered with aquatic plants are improper for camps; yet, during cold weather, a camp may occupy the vicinity of a marsh with impunity. Many districts however are notoriously malarious on the surface of which none of the usual characters exist, as when the bed immediately under-lying consists of clay, which is non-absorbent and impermeable to water; much of the soil of the North-West of India, and of the Punjab is of this nature.

Cholera visited with great intensity the coal fields of England: and this disease is always present, and liable to attack troops on carboniferous ranges in India, as for instance, at Raneegunge and the neighbouring part of the country.

Loose sandy soils and regions where ferrugenous and hornblende granite in a state of disintegration exists, whether in plains, or in abrupt mountain spurs, with deep intervening valleys where black soil, as in Central India, is the prevailing alluvium.

The extreme unhealthiness of localities, the prevailing rocks of which are of the above nature, is well illustrated in the cases of the coast of Guinea and Hong-Kong. Mr. Montgomery Martin first adverted to this circumstance: and the writer of the present volume saw ample reason to believe that the similarity was not only in the geological formation of the two places, but also in the characters of the diseases that render them so deadly as they notoriously are.

This subject is discussed more at length in the author's work on China, to which accordingly the reader is referred; it is right to allude in this place however, to these examples: and to observe that unhealthy as both places are, they are rendered still more so wherever the ground is newly turned up, or the rock excavated. For this reason, the risk attending residence in newly built houses at Hong-Kong is perfectly understood by our countrymen on that island: and it may have been from the extent of building operations then taking place, that the locality was at the time of being first occupied by our troops, rendered so peculiarly fatal to them, as it unhappily was.

A country intersected by ravines, abounding in marshes and tanks, and liable to be inundated:—a country unsusceptible of ready drainage: grave-yards, sites of ancient cities, places saturated with organic matter as where ordure and refuse have been deposited are all unhealthy.

A clay soil or clay subsoil coming near the surface, are retentive of moisture and of malaria. Ground at the foot of a slope, or localities situated at the mouth of mountain gaps or in deep hollow valleys. High positions exposed to winds that blow over marshes: ground covered with rank vegetation: sandy tracts and deltas of rivers ought all to be avoided.

Dr. Parkes in his lectures lays much stress upon the necessity of avoiding sites, where the soil has to be much disturbed, or where it has to be cut away from the side of a hill. He also protests against selecting ground that had been previously built upon, as for example, the remains of an ancient city or town: as well as against the selection as sites of old or deserted grave-yards, and grounds that have been largely used for the deposit of sewage or refuse matters.

Raj Ghát, near Benares furnishes a painful illustration of the results that have arisen from a neglect

of these precautions. The ground upon which the barracks now stand, was in former years used as a Mahomedan grave-yard, and the position has proved so deadly to soldiers sojourning there even for a brief period, that it has had to be abandoned.

Places to avoid.—Vicinity of large cities, especially to leeward of them, also the proximity of cantonments occupied by the native black troops of India, whose habits put all sanitary rules at defiance: grave-yards and places of incremation.

Out-houses such as cook-rooms, servants' rooms, stables, and necessaries, should always be to leeward: so also should places, the soil of which contains large quantities of organic matter, whether of slaughter-houses, public latrines or manufactories of animal substances.

Indeed, on this principle, there are grave doubts as to the propriety on sanitary grounds, of maintaining the fixed places for encampment, that still exist in India, for regiments proceeding from station to station in process of ordinary relief.

Sites which do not possess sufficient fall for effectual drainage should be avoided, unless military considerations demand their occupation. Imperfect drainage, as is well known, may convert a harmless swamp into a malarious boggy marsh, and this important fact ought to be borne in mind in devising schemes for draining a locality about to be occupied by troops; for example, the marsh of Chartreuse, near Bordeaux, is given as an instance of this. The partial drainage of it was followed by a succession of severe forms of fever, and in 1805, 12,000 persons were attacked, of whom 3,000 died in five months.

It is also of importance to bear in mind the fact, that in certain localities the profusion of irrigation required in the cultivation of rice is the cause of malarious disease; hence in Italy, fields of this cereal are prohibited within a thousand yards of forts. In India, a distance even greater than this ought to be

insisted upon; the cultivation of rice should not be permitted within a distance of a mile from where soldiers are quartered.

Marshes, fens, valleys, low-lying ground, ferrugenous soils, sandy wastes, the banks of tidal rivers, the course of dried up streams, places destitute of vegetation, are usually avoided as sites for an encampment if possible: and always so for a cantonment in the absence of powerful reasons of a military nature.

When an individual person, or a body of troops is temporarily exposed to such influences, they should be highly fed, have coffee in the early morning, use quinine wine, as a prophylactic measure, and have a moderate allowance of spirits issued to them.

At night, fires to windward of their camp should be lighted: and the knowledge we possess, that malarious influence is powerfully attracted by woody fibre, whether that be as living trees or as woven cloth, justifies the almost instinctive use made of the handkerchief, by placing it to the nose while in the act of passing localities rendered poisonous by malaria or animal decomposition.

The use of muslin curtains to the beds in India, has also a valuable use in this way, in addition to the more apparent one of preventing the attacks by mosquitos.

Woods.—We learn that the Romans resorted to the shelter of woods for their camps: there is however a great difference between these and jungle, brushwood or low vegetation. If troops are encamped in the body of a wood, not only is malaria from swamps to windward rendered innocuous by being attracted by the trees, but the latter afford shade and preserve the air cool. In India, whenever the necessity of service admits of troops encamping under trees, they do so: and throughout the country groves exist for this very purpose.

It has been practically found in that country, that the destruction of forest trees has had the double effect of diminishing the rainfall, and increasing the heat of the ground; as however, forests in India contain a large proportion of low dense brush-wood, the air is thus rendered stagnant and impregnated with large quantities of the ærial products of decomposition of both vegetable and animal organisms. The tracts of jungle, for instance, which skirt the Himalayas to the eastward of where the Ganges enters the plains, possess these characters pre-eminently; and are so notoriously unhealthy that it is not deemed safe for even a single traveller to pass through them during the night; while for a body of men to do so, except during the day, would be extremely disastrous. Hence, to encamp there is most dangerous.

Trees.—Nothing, says Dr. Jackson, is more grateful than the shade of trees in scorching climates. According to him, they not only refresh, but purify the air, and absorb the noxious qualities of the soil. Hence, as their shade is both grateful and healthful in itself, barracks should be sheltered by an avenue or double row of wide spreading trees, judiciously placed at the exposed points.

A very salutary recommendation has been made also, that in the vicinity of Indian barracks, there should be planted a grove of trees, under the shade of which the soldiers might if so inclined indulge in out-door amusements. It is right to observe however, that a similar recommendation for the benefit of our troops in the West Indies, was made by Dr. Jackson. (See his View of the formation, &c., of armies, page 526, edition of 1824.)

In 1820, Dr. W. Fergusson brought forward the opinion, that marsh poison adheres to trees. The doctrine is now generally accepted, and hence a belt of trees is looked upon as affording the best protection against malaria. It has been stated, that lower vegetation than trees is sufficient for this pur-

pose: that in America, the injury which would otherwise arise from certain marshes, is neutralised by planting them with sun-flowers, and that in the campagna of Rome the same end is attained by maintaining upon it crops of bushy thistles.

As is well remarked by Dr. Chevers, trees to be protective must be themselves healthy. Trees like men, have their periods of sickness and decay; and, during these it may readily be believed, their proximity is injurious rather than beneficial.

Grass.—Long grass in the vicinity of camps or cantonments is objectionable. It prevents free surface ventilation, and harbors numerous vegetable and animal sources of morbific emanation. Verdure, such as low grass, however, ought to be encouraged; it prevents malaria arising from the ground, and renders what had been a sandy plain actually cooler; as for example has occurred at Jullundhur in India. It also by binding the soil diminishes the dust storms, which are a source of not only great personal inconvenience but often of actual injury.

In similar circumstances, the cultivation near the barracks of cereal crops that do not require profuse irrigation, would be grateful to the eye and not injurious to health.

Changes in the degree of healthiness of stations.—In various foreign countries, we find that without any apparently adequate reason, a station changes its character in regard to degree of salubrity or otherwise, according to the length of time it is occupied. In some, as for instance at Hong-Kong and in lower Bengal, newly made cantonments have proved extremely unhealthy but subsequently improved. Gibraltar, as is well known, was in the early period of its occupation by British troops, from time to time assailed by terrible outbursts of yellow fever, one-third of its entire population being upon one such occasion entirely destroyed. In upper India, some stations that had when first occupied been remarkably

healthy, have entirely forfeited their character. In the case of Meean Meer, there was doubtless apparent cause for this in its now notorious cess pools : but at others, as for instance Meerut and Umballah, there is no such evident cause.

Hill Stations —A few remarks on Hill Stations may conclude this chapter. The actual advantages of a hill climate may be briefly enumerated thus, namely : a lowering of the temperature, as compared to the plains of 20° *F.* to 30° *F.* : the recovery thereby of elasticity of physical and vital powers, the ability to take exercise in the open air, and to enjoy a sound sleep undisturbed by heat, or by the insects that combine to embitter existence in the plains.

These stations, however, are not exempt from the ordinary climatorial diseases of India : thus, hepatitis, cholera, croup, diptheria, small pox and typhoid, remittent fever occur at all : and at some, an obstinate form of diarrhœa is endemic.

Experience has taught that the affections which are most benefitted by these climates, are cachexies from malaria, fever with or without spleen disease ; cases of impaired function of the viscera, and cases of constitutional syphilis.

The cases that are not suited for these climates, comprise the following, namely!—pulmonary affections especially scrofulous or phthisical: dysentery, diarrhœa, hepatitis, head affections, neuralgia, and rheumatism.

In fact, removal of a person to these climates has now come to be looked upon less in the light of a curative measure than formerly ; being at the present time only considered as a means of prolonging the existence of a sufferer until a fitting opportunity occur to send him out of the country. The importance of the general subject however, is so great that a chapter is devoted to its consideration in a subsequent part of this volume.

CHAPTER IX.

ARMY HOSPITALS.

General and regimental hospitals—Regimental—Field—General—Hospital ships—Different hospitals necessary—Objections against general hospitals—Civil and Military hospitals—Experience in the Crimea—India—Peninsula—America—Sir James McGrigor—Regimental field hospitals—Dieting sick.

General and Regimental Hospitals.—There is much reason to believe that considerable misconception exists in regard to the nature of hospital establishments necessary for a campaign. Some medical officers talk and write, as if only general hospitals should exist—others, as if only regimental; and not a little gall and bitterness seem to have been by each party heaped upon those who differ from them in opinion.

The experience of all Indian campaigns has shown that not only are regimental hospitals necessary, but that they are absolutely indispensable. They are, in fact, one of the most important and essential requirements to an army that would successfully prosecute a campaign. It is no less true, however, that in extensive operations, and in rapid onward movements, sick and wounded accumulate to an extent which renders it absolutely necessary, not only for their own well-being, but with a view to leave the effective army unencumbered, that they should be sent to the rear. At the basis of operations too, and at ports where reinforcements arrive, and non-effectives embark, large stationary hospitals must be provided.

Thus we perceive, three descriptions of hospitals on shore are essential to an army namely, the regimental to accompany the regiment under

every circumstance of service—to afford immediate succour to sick and wounded, and to accommodate them so long as this can be done without encumbering the effectives.

Secondly,—Field general hospitals.—These are intended to follow at a distance; to receive the sick and wounded from the regimental hospitals: to keep up communication with the front; to provide conveyances and all necessary requirements in transit to ports of embarkation or the basis of operations. Of this nature should be the field hospitals of divisions.

The third description of hospital necessary is the purely general hospital. It must be established at the basis and have in it the means of receiving all cases sent from the front; of sending to the front all requrements in the form of stores, instruments, equipment, medical officers, purveyors, and attendants of all kinds. It must make all arrangements for sending away non-effectives, for receiving the sick of troops arriving by sea; whether from the mother country or from portions of the army engaged in combined operations elsewhere. Other parts of the duties of the authorities connected with it, are to send to the front men who may have recovered, and to obtain from home the supply of officers, men, and stores, so as to be able to preserve in a state of completeness, the establishments in front.

Hospital Ships.—In addition to these hospital ships are necessary, not only for the transport of sick and wounded, but often for their immediate reception from the front when circumstances renders it impracticable to have a hospital on shore at a port of communication.

It is, therefore, evident that no single one of these different kinds of hospital can fulfil all the requirements of an army in operation: but that all are necessary. It is moreover sufficiently evident to any medical officer who has had practical experience.

in the matter, that each kind of hospital requires a particular manner of administration : and that to render the whole effective, the establishment of each should be at all times complete. To add to one at the expense of the other is obviously to impair the whole.

General Hospitals—Objections to.—"The manifest evils," observes Dr. Millingen, "that have arisen from general hospitals, have at all times been deeply felt and lamented. They have proceeded, in my opinion, from their having been thrown in a great measure out of the hands of the medical officers in charge, and entrusted to military commandants unacquainted with the nature of their administration : and to the purveying department."

That these objections are as forcibly, or even more so experienced at the present time as they were during the Peninsular war, is more than evident from the opinions expressed by many authorities whose position entitles them to be heard.

The theory of divided responsibility is no doubt in some few respects good, but only in a very few. In respect to general hospitals, the medical officer in charge is the responsible agent for all requirements of the sick ; yet under the present system, he himself is deprived of the power of ordering the very requirements which he may deem indispensable for them ; being checked upon the one hand by the military commandant, on the other by a purveyor : both of whom be it remembered, are unqualified by absence of professional training for the performance of duties they have actually to superintend ; yet having no personal responsibility for the failure of them.

Civil and Military Hospitals.—It is evident that the purposes of the establishment of civil and of military hospitals are for circumstances of a totally different nature : the one is intended to meet the requirements of a stationary population, and it is needless to observe, is itself stationary. The establishment

and organization of the other is, or rather should be, with a view to meet the necessities of a body in motion, exposed to all the emergencies incidental to field service in a foreign country. If therefore it fulfil all its purposes, one of the most important objects should be to maintain in working order its establishment, upon a principle such as would be applicable to actual military service.

No general hospital, as these are now constituted, can do this; and I appeal to any officer acquainted with their working, whether I am not correct in asserting that no medical officer is, by the teaching obtained in general hospitals alone, rendered even in the slightest degree fitted for the executive or administrative duties that are demanded of him on active service? Most assuredly he is not. He can only be practically initiated into them in a regimental hospital.

Experience in the Crimea.—For some years back the fashion has been to appeal to the Crimea as a standard of comparison: and from the working of general hospitals there to urge their adoption everywhere else.

On reading the accounts of the scenes, the fearful mortality, the want of organization of some of those connected with that expedition,—it seems strange how these features, instead of being held as so many reasons condemnatory of them, should be appealed to as so many recommendations for their establishment elsewhere.

It may perhaps, be deemed sacrilege to say a word that could be construed into anything condemnatory of Crimean institutions. In regard to general hospitals however, it must be observed that the operations of the army having been confined to the vicinity of the sea-coast, the hospitals established were not called upon to fulfil the purposes usually required during a campaign. They were in fact stationary: and in that respect more on the system of civil than of military

hospitals. Nor is it too much to assert, that in their nature they were not suited to the requirements of an army in motion and acting throughout an extended territory, as was the case during the war in the Peninsula—as took place in India, in the Affghanistan war—either of Sikh wars—the war in Gwalior—the operations against the mutineers in 1857-8; extending as they did over many thousand square miles of territory:—or even for the purposes of the expedition to China.

In all these except the Peninsular war, the field hospitals were organised, and all their departments administered by the principal medical officer: and in every instance, successfully, in so far as their working was concerned. In the early part of the Peninsular war they were not so, and the result was that the most experienced officers of that time described general hospitals as the curse of the army.

Peninsula.—So unfavorable an opinion had Baron Larrey of the general hospitals of his day, that he considered them a source of disease; and Dr. Millingen remarked that men, who from unavoidable circumstances had been left on the field, exposed to cold and heat, to rain, hunger and thirst, have ultimately done better than those who had been immediately removed and had received every possible assistance in the general hospitals.

America.—Somewhat similar remarks occur in reference to sick and wounded during the late civil war in America. In that war however as well as in the Peninsular, hospital arrangements would appear to have been very insufficient: patients were crowded together and the hospitals themselves were for the most part on the plan of general ones.

Regimental Field Hospitals.—Sir James McGrigor was an advocate for having regimental field hospitals. According to him, however short a time a battalion or a corps rested in one place, a regimental hospital was established. Indeed, as each carried

with it medicines, bedding, stores, and all the materials of a hospital, a regiment might be said to have its hospital constantly established on the line of march. It was frequently established in the face of an enemy, and nearly within reach of his guns.

This description of what took place in the Peninsula exactly represents what occurred also in India, not only during the sepoy mutiny but in all previous campaigns. It is valuable testimony in favor of the regimental system; but then, we must remember that to do full justice to this system, all necessary establishments must be maintained in a complete state.

Mr. Guthrie, in adverting to the Duke of Wellington's preference for general hospitals, at the same time remarks that His Grace's good opinion was gained by his having acted whenever it was possible, in disobedience to the letter, but not to the spirit of the Duke's orders on the subject: that is, by retaining with their regiments all men who were likely to be speedily cured.

Sir James McGrigor's views.—Considering the aspect assumed by this question of army hospitals, while these pages are in progress of being printed, it is now deemed advisable to enter into some more particulars than were at first intended in regard to them. Let us therefore see what were the measures taken by Sir James McGrigor in regard to hospitals during the war in the Peninsula,—a war, be it observed, that has perhaps tested more than any other the administrative talents of responsible officers connected with it.

At the time when Sir James McGrigor joined the army of Lord Wellington, near Ciudad Rodrigo, the hospitals of the army in the Peninsula were all upon the general hospital system; all sick and wounded were sent to the rear: and of the condition in which Sir James found these, as well as the large depôts

connected with them, he himself informs us in his autobiography.

He arrived at Lisbon, on 10th January 1812, to assume charge of Lord Wellington's army. At that place he found an immense number of sick and of medical officers; and also "a number of sick or reported sick and wounded officers." He reported the circumstance to Lord Wellington, and mentioned not only the great accumulation of sick, but the still greater accumulation of officers, their *ladies*,—as Sir James, in his extreme and habitual politeness expresses himself in regard to, let us hope, their *wives*. In addition to these there were many of the wives of soldiers also present: and it was even said that Lisbon was so agreeable a place of residence, that many soldiers and officers would be slow to resume their duties unless obliged to do so; and he took steps accordingly.

Here then is one of the results of the general hospital system. Let us consider the subject from another point of view.

Sir James informs us that, on making his first inspection of the large general hospital that prior to his arrival had been formed at Celerico, fever of a low type was the prevailing disease: and he adds, "nothing could have been better devised for arresting its progress in the army, than the establishment of regimental hospitals in the cantonments of each corps, instead of sending the sick to a large general hospital." (Biography, p. 324.)

This great administrator however, while seeing the necessity for regimental hospitals was well aware that they alone were not sufficient for the requirements of the army. He tells us that he thought it his duty to state to Lord Wellington "that if the operations in the ensuing campaign should be more extended, or even on the same scale as the last, and at a distance from large towns, we should feel surely the want of buildings for general hospitals to

receive such cases of disease or wounds as would not bear conveyance." (p. 325.)

We have the statement of Sir James McGrigor also as to the measures he adopted with a view to improve a system which was found by him to work in the British army as imperfectly as according to the expressed opinion of Baron Larrey it did in that of France.

He at once proposed that only special cases of sickness or wounds, and such as were approved by him should be sent to the rear: that each corps should have its own regimental hospital, where slight cases should be treated by the regimental medical officers under the superintendence of the medical officers of the division; and that sick or wounded officers should be similarly dealt with. He moreover proposed that no sick or wounded officers should remain at Lisbon except those to be sent to England, and he restricted the medical and purveying staff there accordingly.

He further proposed that in addition to regimental hospitals, brigades should be similarly provided: but Lord Wellington objected to this part of the scheme, for fear, as he believed, of the army being encumbered with vehicles,—an objection which has even since then been often urged by persons who take a partial view of hospital establishments to meet the requirements of actual service.

No sooner however, was the system of regimental hospitals brought into operation than we find medical officers of corps becoming loud in their praise. During the advance on Badajos, many regimental surgeons and commanding officers informed Sir James McGrigor that with these, if they had only some kind of conveyance such as the common country carts, it would be necessary to send but few men to the rear. At this time, each corps had attached to it two spring waggons, from the waggons corps, and the responsible officers were all pleased with the newly introduced system.

While the siege of Badajos was in progress, Sir James McGrigor became convinced of the necessity for establishing field hospitals; these were accordingly formed, and to them cases of wounds and accidents not conveyed to the hospitals of regiments were taken: whence if necessary they were dispatched by spring waggons to Elvas.

Nor is this all the testimony that has reached us on the subject. During the succeeding winter while the army was in quarters at Frenada, a regular system of regimental hospitals was established: the abuses of general hospitals were so far remedied, that 600 men were sent to join the second division of the army alone in one month: and, in the words of the historian of the Peninsular war, (Napier, vol. V., p. 503, quoted in Biography of Sir James McGrigor, p. 322,) this salutary measure was rendered more efficient by the establishment of both permanent and ambulant regimental hospitals, a wise measure, and founded on a principle which cannot be too widely extended; for as the character of a battalion depends on its fitness for service, a moral force will always be brought to bear upon the execution of orders under regimental control, which it is vain to look for elsewhere.

Many years afterwards, and when Sir James McGrigor had retired from the position of Director General of the army medical department, he thus expresses himself in regard to the hospital system then in force, as compared to that of the French army; and now, at this distance of time, the writer of the present remarks ventures to observe, that no medical officers will more thoroughly coincide with him than those of that army themselves.

"I think," says he, "I have seen every edition of the regulations for conducting the French hospitals from the time of the revolution to the present, and I am free to confess, that I see very little to copy from them as an improvement on our own." He exempts the ambulance for the transport of the sick and wounded;

the great advantage of this part of the French system over our own, having been as apparent to him as it has been to all other writers who have paid attention to the subject.

Regimental Hospital.—Regimental hospitals had, shortly after the end of the Peninsular war, proved themselves so well adapted for their purpose, and been found so excellent, that Dr. Millingen thus expressed himself in regard to them :—"Regimental hospitals in His Majesty's service, have arrived to that degree of perfection in military, professional, and financial arrangements, that nothing more satisfactory can possibly be desired." And he further observes :—"In addition to the advantages over general hospitals, which I have already pointed out, they offer the attainment of that important desideratum—the means of treating the sick of armies without that accumulation which large hospitals must render unavoidable ; and which will always prove the source of concentrated disease, irregularities, confusion, and ultimately considerable injury to the service."

It is to be hoped that even yet, it is not too late to arrest the tendency which is apparent, to abolish our regimental hospital system ; and in its place to establish that which has already been considered the *curse of the army*,—and is in the French army, loudly condemned by the medical officers of that service.

In order however, to be prepared for the emergencies that take place on active service where moves are sudden, it is essential that each regimental surgeon have at all times his hospital establishment complete, and so arranged that it may act independently as a whole, or divided with the wings of the corps.

The writer is fully aware that there exists a party in the army medical department, who would desire that no medical officers shall form a part of the staff of a regiment as at present. According to this party medical officers would be simply attached, not belong to a regiment ; and therefore, they argue, there being

no regimental medical officers, hospitals conducted on the regimental system must necessarily cease.

With reference to this it is to be observed, that even under present circumstances, some medical officers of the army although in a manner belonging to regiments, they are all in reality members of a distinct and separate branch of the military services: and many detachments and regiments are under the charge of staff medical officers. Yet so long as these officers have such charge they are in regard to discipline, and of routine of duty as much under the orders of the officers commanding, as if in the army list their names were borne upon the list of regimental officers, they paid mess and brand subscriptions—and wore regimental instead of medical staff uniform. It does not therefore appear, how this circumstance should in any way interfere with the ordinary routine system of duty in a regiment.

Dieting sick in Hospital.—A few remarks on dieting sick in military hospitals, may appropriately end this section. Great as is the variety of diets that have been of late years permitted, many medical officers consider,—and with good cause—that the advantages of these to the sick are more supposed than real; for however varied the regular diet may be, it is apparent that no one diet contains the particular article for which a patient may at the time have a desire: and that if it happen to do so, the greater part of the other ingredients constituting the diet must be wasted as being unsuitable.

The capricious appetite of a sick man will often turn against an article that has to be ordered, as is the case with diets, nearly thirty hours before issue: while, if the same article were given at the time the desire for it was felt, it would be relished and enjoyed.

The regulations relative to articles under the name of extras or medical comforts are far too strict. Medical officers are in effect, all but prohibited from ordering very sick patients articles which alone could

be enjoyed by them. Hence, whatever theory may indicate, it is found in practice that the simpler is the scale of diet allowed to the sick, the better for them —the more convenient to the cook, and the more economical to the State: while the greater the latitude allowed in the item of extras to cases of severe illness, the greater is the actual benefit to, and comfort of the sick man. It is a sad thing to see a dying man beseech to be allowed some trifling article, which the prescribing medical officer can only grant, by himself paying for it.

CHAPTER X.

SOME OF THE MEANS OF TRANSPORT FOR SICK AND WOUNDED.

Different conveyances—Conveyances by men—Stretchers—Brancards—Doolies—Hammocks or Dandies—Baskets—Contrivances carried by draught animals—The Litier—Cacolet—Stretcher—Conveyance by Elephants—Cradle or cajawahs—Camel Litters—Brancards—Login's Litter—Wheeled conveyance—Heavy ambulance—Light ambulance—Long carts—Light carts—Cherry's ambulance—The Shigram—Maltese carts—Currie's ambulance—Commissariat waggon—Araba and Hackery—Disadvantages—Sir John Hall's opinion—Crimean and Peninsular wars—Fuller's springs—In India—Difficulties—Wheelbarrow ambulances.

Different Conveyances.—The different contrivances by which, during active service in the field, the sick and wounded of armies are transported from place to place, may conveniently be divided into the following classes, namely :—

1. Conveyances carried by men.
2. Contrivances carried by draught animals.
3. Contrivances of a nature to render them capable of being carried by men or animals.
4. Wheeled conveyances.

1. *Conveyances carried by men.*

It may be well to note in this place as a mere point of interest in the history of the army, that the first purpose to which the sash of commissioned and non-commissioned ranks was supplied to them was, that they themselves or their comrades, if wounded in battle, might be carried off the field in it; the halberts that the latter class carried, until within a comparatively recent time, being intended as stretchers whereon to extend the sash when used for the above purpose.

The use of the sash for this purpose has, it is almost useless to observe, been long since abandoned: and at the present time, the following seem to comprise the means of conveyance by men that are in most common use, namely:—

(*a.*) Stretchers.—These consist of a canvas bottom, supported at each side by poles; a cross bar at either end maintaining the whole in position.

The stretchers in use in the British army weigh each, lbs. 14: and fourteen of them are carried upon the ambulance cart that follows in rear of each regiment. Full instructions are given in regard to the manner in which they should be packed, in War Office Circular 856 of 31st March 1864.

They are chiefly used in removing wounded from the field to some means of transport, or to a hospital; and are carried by a couple of men, who are either of the army hospital corps, or belonging to the Bands of particular regiments told off for the purpose during action.

(*b.*) Brancard.—The brancard of the French, seems to be nothing more than a stretcher of the above description, so arranged however, as to be capable of resting upon the ground; and so forming a temporary bed for the patient.

(*c.*) Doolies.—These are confined it may be said, solely to India; and although some trivial differences exist in the construction of them in the different Presidencies, these are but of immaterial consequence.

Unquestionably no means of transport has yet been discovered, which affords to a sick or wounded man, an equal amount of comfort as the dooley. It is so light as to be capable of ready conveyance from one part of the field to another: and a sick man once placed comfortably in it, it supplies all the requirements of a bed.

In former times, only two objections seem to have been urged against the dooley, both of which were with reference to its bearings not upon the comfort

of the person using it, but upon the efficiency of the army that had no other means of transport for its sick. These objections were the enormous retinue of camp followers as bearers, that thus became necessary: and secondly, the inability of these bearers to keep up with cavalry and artillery in some of the rapid advances or pursuits that are of such frequent occurrence in Indian warfare.

Various modifications of the dooley are in use: some of which like that contrivance itself, are made to be carried by two men at either end of the pole,—others of a lighter kind, such as were prepared in China, to be carried by one man at either end. A very excellent substitute of this nature has recently been produced in India. The bottom, instead of being made of wicker work, consists of light boards with grasshopper joints, so as to render them easily capable of being arranged to support a fractured limb.

Hammock or Dandie.—This contrivance, known in Africa under the first, and in India by the second name, consists of a piece of strong canvas or other cloth; having a ring at either end, by which it is secured to a pole,—pegs being placed at suitable distances from each other, to maintain the "hammock" open.

In Africa, two natives of that country are capable of carrying a sick or wounded man in one of these, but in India, four are required.

The contrivance itself cannot be looked upon as otherwise than inconvenient and uncomfortable: and as only intended for use in steep hilly districts, where the pathways are so narrow as not conveniently to admit doolies.

Baskets.—These would appear to be altogether peculiar to Western Africa: and therefore not likely to be much used in the British army; there being few inducements for extending conquest in that country.

As their name implies, each consists of a wooden frame over which basket-work is interlaced. The length of the basket is sufficient for a man of ordinary height; the breadth being about twenty inches.

In order to carry a person by one of these, a native bearer supports upon his head either end of the basket. It thus is evident, that as a means of transport it is not only not safe, but is extremely ill adapted in other respects.

2. *Contrivances carried by draught animals.*

(*a.*) The Litier.—The French litier is made so as to unhook: two men can take it with the wounded man in it, and place it upon the ground. This means of transport is said to be easy: but it has the disadvantage that men cannot be transported in it to any great distance.

(*b.*) The Cacolet.—This consists of a seat, so arranged as to be capable of being secured to a pack saddle; a mule carrying one upon either side, and thus conveying a couple of wounded men. They however are only intended for the conveyance of persons having comparatively slight injuries, and these in the upper parts of the body.

According to page 77 of the medical regulations, the cacolets and litiers ought to be removeable from the pack saddles, so that stores may be brought back by the mules after having conveyed to the rear, sick or wounded; and that when a force is detached, these means of transport shall be distributed as the P. M. O. may direct.

(*c.*) The Stretcher.—A contrivance, which is figured in some works on transport, and is intended for the conveyance of sick or wounded men, consists of something like an ordinary stretcher, only having its poles lengthened and so arranged at either end, as to be readily secured to the harness of a draught animal, as a mule or pony. This is intended to be carried by a couple of these: one yoked in front, the other

behind: but as is evident from its very nature, cannot be other than an inconvenient arrangement.

The contrivance invented by Sir John Login, among its numerous advantages, is said to be readily capable of being so arranged as to form a litter to fit as here described between two ponies going "tandem" fashion.

(*d.*) Conveyance by Elephants.—During the mutiny in India, a contrivance was extemporised, by which six men could be without inconvenience carried upon one elephant. This was chiefly for the purpose of following up the rebels in swampy districts, and could, under certain circumstances be employed for the conveyance of the more slightly sick, or trivially wounded.

It consisted of a frame work of wood, divided into spaces on each of which a man might sit: there was a back board for support, and a foot board suspended by chains at either end, upon which the feet were supported. The whole was sufficiently strong to withstand the rough usage to which it was subjected. It was so arranged by means of belts and hooks, as to be readily secured upon the kind of saddles usually provided for elephants, and formed in fact, a kind of long cacolet; one of these slung on either side of the animal, readily carried three, and at times even four men.

(*e.*) Cradles or Cajawahs.—It is evident that the so called cradles that were used by Baron Larrey during the campaign of the French in Syria, and by us during the war in Affghanistan, were more or less similar. Baron Larrey states that camels were the only beasts of burthen available in Syria; he therefore extemporised means of transport for his sick, by having a hundred baskets made to fit, cradle-ways: two for each camel, secured upon the animal by elastic straps.

Some of these seem to have been made short for the accommodation of persons capable of sitting up; others were long, for those who required to be kept in the horizontal posture.

Experience speedily showed that the simpler was the construction of these, the better they withstood the use to which they were put: and it was soon found, that the best and simplest construction of "cradle" was that of basket-work, a little raised at one end, the better to elevate the head of its occupant: and having over it a tarpaulin to be used in case of bad weather.

The manner of securing it to the pack saddle, that was found most effective and least liable to damage, was that by straps or bent iron bars going completely round the cradle, turned into a ring at the inner side, and properly placed; one or two spare rings should in addition, be secured where wanted on the cradle: and by these and straps, the whole may be more perfectly steadied upon the animal.

A frame work of wood with a corded net work bottom should be placed inside, together with a quilted matrass and covering; the last wide enough to double, if necessary. There should be two pillows; one for the head, another to lay by the side of the patient to steady himself.

Insufficient Transport.—That the litters were far from sufficient on the expedition to Syria however, we learn from M. Bourienne, who relates that some of the wounded were carried in litters, the remainder on horses, mules and camels; and in his account there is so remarkable an example of the horrors that arise from insufficient means of transport for the sick and wounded, that an extract may be given as a warning to officers charged with similar arrangements in future.

On the return march from St. Jean d'Acre, M. Bourienne saw officers whose limbs had been amputated thrown off the litters. He saw the amputated, the wounded, the infected (by the plague); or those only suspected of infection, deserted and left to themselves. The force was constantly surrounded by plunderers, incendiaries, and the dying who, stretched on the sides of the road, implored assistance in a feeble voice.

In this emergency, Napoleon dictated an order that every person should march on foot, that all the horses mules and camels should be given up to the wounded and the sick. A more serious result than personal inconvenience however, was more or less directly the result; for we read that on this occasion, "the remains of our heavy artillery were lost in the moving sands of Tentoura from the want of horses; the small number that remained being employed in some indispensable services."

Of the cajawahs used in Affghanistan, each was capable of containing two men sitting up, so that each camel conveyed four. Similar contrivances could however, be made for transport of the same number of men in the recumbent posture. These consisted of a wooden frame work, about four and a half feet long by three and a half broad, with a seat at the back for two men; the sides of the frame work were formed of gunny cloth.

This must be but an uncomfortable conveyance, both on account of its own construction, and on account of the characteristic gait of the camel that carries it.

(*f.*) Camel Litters.—Dr. Brett in his work upon Surgery in India, gives figures of what seem to be excellent camel litters for sick and wounded. These litters which seem to have been invented by himself, are sufficiently long to accommodate a man lying at full length: and of sufficient width for a person of ordinary size; a light frame work made of canvas over them, acts as a shade: and a pair can be hooked together upon a saddle for the purpose. In many respects they are very similar to the French brancards, and are doubtless well adapted for transport of sick in difficult countries.

3.—*Contrivances of a nature to be carried by men or animals.*

Only two descriptions of contrivance of this nature seem to have been brought to any degree of perfection by our own countrymen.

(*a.*) Brancard.—Of these, the brancard invented by Dr. Millingen was so constructed, as to be capable of being used for conveyance by men, or to be fixed upon the back of an animal; being in fact, somewhat akin to the French brancard, and to a certain degree well adapted for its purpose.

(*b.*) Login's Litter.—The other contrivance is the litter invented in India, by Sir John Login. This gentleman very justly observed that, although no mode of conveyance can be more easy for a sick person than a dooly, yet in mountainous countries such as Affghanistan; or in those traversed by ravines and large rivers, such as the Western Punjab, this mode of conveyance becomes but imperfectly adapted, or indeed utterly unsuited.

In advocating his own invention, Sir John Login enumerated a variety of objections against the dooly: some of which are real, but others of a questionable nature; of these objections, an important one is that the dooly is ill adapted for the continued treatment of fractures, inasmuch as its bottom is not sufficiently firm.

Another is the great bulk of the dooly and the consequent difficulty in transporting a large number of them across a river, during military operations: for on account of the great size of them, it is seldom that more than two, whether empty or full can be placed upon one boat; and, on the line of march, such is the enormous extent of space taken up by them, that the doolies of one regiment occupy in single file, a length of not less than six hundred yards.

To obviate these disadvantages, Sir John Login proposed a kind of litter, evidently after the plan of that adopted by Baron Larrey in Syria. Those that were issued for use to the army in Gwalior in 1843, were so constructed as to be capable of being carried upon elephants, ponies or camels: and were so light, as to admit of being carried by two men. They were moreover portable, so that they could be taken to

pieces; six of them when thus packed took up only the bulk of one dooly: and this number, when not required for use, could be packed and carried by a camel,—three of the litters on either side.

He enters into a variety of particulars on this subject, some of which may with advantage be noted in this place. Thus, he considers it to be seldom necessary to make arrangements for the conveyance of more than 60 sick per regiment: the scale therefore, he would have for this amount, would be as follows, *viz.*—

10 litters carried by bearers.
50 „ „ on 25 camels.

Forty spare litters, say upon 8 camels: and as the sick increase, litters could be mounted upon the Commissariat camels, which daily become spare.

As it becomes necessary to establish Commissariat depôts, additional camels could be there obtained when necessary: and sick and wounded disposed of.

Sir John Login would also have the lascars connected with transport of sick, formed into a regular corps, attached to the hospital: to be there employed as coolies, messengers, &c.; and in camp, as tent pitchers. Those not actually employed in carrying litters, could accompany the hospital train of camels, &c., upon the march: and during an action, their special duty would be to man the litters for removal of wounded from the field.

He thinks that the establishment necessary for conveying all the litters, provided the whole were transported by men, would be:—

Hospital lascars	47
Bearers	400
Extra followers, say	50
Total ...	497

If other modes of carriage are in use, there would be :—

Hospital lascars	47
Hired bearers for 10 doolies	40
Camel drivers, Hackery men, &c.... ...	16
Extra followers, say	12
Total ...	115

Under the system of having doolies only, there are required

Bearers	600
Mates	20
Sirdars	10
Total ...	630
Spare bearers, ...	70
Making the whole native establishment for a regiment	700

Thus, there would be by Sir John Login's plan, a saving in this respect of 203, and in the other, of 585 persons.

The average price of one of these litters would be about Rs. 24, that of a doolie Rs. 16.

The average monthly charge for the conveyance of sick of one regiment, amounted under ordinary circumstances in India, to about £126 per month, under extraordinary circumstances, to £320; these amounts being taken up chiefly in the payment and rationing of the bearers: for during times of war, bearers are fed by the Commissariat, in addition to being also granted their particular rate of wages.

4.—*Wheeled conveyances.*

Under this head are naturally included all the different varieties of ambulance cart, hackery or araba,—these being the conveyances capable of following an army to the field.

The Ambulance.—This includes a variety of forms of conveyance, the principal of which are the following, namely:—

(*a.*) Heavy Ambulance.—The heavy ambulance waggon such as is used in the French army, capable of conveying sick or wounded: supplied with medicines, instruments, bedding and clothing, means of cooking, a small amount of medical comforts, and the means if need be, of forming a temporary hospital.

(*b.*) Light Ambulances.—Carts of a somewhat lighter description, each capable of conveying two men in the horizontal posture, and four sitting up: but not fitted up with medicines and stores, as are the heavy ones.

(*c.*) Long Carts.—Long carts, like Irish cars, having a range of seats upon either side for the accommodation of men who are able to sit up.

Conveyances of this kind have of late years been introduced into India; and being in that country drawn by bullocks, are invaluable for the purpose of taking men who are convalescent out for an airing.

Dr. Millingen and Sir George Ballingall, both speak highly of this description of car. It is, they say, less liable to block up roads than those of a broader description; and if need be, can carry in it's body 12 paliasse and bolster cases, and 24 pairs of sheets. Upon a march, they could moreover convey sickly men, and the packs of men unable to carry them. The latter advantage, however, has special reference to European warfare. It is not needed in India, where the packs of soldiers are always carried for them.

(*d.*) "Light" Carts.—"Light" carts of various kinds, chiefly for the purpose of taking patients rapidly to hospital when in garrison: or in European warfare, to remove from the field of battle, wounded men. Of these, the most sinple and efficient is a light cart drawn by one horse, and which, with a little ingenuity, could be so arranged, as to carry either the large and

heavy articles that are required by an army, or sick and wounded men.

(*e.*) Mr. Cherry's Ambulance.—Mr. Cherry who published a pamphlet on transport, in 1825, invented a conveyance that was then considered capable of being readily adapted to the carriage of stores, of transport of sick.

The conveyance is figured in Sir George Ballingall's work on Military Surgery, at pages 114 and 115, and so far as can be judged by appearances, is exceedingly well adapted for its intended purpose ; but there does not appear to be evidence, as to how it has been found to work on actual service.

(*f.*) The Shigram.—On the southern side of India, families proceeding on a march, often use a description of vehicle known there as a "shigram" or "cranchie" : it consists of a light cart upon springs and two wheels, the frame work of sufficiently strong materials to withstand ordinary usage, but the upper part of a lighter kind of material : often of cloth rendered water-proof by paint.

The whole has somewhat the general look of an omnibus, only it is both shorter and lower than that kind of conveyance ; the interior is fitted up with moveable seats, which can by an arrangement for the purpose, be converted into a sleeping place. There are pegs and drawers for such articles as are necessary on the journey ; the vehicle is well ventilated by means of windows, which can be shut or opened at pleasure. And thus, drawn by a couple of bullocks, and with a servant in the "box ;" a small family can with no other marching equipment, perform in comfort a journey of many days duration.

Such a conveyance would be a most excellent one for some of the more severely sick or wounded : but on account of its great bulk, and of its comparatively fragile nature, it would not be adapted for the general purposes of a campaign.

(*g.*) Maltese Carts.—During the Crimean war, conveyances of this nature seem to have been partially used. They appear to be nothing more than light spring carts with a top; and having suspended in their interior, double frame work stretchers, upon which a couple of sick or wounded men may lie.

(*h.*) Captain Currie's Ambulance.—Captain Currie has lately constructed a description of ambulance, which, in his opinion, can follow wherever a gun carriage can go; and is capable of conveying three men in a recumbent position, or from eight to ten men sitting up.

The conveyance figured by this officer, is a long waggon upon two wheels. It is open at the top, except that it is protected by a canopy. It is furnished with springs, and to all appearance, is well adapted for conveyance of sick along tolerably even ground. When not required for this purpose, it would with advantage be used in ordinary marches for conveying the families of soldiers: and as the Indian Government has recently sanctioned a proportion of conveyance being given gratis for this purpose, the waggon of Captain Currie seems extremely well suited for such an object.

(*i.*) Commissariat Waggon.—This is in reality a strong well built cart, drawn by bullocks or horses, and having four wheels. It is chiefly intended for conveyance of stores of various kinds to the front, but is extremely well adapted for transport of sick: and could by means of a few matrasses and blankets, and by having a canopy placed upon it, be readily adapted for this purpose, for those who must be retained in the recumbent position: while, by simply having two or three seats placed across it, it becomes at once available for those who can sit up.

Carts of this description, horsed and driven by cattle and men of the military train, were found most useful during the China campaign: and notably during the occupation of Tientsin, when they were of

the greatest service in taking weakly men into the country for an "airing." They have recently been introduced into India but have not yet been converted to hospital purpose, in that country. It may perhaps be well to remark that their excellence is chiefly in the total absence of springs in them.

(*j.*) The Araba and Hackery.—It would appear that the wheeled conveyance, known in the Crimea as the Araba, is almost identical with the hackery of India: and like it, is merely a rough description of cart with wooden axle, rough heavy wooden wheels, and drawn by bullocks.

So coarsely are these arabas and hackeries built, that they are liable to fall to pieces after a small degree of use. Their wheels fall off and become unserviceable, and in addition to these disadvantages, the want of springs renders them at best an uncomfortable conveyance for sick or wounded.

It is true that in India, by placing matrasses or straw in the bottom of the common hackery, that conveyance is in a manner fitted during times of emergency for conveying sick: and during the years of the mutiny in that country many sick and wounded were by these transported from Cawnpore to Allahabad, a distance of upwards of one hundred miles.

They possess however, two great objections against their being used except in times of emergency, and even then, more than very partially: namely, that by their construction they are not adapted for proceeding across country, and from being drawn by bullocks, are unsuited for rapid military operations.

Disadvantages.—It may be safely assumed that on active service, the larger the waggon, the more complicated its construction: and the larger the number of cattle required to draw it, the more liable do the whole become to break down. Thus, the addition of one horse to a cart doubles the power to get over any road not particularly bad; but if one horse

in a team of four fail in stength, the additional strain is thrown upon the other three, and they speedily knock up; then, the strength of a few men would fail to get a large waggon over a slight impediment, while the same means applied to carts, would readily surmount the obstruction.

Sir John Hall's opinion.—Sir John Hall, during the Crimean war, seems to have practically experienced some of these disadvantages in the waggons supplied to him: for in his evidence before the Royal Commission, he stated that his ambulances were too heavy for the road between Sebastopol and Balaclava: and that he therefore gave the preference to the French litier and cacolet, rather than the cumbersome waggons at his disposal. Of the various kinds of ambulance, he preferred those having four wheels to those with two. The latter were upset every time they went out, or nearly so.

In the Crimea and Peninsula.—The liability of the springs of these conveyances to give way, became in the Crimea a source of serious inconvenience. A similar drawback was often experienced during the Peninsular War: on the latter named occasion, wheeled conveyances of complicated workmanship were found to be so unsuited for the countries through which our troops had to advance, that common carts had to be employed largely for the transport of the sick and wounded to the hospitals in the rear; a few only being carried on the backs of mules.

Fuller's Springs.—It is believed that had Fuller's patent springs reached the Crimea in sufficient time, the inconvenience above alluded to might have been mitigated, if not altogether remedied. These springs are of india-rubber, and would have probably resisted the jolts that were sufficient to render useless those of steel. These, however, did not reach in time, and information is not now available as to whether they have been subsequently used with success.

In India.—During the operations against the Indian mutineers in 1857-58, a light description of ambulance was rapidly prepared and supplied to some of the regiments in the field. These conveyances were it is true, made of partially seasoned wood ; they were put together by natives, and with the usual flimsy workmanship of these : they had moreover, a canopy that was too high in itself, and was supported upon posts of too light a description.

It is scarcely therefore, to be wondered at, that for the purpose of going across country these conveyances were absolutely useless. They were liable to be upset,—to have their tops knocked off, and to have their springs broken. It may be observed that they had only two wheels, and were drawn by two bullocks each.

It is readily granted that ambulances are not suited to traverse the narrow preciptious paths along which troops have had to move on some of the hill campaigns in India : as for example—Sittana, Sikkim, or Bhootan. In these, doolies and dandies are the means of transport best adapted for the purpose : but even there, a few light ambulances would be most serviceable to convey to hospital sick or wounded who might be brought to them by doolies ; the conveyances themselves being retained for use at intermediate points, where the roads permit of the passage of wheeled transport.

Among the great disadvantages of having as heretofore in India, to trust solely to the dooly for conveyance of sick and wounded, was the serious one of the bearers being imperfectly able to keep up with artillery and cavalry in a rapid advance, or during pursuit of an enemy.

An ambulance capable of conveying eight men would dispense with the services of 48 bearers, the pay of whom at Rs. 5 per man would be Rs. 240 per month, while the entire cost of maintaining the ambulance, the driver, two bullocks and a spare one,

would only be Rs. 15 or 16 per month, that is £1-10 to £1-12.

Colonel Broome has proposed a description of ambulance capable of conveying 11 or 13 men. The original cost of it would probably be Rs. 1000 : but its adoption would dispense with no fewer than 78 bearers, with a monthly saving of their pay of Rs. 390. equal to £ 39.

Dr. Butler has expressed an opinion that there should be ambulance conveyance for one-third of the sick of a regiment, and doolies for two-thirds. And that one or two ambulances should be always retained in cantonments in India for the purpose of taking out convalescents for an airing.

Although in these remarks, the various disadvantages possessed by each description of conveyance have been enumerated; it should be recollected that this has been done, not with a view to entirely deprecate the adoption of any particular one, but to point out the disadvantages that experience has proved each to possess. In times of war, it is the duty of the supreme medical as of all other responsible officers, to take advantage of whatever means are obtainable in view to maintain the efficiency of the general force, and turn whatever they can to their own purposes.

The history of every campaign has given evidence of the difficulty or absolute impossibility to provide and carry with an army from the first, an adequate amount of transport for all its requirements. Perhaps this has been so to a less extent in India than anywhere else: yet many examples of the difficulty have occurred even there, and we learn that in the recent struggles in America, notwithstanding all the advantages and appliances now at the disposal of the contending forces, not a few sad scenes occurred as a result of the inadequacy of the available means to bring on with the army, those who had fallen wounded in battle.

In this, as in other matters, however, the most efficient army medical officer is he, who while fully

acknowledging difficulties when they arise, does so only to overcome them.

A very serious difficulty has of late years occurred in India in regard to the provision of doolies for troops on the march, and one which is likely to increase more and more. It is caused by the gradually decreasing numbers of the class of men who become dooly bearers.

The Government of that country therefore, seeing that provision must be made for altering the condition of the natives in this respect, referred the matter to the Sanitary Commission for Bengal, the recommendations of which body may be thus epitomised.

(*a.*) That as a general rule, for the purpose of carrying sick from barracks to hospital along good roads in a station, ambulances are preferable to doolies.

(*b.*) That a proportion of ambulances would be otherwise useful in taking out for an airing, patients who are too weak to sit upon an elephant, and who require more rapid movement through the air than would be obtainable in doolies.

(*c.*) That on an ordinary march, ambulances may be substituted for a portion of doolies: but whether they can be altogether substituted for doolies, either in cantonments or on service, is questionable.

(*d.*) That ambulances drawn by bullocks or by horses be supplied experimentally in addition to the full complement of doolies on field service.

(*e.*) That on an ordinary march, one half the amount of carriage for sick should be made up of doolies, the other half by ambulances. This for a regiment 920 strong, would include three ambulances, each carrying 8 men = 24: and 22 doolies = 22; total 46. The sick in hospital at the time, should have conveyance over and above this proportion.

(*f.*) When sick move with a regiment, ambulances and doolies may be provided for them in equal proportions, as at least one-fourth may be considered to be convalescents: and one-third to be suffering from trivial diseases.

(*g*.) That there should be permanently attached to each regiment, while at a station two ambulances in addition to the two doolies allowed by existing regulations; in the event of the regiment becoming divided, one should accompany each wing.

(*h*.) That for a battery of artillery, the light cart already supplied is sufficient in addition to the one dooly already sanctioned, while in cantonments.

Wheel Barrow Ambulances.—While this volume is in course of being printed, the Departmental Blue Book for 1863 has been received. In it is a paper by Professor Longmore of Netley, on the subject of ambulances to be propelled by hand after the manner of wheel barrows.

The reader will do well to consult that paper: in order however, to fulfil as much as possible the objects aimed at in the present work, a few of the statements made on the subject of these ambulances, by Mr. Longmore, are transferred to its pages; premising that this mode of conveyance for sick or wounded is by no means new.

Sir James McGrigor, as he himself informs us, was, when at Embden, during the retreat of the allies from Nimeguen in 1794, seized with typhus fever in so severe a form as to completely prostrate him. At a farm house in the vicinity where he was billetted, his host and hostess brought a wheel barrow into his room, stuffed with straw and blankets: and wheeled him out of the house to a small eminence, from whence he could see the masts of the vessels by which the regiment to which he belonged was then about to proceed to England. This is the first mention of wheel barrows, as a means of transport, that has been observed.

It would appear that Baron Larrey made use of conveyances of this nature for the purpose of transporting wounded after the battle of Bautzen, in Saxony, in 1813; on that occasion, two-thirds were conveyed from the field to Dresden—a distance of 30 miles, on vehicles of the nature of wheel barrows.

From that time till 1864, they do not seem to have been used in actual war: but in the latter years hand wheel carriages were used for carrying wounded in the Schleswig Holstein war. According to Mr. Longmore, however, they are not intended to be used as substitutes for ambulance carts or waggons, but merely for the purpose of travelling over the spaces between the ground upon which the wounded have fallen, or between the immediate rear of the place of contact and the first or second lines of surgical assistance.

Rapidity of movement of these conveyances is gained by the use of high wheels, if the barrow be made in such a manner, as to rest upon a pair, as figured by Mr. Longmore. The need of numerous bearers as required for carrying stretchers, is averted by the use of the present contrivances: as is also the necessity of maintaining numerous animals for carrying cacolets and litiers.

One attendant is sufficient for the transport of a man lying upon a wheeled litter, if the ground be favorable.

Of this description of conveyance, there are several modifications, such as the following, namely :—

1. *The Bautzen Wheel Barrow* (*Brouette*).—These are so curved and inclined, that a person lying upon them would find his position more easy than he would upon a barrow, the floor of which was flat; there is only one wheel, but it is broad, and the vehicle is so constructed, as to be with difficulty overturned.

2. *Evan's Hand-Wheel Litter.*—This vehicle is designed to carry either one or two wounded men; one being recumbent, the other in a sitting posture. It can be wheeled by one, or carried by two men; it consists of a frame work resting upon two wheels, and so curved, as to accommodate itself to the shape of the patient upon it.

3. *The Ordnance Ambulance Barrows.*—In 1856, two forms of barrow were prepared, one having only one

wheel, the other being two-wheeled; neither of these was considered to be adapted for the purposes of transport by the committee that was ordered to report upon them, but no reasons for this decision seem to have been recorded.

4. *China Ambulance Barrows.*—In 1860, a number of ambulance barrows were fitted up for the use of the expeditionary force to China; these conveyances have since then been known by the name of "China barrows." The total weight of each was found to be lbs. 234, oz. 9. It does not appear however, that they were used on that occasion.

5. *Neudorfer's Hand-Wheel Litter.*—These are two-wheeled vehicles, each wheel four feet in diameter: the frame work is supported on springs; these admit of adjustment, so that a wounded man can be placed in any desired position: when two patients are carried, they recline back to back. The stretcher or canvas frame upon which the patients rest, is removed and placed on the ground when required. The conveyance can be taken to pieces for packing, in which state it occupies a space the size of the diameter of the wheels by seven inches in thickness.

6. *Neuss's Two-Wheeled Litter.*—These carriages were constantly employed by the Prussian army, during the war between Germany and Demark in 1864. The carriage consists of a litter partly made of wood and partly of canvas, stretched between two side poles and placed upon springs; the springs rest upon an iron axle connecting the two wheels of the machine. The side poles have handles at either end, so that one man pushes the conveyance or two men carry it when necessary as an ordinary litter.

The vehicle is made of hickory wood, and the spokes of the wheels so arranged as that on bad roads pressure is equally distributed over the rim; the patient when placed upon it is made comfortable by means of cushions with which it is furnished; its entire weight is lbs. 109, oz. 13 avoirdupois.

They were employed both before and after the siege of Düppel, and could be so upon roads that are impossible to an ordinary waggon, as they admit of being readily lifted over obstacles; and by removing their wheels, they admit of being easily packed. Deputy Inspector General Longmore does not think however, that they could with advantage be taken into use in the British army: their cost also is too high, being from £10 to £15 each.

CHAPTER XI.

ESTABLISHMENTS AND EQUIPMENT FOR SICK AND WOUNDED.

Dr. Milingen's views—His scale of transport—Medical staff corps formed—Ambulances sent to the Crimea—Transport in Crimea—At the Cape—Transport on first landing in Crimea—Waggons too heavy—Imperfect organization—M. Boudin's view—Sir John Hall's scale—For a regiment—For a brigade—For a division—Mr. Alexander's scale—A Purveyor's view—Conveyance from the Commissariat—Scales by army medical regulations—War Office circular 856—Necessity of maintaining ambulance corps efficient.

Dr. Millingen's views.—Dr. Millingen, writing in 1819, suggested that a hospital corps of ambulance should be embodied. Many years were permitted to elapse before his recommendations obtained that partial recognition which they subsequently commanded; and even now, the experience of several hard fought campaigns has failed to produce such an establishment in the British army as he had suggested while the impressions gained in the Peninsula were yet fresh upon him.

He proposed to divide this corps into 1*st* personnel, and 2*nd* materiel. The first of these into field companies, *b*, drivers, *c*, conductors of stores.

These men should, according to him, be trained in the prompt methods of putting up, and taking down bearers, establishing field hospitals, pitching tents, fixing the cooking triangles, opening the operating stretchers, and striking and repacking the same with rapidity. Perhaps the slight degree of training now given to the men of the army hospital corps, under the recommendations of Colonel Kennedy's committee, may be looked upon as a near approach at the present time, to what was then recommended by Dr. Millingen.

The second sub-division of the establishment, he would arrange thus, namely *a*, transport for wounded : *b*, transport for stores and equipment.

He would appoint 20 men of this corps to a regiment of 1,000 men—the men attached to the different regiments of a division being under the command of a Captain or Subaltern. A sufficient number of farriers, wheel wrights, saddlers, and other workmen should he considered, be also attached.

Dr. Millingen's scale of transport.—His scale of transport for sick and wounded would have been, *a*, two spring waggons for each brigade: *b*, one long car for each battalion : *c*, bearers (stretchers) upon the plan of Baron Percy, in the proportion of one between every two privates of the army hospital corps : Thus, according to him, a division of 10,000 men in four brigades, and consisting of fifteen battalions, would take the field with 8 spring waggons, 15 regimental cars, 100 bearers, and 2 store waggons for the transport of the field hospital stores.

It was not however, until the outbreak of the war with Russia, that any actual steps were taken to organize the establishments the want of which he had so many years before pointed out.

Medical staff corps formed.—In January 1854, the medical staff corps was formed. Arrangements were made to furnish hospital conveyances to the army: and a scale was drawn up according to which, for each two divisions, there were to be 20 conveyances for sick : 5 for materiel and equipment, for farriers tools, and a farriers portable establishment.

Ambulances sent to the Crimea.—Forty ambulance waggons were shortly afterwards dispatched from Woolwich to the seat of war. Of these, twenty were of a light description, suspended by springs, and having only two wheels : capable of being drawn by two horses. Twenty others were of a heavier and firmer description, each intended for four horses. The latter contained light bedsteads, and water proof sheets.

Each waggon contained four well ventilated apartments in which the severely wounded could be accommodated: one in each; the beds were suspended upon india-rubber springs. In a compartment attached to each waggon were medicines, instruments, a portable table, and some white coverlets.

Each of the two-wheeled ambulances was well provided with water barrels, and had also a small supply of medicines: on the top six seats: and at the back, three commodes. The seats were disposed sideways, somewhat like an Irish car, each with a leather belt in front to secure the wounded man in his place. Each ambulance was provided with a pole, so as to be conveyed if necessary by bullocks: and each waggon had the means of removing or changing its wheels, springs, &c., and of being repaired—and was so constructed as to be readily moved from, or on board a ship.

Transport in the Crimea.—During the war in the Crimea, the actual amount of transport shewn to have been provided for the 30,000 men, who formed our army there was as noted below, namely:—

Bearers or stretchers	780
Spring carts, on 2 wheels	20
Spring carts, on 4 wheels	20

Besides these, there were "Flanders" waggons, but in what number does not now appear. These were used for conveyance of stores.

Each of the larger spring waggons for the sick carried ten men, namely—4 badly, and 6 slightly wounded. This establishment, poor as it was, was yet an important step towards making some provision for sick and wounded. It was for example, a great improvement upon what had hitherto been the establishment allowed on field service in our colonies, an illustration of which was given by Mr. Alexander, in his evidence before the Royal Commission.

An Example at the Cape.—Thus, when during the Caffir War Mr. Alexander landed at the Cape, the only transport given to a regiment for hospital

purposes consisted, as he stated before the Royal Commission, of a mule carrying a couple of panniers: subsequently, and no doubt on his urgent representation, a waggon was allowed to each regiment for the purpose of carrying stores. Sick and wounded were put into Commissariat waggons, as food was consumed: and a few were carried upon stretchers.

Transport on first landing in Crimea.—In the same evidence before the Commision, he gave a word-picture of what with the improved establishments in the Crimea, was the actual condition of the sick and wounded.

When, according to him, the troops first moved after having effected a landing in the Crimea, the entire transport available for hospital purposes consisted of a mule per regiment carrying a couple of panniers, precisely as he had found to be the case at the Cape. After leaving Varna, an araba was allowed to each regiment: as however at the time of landing, no transport animals had been disembarked with the troops, surgeons were soon forced in order to bring along their sick, to take possession of any arabas they found straying along the road.

The wheeled transport already enumerated, had not then been received. Mr. Alexander stated that for the conveyance of sick and wounded from Sebastopol to Balaclava, 12 waggons arrived from Varna on 12th October, 1854. These he observed were sufficient, so long as the roads remained good: but as if to add his testimony in regard to one of the serious disadvantages connected with the use of this mode of transport, he states that the waggons were too heavy. Ammunition waggons could not be used on account of the heaviness of the roads: he therefore comes to the very natural conclusion, that carts for such a purpose should be made light.

Imperfect organization.—It is undeniable that the establishments connected with the transport of the sick and wounded were very imperfectly organized,

as well as numerically inadequate for their purpose; and fortunate it is that the longest march the troops had to perform, was of but a few miles, certainly not more than seventy. Had the operations extended over vast areas of country, as did those of the forces employed shortly afterwards in suppressing the mutiny in India, we are justified in believing that the results to the sick and wounded would have been very terrible.

As matters were, the opinion of a French observer may even yet be of value, although in no other way than to serve as a warning against exposing an important portion of our military establishments to so severe an imputation, should the occurrence of another war take place.

M. Boudin's account.—M. Boudin is the observer referred to, and he thus expresses himself—"Hitherto, on an army marching onward after a battle, the Commissariat officers did not consider it part of their duty to provide for the wounded. The Purveyor General did not take cognizance of the wounded until they reached the hospitals. In the meantime, the wounded were left to themselves, exposed for a longer or shorter time to the scorching sun by day, and to the cold and wet by night."

Hospital Equipment by Sir John Hall.—The revised equipment for hospitals in the Crimea, allowed by Sir John Hall to be necessary, was as follows:—

1. *For a regiment.*

For a Regiment.—1. long car, drawn by two mules, with a driver mounted. The car to convey 6 men sitting, 4 reclining: together with their packs, arms all spare medicines, surgical materials in the drawers, in the well; and four canvas bearers.

One cart, with two mules, to convey the hospital marquees, two bell tents, medical comforts, "A" and "B" canteens, fracture box, spare mule chairs and litters, 2 pairs each.

One mule, with a pack saddle for the surgeon's panniers, to which either cacolets or litters could be attached in place of the pannier, in case of necessity.

One mule, with pack saddle for water skins.

One mule, with a pack saddle and pair of litters.

One mule, with pack saddle, and pair of cacolets.

Total two carts and eight mules.

These are calculated to remove on emergency 19 sick or wounded, or convey on the line of march 11 sick or wounded, the surgeon's panniers, 15 cwt. of stores and equipment, and a pair of water bags.

When before an enemy, the equipment of a regiment should consist of the following articles, to be conveyed in the store carts, namely :—

One hospital marquee	weight lbs.		400
Two bell tents	... „	...	140
20 Cork matrasses	... „	...	100
20 Blankets ...	... „	...	80
20 Rugs ...	... „	...	80
20 Water-proof blankets	... „	...	85
"A" and "B" canteens	... „	...	160
Box of fracture apparatus	... „	...	35
One spade, one pick-axe, one hand saw, one axe, and two water buckets		...	32
6 Canvas bearers	...	...	84
Medical comforts, as detailed below		...	180
Spare pack saddles and litters	...	...	108
Total weight lbs.		...	1484

The List of comforts above alluded to, is as follows; it being understood that the daily ordinary ration of bread and meat is to be furnished by the Commissariat, *viz.*—

8 Bottles of brandy... } 12 Bottles of wine ... }	Packed in a box, with divisions secured with a lock.
5 lbs. of tea ... } 10 lbs. of arrow-root.. } 12 lbs. of barley ... }	Packed in cannisters, with hinged top and fitted into a canteen.

50 ¼ pints of essence of beef ...
24 tins of cocoa and milk ...
7 lbs. of salt in a stone jar ...
1 lb. of ground pepper in a bottle ...
12 lbs. of dried compressed vegetables
10 lbs. of candles ... ...
} To be packed in a box.

one lamp with reflector, fitted in its own case and carried in the store cart.

A knife for opening tins.

The following articles are to be carried in the Irish car, *viz.*—

4 canvas bearers	weight lbs.		56
7 knapsacks, complete	„		392
7 men	say „		980
Articles packed in well of the car	„		56

2. *For a Brigade.*

For a Brigade.—If detached, one of the divisional store waggons for medicines and medical comforts, and a waggon for other stores will accompany a brigade, in addition to the regimental equipment of individual regiments.

3. *For a Division*=10,000 *men.*

For a Division.—Four store waggons for hospital stores and equipment.

13 mules to carry 13 pairs of surgeons' panniers, with pack saddles, complete.

13 mules to carry 13 pairs of water-skins.

26 mules for 13 Irish cars to accompany regiments, to carry six men each, wounded or sick=78 men.

26 mules for 13 regimental store carts.

48 mules for waggons, with india-rubber springs, improved, to carry 8 sick or wounded, each ... ... 96 „

13 mules for 13 Maltese carts, fitted with two spring cots in each ... ... 26 „

100 mules for 100 pairs of mule chairs 200 „

50 mules for 50 pairs of mule litters ... 100 „

32 mules for 8 divisional store waggons

321 mules for conveyance of sick. ... 500 „

It is not expressly stated that the above means of transport include the regimental allowance, but it seems apparent that such was the case: so that the actual means of conveying sick and wounded was only equal to 2 per cent. of strength,—a proportion altogether inadequate to meet emergencies.

Reserve.—In addition to regimental equipment, Sir John Hall considered that there should be a reserve divisional establishment, capable of receiving 100 patients. This would require the following equipment:—

5 Hospital marquees.
3 Bell tents.
100 Cork mattrasses.
100 Blankets.
100 Rugs.
100 Waterproof sheets.
100 Nightcaps.
1 Colored signal lantern
5 Ward lamps, with burners for double wicks.
6 lbs. Cotton wick.
A Can of oil.
A Feeder for trimming lamps.
1 Hand lamp.
6 Tin meat dishes, 13½ inches.
2 Frying-pans.
2 Flesh forks.
2 Soup ladles.
24 Chamber pots.
12 Bed-pans.
12 Stool-pans and frames.
12 Urinals.
12 Spitting cups.
12 Wash-hand basins.
2 Axes.
1 Lamp, with reflector, for operations at night.
2 Candlesticks, with snuffers chained.
100 Tin plates.
112 Pint tin cups.
100 Knives and forks.
6 Carvers.
100 Iron spoons.
2 Flanders kettles.
2 Nests of saucepans.
2 Tin kettles, 4 quarts each.
24 Hand towels.
12 Jack towels.
1 Folding bath.
18 Yards huckaback.
12 Yards of flannel.
24 Boxes of matches.
1 Set of diet scales and weights.
2 Claw hammers.
1000 Nails, assorted.
4 Clasps, staples, and padlocks.
12 Bearers for wounded men.

2 Meat choppers.
1 Hand saw.
2 Spades.
6 Water buckets.
1 Set of oil measures.
2 Portable lanterns.
6 Water dishes.
2 Shovels.
2 Pick axes.
1 Water-skin.
1 Measure for wine.

And the following Medical comforts :—

12 Dozens wine.
6 „ brandy.
56 lbs. arrow-root.
56 „ tea.
56 „ candles.
56 „ soap.
56 „ barley.
112 „ sugar.
112 „ preserved potatoes.
112 „ preserved meat.
1 Knife to open tins.
75 lbs. in ¼lb. tins, essence of beef.
50 lbs. tins cocoa and milk.
20 lbs. desiccated milk.
56 lbs. compressed vegetables.
28 lbs. salt.
5 lbs. ground pepper.
5 lbs. ground mustard.

These weigh in all, lbs. 1,612. A divisional supply of medicine is also required.

At whose disposal.—He thinks that each regiment and division should have a fixed amount of ambulance attached to it. The regimental to be at the disposal of the surgeon, the divisional at that of the principal medical officer of it: and the whole of the P. M. O. of the army. The care of the animals and discipline of the men being under the orders of the field train.

Mr. Alexander's Scale.—The scale of equipment and of transport as laid down at pages 69, &c. of the Medical Regulations, was that deemed necessary by Mr. Alexander. In his evidence before the Crimean Commission however, he gave a few additional particulars which may here be transcribed. He distinctly points out that each battalion, brigade and division should be so far complete in themselves, that on any sudden emergency, it would be known what amount of transport each would be entitled to, and which ought to be supplied to the medical officer of either

the battalion, brigade, or division—the whole being at the disposal of the P. M. O. of the force.

According to him, the 44 mules per division, enumerated at page 76 of the Book of Regulations, should be forthcoming for the services of the division when stationary. Allowing those for the panniers to be employed daily in bringing water, wood, &c. for the hospitals; there would remain 36 mules for transport of the sick, *viz*:—

6 regimental ambulance cars = 12 mules = 48 sick.

12 other ambulance cars = 24 ... 96

Or 6 regimental ambulance cars = 12 mules = 36 to 48 sick.

20 pairs of cacolets or litters = 20 mules = 40 sick.

2 carts for knapsacks of men who are carried on mules, backs by cacolets=4 men.

The whole=36 mules=76 to 88 sick: the ambulance carrying 6 or 8 sick according to the state of the roads; or a ratio of 1·5 per cent.!

Cacolets.—All cacolets should like the French, be asunder from the park saddles.

Reserve at Head Quarters.—At head quarters, there should be a supply of medicines, comforts, materials, and hospital field equiqment for three months,—and waggons for the removal of the sick, if necessary.

Ships.—Hospital ships for the conveyance of sick, and as receiving ships if necessary.

Hospital corps men.—Hospital corps men to be supplied to act as orderlies, cooks, servants and bât men to medical officers.

Dispenser.—A Dispenser in charge of medicines and materials.

Purveyor.—A Purveyor's clerk in charge of the hospital stores and comforts.

Issuer.—A hospital staff corps man to each of these, as issuer.

Boxes conveniently arranged.—All packages and boxes to be so arranged, as that two shall form a load for a mule.

Finally, notice of a move should always be given to the principal medical officer, by the military authorities.

The Purveyor's view.—The views of another witness examined before the Crimean commission deserve to be quoted here, as they represent what may be considered the impressions on the matter entertained by the Purveyors' department.

According to these, there should be in the field a Commandant of Hospitals, and he, in conjunction with the Purveyor, should do everything for the sick. A Purveyor's clerk should be attached to each regiment: his duties would be to prepare returns, and after an action, under the orders of the Commandant, to have the entire duty of removing the sick.

A portion of the military train should be transferred to the Commandant for this purpose, but there should be a superior military officer, equal in rank to the Quarter Master General, who would take the management of these matters.

Each regiment should be supplied at once with its due allowance of hospital accomodation and furniture, without requisition: and these should follow the divisions in which the particular regiments are.

By Army Medical Regulations.—According to the Army Medical Regulations of 1859, it is laid down, para. 3, page 69, that in time of war, a fixed amount of wheel and other transport in charge of the military train, shall from time to time, on the requisition of the Director General, and subject to the approval of the officer commanding the forces, be allowed to the medical department of an army in the field: and such transport shall be allotted according to the requirements of battalions, brigades and divisions, by the principal medical officer, in communication with the officer commanding the military train, in such

manner as the principal medical officer shall judge necessary for the service.

In the event of any emergency requiring an addition to the amount of transport over and above that for which requisition had been made by the Director-General, the principal medical officer shall make requisition for such additional quantity on the Quarter-Master-General.

From the above paragraphs therefore, it appears evident that the principal medical officer is henceforth to be the authority to whom we are to look for the disposal of means of transport for sick and wounded in the field.

This too is in accordance with the views of Sir John Hall, who considers that the principal medical officer should have this authority: that he should have full control over this, as over all other medical arrangements, and that ample carriage should be placed at his disposal, to enable him to carry out all his arrangements.

To enable him the better to do this, Sir John Hall considers that the principal medical officer should have notice of all intended moves of the army.

Transport furnished by the Commissariat.—In further evidence before the Crimean Commission it is stated that conveyance for removal of wounded to the rear should be furnished in sufficient amount by the Commissariat. There should for this reason, be sufficient in reserve to meet all requirements, without impairing the efficiency of that for regiments and divisions: and the whole of the means of conveyance should be under the orders of the P. M. O.

The necessity of this arrangement has also been demonstrated by the experience of the late war in America.

Regulation Scale of Transport.—By the same code of regulations, a scale of transport is laid down as follows, *viz*:—

For a battalion 850 *strong.*

For medical panniers—1 mule.

A cart for surgical equipment—2 mules.

Ambulance cart to follow in the rear of the battalion, capable of carrying six or eight men and 14 stretchers, a water barrel, and light operating table—2 mules.

That is, for the battalion—5 mules.

Total sick thus provided for, 6 or 8. *For a brigade* of 3 regiments or 2,500 men: in addition to regimental equipment, when the brigade is acting independently, the following, *viz* :—

Medical panniers for brigade medical officer—1 mule.

One large waggon, or two carts for stores—4 mules.

One cart to carry lbs. 500 to 600 weight of comforts, the same of materials: and from lbs. 100 to lbs. 150 of medicines—2 mules.

Total for a brigade—7 mules.

Thus we have for regimental sick, conveyance for 6 to 8, and for those of brigade 0 = 6 or 8. *For a division* of six regiments=5,000 men, in addition to the regimental equipment; we have the following, *viz.* :—

Two sets of medical panniers, one for each brigade—two mules.

Two large waggons, or four carts for hospital stores—eight mules.

Two carts for medicines, comforts, and materials—four mules.

It is clear that the above are the only articles of transport and equipment of their kind that are intended specially for the use of the separate divisions of an army: and that the following are merely for particular regiments, there being none, separately detailed for divisions, namely :—

Six carts for surgical equipments, one for each regiment: drawn in all by 12 mules.

Six ambulance carts, one for each regiment: drawn in all by 12 mules.

Six sets of panniers, one for each regiment,: requiring in all six mules.

Thus then, there is in reality, provision made for the transport of only 36 to 48 sick or wounded per force of 5000 men, or from 0·7 to 0·9 of a man for 100 effectives.

It is true that the same regulations assume that sick may have to be carried at the rate of 5 per cent., and that the following transport will be necessary for a division, namely :—

128 sick in 16 carts, 8 in each	= 32 mules.
122 sick in cacolets or litters	= 61 ,,
250 sick.	93 mules.
or	
126 sick in 21 carts, 6 in each	= 42 mules.
124 sick in cacolets or litters	= 62 ,,
250 sick.	104 mules.

Some carts or spare mules would however, be required to convey the knapsacks of those men who are carried in cacolets : It is plain however, that arms and kits of men carried upon wheeled conveyances are intended to accompany them.

War Office Circular 856.—By a war office circular No. 856 dated 31st March, 1864, instructions were given, illustrated by sketches as to the manner in which articles of stores and equipment should be packed for more ready conveyance upon waggons. That circular will doubtless be in the hands of officers hereafter entrusted with the duty of organizing means for the transport of hospital equipment in the field.

It is evident from a perusal of these remarks, however, that, as yet our means of transport are totally inadequate, and that, in the event of war with a Western nation,disasters must occur, unless a great and speedy remedy against such a circumstance takes place.

If indeed, sick and wounded are in accordance with the recommendations of the International Congress on the subject, to be left indiscriminately in the hands of the enemy it is true that comparatively little transport for them will be necessary. That enemy may however, have a method of treating the helpless that is not in accordance with English ideas: and as it may safely be presumed, that steps will be taken to prevent the recovered men from rejoining their own ranks, it is needless to observe that an army would speedily become weakened to a serious extent if this routine be carried out.

An organised system of ambulance may indeed, be expensive, and on service cumbersome: but in times of sickness, as well as in health, it is not only an inestimable boon to the sufferers; but by systematically removing and taking care of them, adds to the present and prospective efficiency of the force.

Necessity of maintaining ambulance corps efficient.—It may seem a mere common place truism to make the remark, that in order to maintain an establishment in a state of efficiency, it should be carefully practiced in the duties to be performed by it.

This is carefully done with all connected with the army, with the exception of those of a medical nature; Not so however, in the French army. There, on the occasion of a grand parade, the ambulance fully equipped is in its place, with as much precision as are the transport and pontoon trains.

So it should be in the British army, and until it is, we need not expect that it can be maintained in a state of efficiency and ready for emergencies. That this end cannot be obtained except at a considerable expense to the State is unquestionable; but, inasmuch as the careful treatment of, and attendance on the sick and wounded, form not the least of the differences that separate civilized nations from those yet in a state of barbarism, it seems but just and reasonable that our means of giving succour to those who form

the wreck of battle, should be as complete in their way, as we endeavour to render those intended for destruction of our enemies.

It is therefore to be hoped, that ere long, the ambulance establishment of regiments will be made to appear on parade: and on field days, such as are now common at our camps and larger garrisons, perform its rehearsal of what would be required of it in the day of battle, in the same way that the troops perform theirs. The subject has indeed, while this volume is being printed, attracted the serious attention of the military authorities; and it is to be hoped that the committee by which the whole question of transport is being considered, will devise measures that shall be not only sufficient, but practicable; for as yet, it is most unquestionably not upon that footing which its importance demands.

CHAPTER XII.

SOME ILLUSTRATIONS OF THE RATES OF SICK AND WOUNDED ON SERVICE.

Casualties in war—1792—1801—Egypt—Eylau—Retreat on Corunna—Albuhera—Burgos—French army, 1813—Austrelitz—Accumulation of sick—Moscow—1811 to 1814—Tolouse—Last three years of Peninsular War.—1859. Austria—America 1861 to 1864.

CASUALTIES IN WAR.—In selecting the following illustrations of the casualties in war, the object in view has been to show by actual examples, how extensive must be the scale upon which medical arrangements must necessarily have been in order that all requirements might be fulfilled: and how great must be the resources of different kinds at the disposal of principal medical officers under these circumstances. Indeed, we shall presently see that under certain circumstances, the casualties in war are far beyond the capabilities of any arrangements that can be made in the force, for them.

It may be observed that the examples are taken principally from warfare among civilised races. In wars against nations who are uncivilised, not only are the casualties, as a general rule, less numerous, but conveyance can more readily be extemporised than under the opposite circumstances.

No other arrangement is followed, than an observance of the events recorded: thus—

In 1792, the allied army was bivouaced on the open plains of Champagne. These were sterile, destitute of water, forage and provisions; the rains had set in with more than ordinary severity, the troops were severely affected with dysenteries and other contagious

maladies, which had already cut off one-third from the effective strength of the army.

On 30th September, the allies began their retreat. By the end of the October they had evacuated France, but left behind them melancholy proofs of their disasters ; all the villages were filled with dead or dying, and without any considerable fighting they had lost in that short time, 25,000 men, or more than a fourth of their numbers (Alison's History of Europe).

In the three days, during which the battle of the Trebbia lasted in 1799, out of 36,000 on the field, including French, and allied Austrian and Russians : the former lost in killed and wounded above twelve thousand, and the allies nearly as many (Alison). We are further informed that on this occasion, the whole of the French wounded amounting to 5,000, fell into the hands of their enemies.

Egypt.—The French army, in the action which led to the capture of Alexandria had in a strength of 10,000—250 men wounded. On the occasion of the march to Suez, it lost 800 men in wounded at El Arish. Its loss at Jaffa does not appear : but at Acre, the wounded amounted to 2,000, besides many men who had become affected with plague,—and numbers of the Arabs, were taken care of under the orders of of Baron Larrey. It is interesting to note however, that about 1,200 of them were speedily embarked at Jaffa for France, and that 800 were sent back to Egypt, 60 miles across the desert ; they arriving there perfectly healed.

We learn that when in August, 1801, the troops under Sir David Baird reached lower Egypt from India, they enjoyed a remarkable degree of health, yet within a week after being encamped upon the Island of Rodda, a position which modern sanitation would have declared unsuitable, some corps had one-twelfth of their numbers in hospital ; others one-tenth.

At the beginning of November, that is, in less than three months from the former date, the sick of that

army amounted to 1,350 : although at no time did the force number more than 7,800, and no battle had been fought. It is to be gathered from the " sketches" given of this expedition by Sir James McGrigor that in addition to the causes of disease existing in Rodda itself, those among another portion of the army at Ghiza were to be found in the filthy condition of the ground on which they were encamped; and no doubt also to the circumstance of disease having become localised in it; for we are informed that the position had been occupied by large armies, alternately of Turks, Mamelukes, French and English, from all of which a number had died.

At this length of time, it may be interesting to note that in an aggregate strength of 3,759 British troops, who formed part of this expedition between 1st March 1801 and 1st May 1802, there occurred 309 deaths by disease : for as observed, there was no fighting, and 117 had to be invalided to England.

Of the deaths, 38 were by plague, 18 by fever, 64 by liver complaints, 148 by dysentery, 4 by diseases of the lungs, 2 by stroke of the sun, and 41 by causes unknown; some of the latter being cases of sick who were lost in the " Julia," wrecked in the Red sea, and others, not properly accounted for.

Eylau.—The numerical strength of the forces engaged at Eylau has not been obtained: but it is on record that at the conclusion of that battle, 50,000 men lay upon the field weltering in their blood; and these, friends and foes alike, had to be provided for by the French army medical department. Tents or hospital accommodation however, were out of the question : all had to pass the greater part of the night " on the ice and snow around the fires of the bivouac of the ambulances".

Albuhera.—Of 7,500 British troops at Albuhera, 4,300 were killed or wounded : and at the end of the action, we learn that only 1,500 men remained

unwounded: while, of 19,000 French, 8,000 were killed or wounded (Alison).

Retreat on Corunna.—The horrors of various kinds, by which the retreat of the army under Sir John Moore in December 1808 and January 1809 was attended, are matters of history: that the whole line of retreat presented a frightful scene of misery, drunkenness and disorder, in addition to that of soldiers being left to die by the road sides, and women giving birth to children amidst the snow that then lay deep, we all know: but the fact is perhaps not so notorious, that among the many misfortunes which befel the force, one of the greatest as regards its ulterior effects was the imbibition by the men of the germs of typhus fever. By the time the remnants of that force had arrived at Portsmonth in their transports, this disease had spread extensively among them; so much so, that the number of sick among them was overwhelming.

Sir James McGrigor at the time P. M. O. of the south-western district, fearful that the disease would spread to the civil population, engaged for the sick soldiers all available accommodation in private establishments, and obtained the use of the greater portion of the naval hospital at Haslar. All these however, did not suffice for the number sick, and who were daily becoming so: accordingly ships afloat were converted into hospitals: medical officers and purveyors from all parts of the United Kingdom were sent down to Portsmouth, and the number of these being insufficient, the services of private practitioners were engaged.

We learn that notwithstanding all precautions, typhus fever spread to the regiments of the line and the militia stationed at and near Portsmouth: finally to the civil population in Sussex, and the military at Horsham. Thus we see that it is not alone the troops, who, under certain circumstances, suffer during retrograde movements; but that disease then attacking

them, may spread severe havoc in the neighbourhood of the port to which they return.

Burgos.—Of the retreat of the allied army from before Burgos under the Duke of Wellington, we learn from Alison that the army lost 7,000 men during three days, principally by stragglers: yet that neither stores nor wounded were abandoned.

French Army in 1813.—Some idea of the proportion of casualties that may happen, may be gathered from Baron Larrey's account of what occurred in the French army in 1813.

According to his account, from 1st of May to 1st of June following, there were 22,000 wounded in the various actions in which that army was engaged. Of these, 14,084 were on 30th June examined by a Medical Board; and the result was that 6,703 officers or soldiers who were cured were sent to re-join their ranks; 4,027 partially cured were deemed fit to be employed in trains of artillery and ambulance, and 3,354 were unfit for further service. Of the first mentioned number, 731 had one or two limbs amputated. He calculates that 2,416 died of their wounds, and that 3,000 had re-joined their regiments before 30th of June.

A very valuable lesson may be obtained from these figures.

	per cent.
They teach us, that of wounded, there were fit for duty within two months ...	30·46
There were partially cured, and fit for some kinds of duty	18·30
There were totally unfit for duty of any kind	15·24
There were cured within a month ...	13·63
There died from their wounds ...	10·98
	91·61

Austrelitz—accumulation of sick.—After the battle of Austerlitz, among the 30,000 Russian and

Austrian prisoners who fell into the hands of the French, there were many severely wounded. These, and the wounded of the French themselves were crowded into the hospitals at Brün: and there, typhus fever broke out with such intensity that about one-fourth of all the patients died, thus verifying the principle of Sir John Pringle, that hospitals are themselves a source of disease,—a principle equally acknowledged by Sir James McGrigor and Baron Larrey, as we have discussed more at length in the chapter on army hospitals.

With regard to the evils of assembling large numbers of wounded in one place, the latter authority observes that they fall into profound discouragement, the suppuration and foul exhalations engendered by them are fertile in producing hospital putrefaction, gangrene, and typhus. "Each diseased man becomes a source of infection to his neighbour." He therefore advocates the removal of the wounded to a distance; and this indeed he did after the battle of Eylau, to a distance of not less than fifty-five leagues.

That no harm to the sick and wounded may be anticipated from such a proceeding,—at least in comparison to the injury that certainly would arise from accumulation, is illustrated by what happened in the heat of Egypt as well as in the cold of Poland. In either case Napoleon quite agreed with Larrey in this opinion, and gave every facility for their removal.

Risk.—A remarkable illustration of the little risk, nay absolute advantage to patients suffering from severe disease, in being moved from crowded and otherwise not suitable quarters, even when such removal is attended by much of what is commonly called "roughing," is described by Sir James McGrigor as having happened to himself.

While in Holland, and suffering severely from typhus fever, the force with which he was, had suddenly to march: at this time he was so ill, as hardly to be able to sit up in bed: the room in which he lay,

was a small ill-ventilated one in a farm house : and in the apartment, three members of the family had died, one after another. Dr. McGrigor was placed on horse back ; he was unable to sit : a friend then placed him across the back of a horse ; one soldier supported his head, another his feet, and he states that awful as his position was, he revived a good deal from being in the open air (Biography p. 35.) That this rule is not of universal application however, we have many illustrations. In Egypt, for example, the removal of persons affected with plague, is said to have almost always caused death.

Moscow.—A few particulars regarding the statistics of the French expedition to Moscow may not be here deemed uninteresting, as exhibiting with sad vividness the duties which may, under trying and adverse circumstances, be thrown upon the principal medical officer.

From the memoirs of Baron Larrey we learn that in June, 1812, 400,000 men under Napoleon crossed the river Niemen. A few small engagements with the Russians almost immediately furnished 150 wounded, while bad roads and exposure produced many deaths and much sickness. At Wilna, hospitals with all requiments were formed for 6,000 sick.

On 24th July, this army, in action with the Russians at Benchenkowiski had 600 wounded : and was burthened moreover with 500 wounded Russians, who had been by their own countrymen left upon the field. On the following day Larrey established hospitals at Vitepsk for 1,500, including the recently wounded.

On the advance to Krasnoe, the French lost 500 men in wounded, and these were immediately accommodated at that place.

Smolensk was entered without fighting ; fifteen of the largest buildings found in that city were converted into hospitals ; but many supplies, especially dressings for the wounded were deficient. This place

seems to have been converted into a kind of basis for further medical arrangements ; little expecting the disasters that were impending, for no fewer than 10,000 sick and wounded appear to have been accommodated in it.

The army soon pressed on towards Moscow; at Valentina an action with the Russian rear guard furnished the French with 700 wounded, all of whom were by means of the ambulances volantes sent back to Smolensk.

On 5th September, they came in contact with the Russians near Mojaisk, not far from Moscow. The number wounded, on this occasion do not appear on the returns, but on the 7th of the same month, the action of Moscowa or Borodino as it is called, was fought. During the 15 hours it lasted, 20,000 French were put *hors de combat.* All day the ambulances volantes were employed, and not fewer than 200 amputations were performed. The wounded we learn, had neither couches, blankets, nor covering of any kind ; there was a scarcity of bread and flour, and their chief diet consisted of soup of horse flesh, with cabbage stalks and some potatoes : the lint and splints were deficient, and the wounded lay on the cold damp ground.

On reaching Mojaisk, it was found that the Russians in their retreat had set it on fire; only a few houses were spared, and into these the wounded were put. From here to Moscow, the army marched across a long sandy plain, devoid of trees, verdure, or streams ; without inhabitants, and without supplies of any kind.

On 14th September they reached Moscow, and the sick were immediately put up in the spacious hospitals of that city. On the night of the 15th the conflagration of the city first began. On 18th and 19th it was at its height; the violent gales of the equinox acting like a bellows to the rising flames.

Subsequent to the destruction of the city, clouds of Cossacks attacked foraging parties of the grand army,

killing on one occasion alone 500 of the latter. The peasantry killed those of their countrymen who were ascertained to have furnished the French with supplies: the Russian force was daily being increased, and it was clear that Napoleon must retreat.

The rates of sickness and mortality from day to day during this part of the Russian campaign are not now available, but we learn that Napoleon who had entered Moscow with 90,000 combatants, and 20,000 sick and wounded, left it with upwards of 100,000 effectives; 1,200 sick being left behind. Thus, then in these few months about three-fourths of his army seems to have perished by sickness, fatigue, exposure and battle, notwithstanding that so indefatigable were the exertions of Baron Larrey that although the army was daily being enfeebled by engagements, Napoleon was able to leave Moscow with more men upon the effective list, than when he entered that city.

His retrograde movement began on 19th October. At Kalouga the army was attacked by the Russians, and during the day the French lost in wounded 2,000 men, many of whom had to be conveyed in the private carriages of officers. From here to Wiazma the retreat seems to have been attended by many hardships, not the least of which arose from the deficiency of transport for the sick. At that place the Russians again made an onslaught, killing or wounding 4,000. It was now 28th October: a cold north-west wind prevailed: and as the army retraced its steps, it came upon many corpses, stiff and frozen. It reached Smolensk on 12th November, but there, instead of the expected shelter found only a ruined city. Skeletons of horses in the streets, no meat, and no food except rye, flour and vegetables.

Forty days' march were yet before him: and already the force, which 24 days before had left Moscow upwards of 100,000 strong, had dwindled to 36,000 effectives. From Smolensk to Krasnoe, the villages had

been all destroyed : no food was obtainable along the line of retreat, soldiers knocked down horses, cut them in pieces, and devoured them on the spot : and the women eagerly partook of the same repast.

On 17th November, Napoleon in leaving Krasnoe, was attacked by 60,000 Russians : and besides killed, had 1,200 wounded, most of whom had to be left to the surgeons of that town. By the time he reached Orscha, scarce 12,000 men remained.

Soon after they had reached the Beresina, and begun to cross, the Russian army had come up to them, and opened fire. A temporary hope was inspired in Napoleon by the arrival of Ney, who with 8,000 men kept at bay 27,000 Russians : about 700 French however, were wounded, besides those killed, drowned, or crushed by carriages, which in the confusion pressed against each other.

By 29th November, the remnant of the army had crossed the Beresina : and, on doing so, they destroyed the bridge by which they had effected it. Having reached Smorgoni, they halted 5 days: and at this place the Emperor left them, starting in a sledge for Paris. About this time, the thermometer had descended to 21° of Réaumur's scale, and a few days afterwards, it had fallen 6° *R.* still lower. So great was the cold, so deadly the enemy's fire, that of 12,000 men composing the twelfth division, all except 350 perished between Wilna and Ochmiana. At last, on 13th December, after 46 days of march through snow, the army began to cross the Niemen at Kowno : and it has been said that 3,000 of the hospital guard were the only effective part of the half million, who had six months before entered Russia; while of the whole army, four-fifths had melted away.

1811 to 1814.—In the French army, we learn that in a period of twenty one months, namely, from January 1811 to May 1814, the ratio per cent. absent on account of sickness or wounds, was 225 by the former, and 15 by the latter, or in all 240. Thus, in

that short time, the numerical strength of that army must have in reality included in men more than double the numbers represented in a figured statement.

Toulouse.—At Toulouse, in a force of 12,000 men, there were wounded 1,359. It may be of interest also to observe in this place, that to attend upon these, there were 54 medical officers, that is, one to every 25 wounded. Nor must it be forgotten that, on an active campaign, or with an enterprising enemy, a succession of severe battles may take place within a few days of each other ; as happened in the case of Tarbes, Orthes and Toulouse, and, as is now actually occurring in America. Hence, it is evident, that the requirements, both as regards transport and attendance, should be upon a scale sufficient as far as practicable to meet such emergencies.

Last three years of Peninsular War.—During the last three years of the Peninsular War, the number of men in hospital usually averaged one-fourth of the whole. The ratio of death was 16 per cent : of which proportion 4 per cent. only, died in battle. Thus to maintain the average strength of that army, *viz.* 50,000 men, 8,000 able-bodied men per annum had to be provided to meet these casualties.

1859—Austria.—Of the war in Austria in 1859, we learn that even before Solferino, the hospitals were crowded ; after Magenta, the daily growth of sick was 600 to 800. Twelve hundred sick and wounded daily traversed the route of Casarza and Palmanuova to Navresina. The railway having broken down, the men were conveyed on country carts. Soon, the cattle fell sick, transport became difficult : and at Palmanuova, 1,300 men, almost all wounded, were seen without shelter or other arangements ; there existed no material for dressing their wounds, and there were only two surgeons to attend to the requirements of the whole number.

From this and other campaigns therefore, Dr. Parkes, arrives at the conclusion, that in a great

campaign, so enormous is the pressure of sick and wounded, that the medical department and hospitals can never suffice for all: and that the nation must aid in the work of attending to those injured in its cause.

America, 1861 to 1864.—Returns of the Federal army published in 1861, stated that the average rate of sickness, that is, constantly sick, we may presume—was 73 per 1,000. So unequally were the individual ratios divided however, that while in New Guernsey, it only amounted to 36, in Ohio it was 19 per 1000. Hence, it is evident that arrangements were required for the larger proportion, over and above what might at any time be called for in the emergency of an action. We may thus say, that in Ohio, one in five was always sick: and certainly one in five of the troops who remained healthy, might at any time be disabled in action; thus, the equipment must have been in proportion of 400 per 1000,—a proportion that is enormous,—yet obviously necessary. The mortality, however, does not seem to have been more than at the rate of 2 per cent. per annum from sickness.

In that part of the Federal army employed in Tennessee, the number actually sick is stated to have amounted to five, and some times to fifteen per cent. of the effective force; while the number prescribed for, much exceeded this.

It may be assumed from the experience of warfare among European races, that after a well contested battle, the wounded will amount to twenty or thirty per cent. of the forces engaged; taking therefore, armies of 100,000 men, such as the opposing forces have recently presented, we find, as was actually the case, twenty to thirty thousand men as the wreck of battle, demanding relief and transport.

Antietam.—A member of the American Sanitary Commission has stated, that after the battle of Antietam, he saw fifteen hundred men, wounded and lying upon straw about the barns there; for, as he observed, there is not a barn or farm house, or church,

or school house, that is not gorged with wounded: several thousands lie in the open air upon straw.

The current accounts of this great civil war contain numerous illustrations of the unexampled amount of casualties, for which provision and arrangements had to be made in America. From these we learn that on several occasions, a sudden move in advance, as well as towards the rear, rendered necessary the abandonment of as many as 500 sick and wounded at a time.

In one action, near Allsops Mills, on 12th May 1864, the Federals had in less than two hours, 2,000 wounded men brought to their field hospital. On the army advancing the following day, 1,800 of them were sent to the rear; but want of conveyance rendered it necessary that the remaining 200 should be left where they were, with all necessary establishments.

Few as these examples of casualties are, they will serve to give an idea of the enormous scale upon which medical arrangements, sufficient to meet even a tithe of them, must be made,—and of the great responsibility attaching to the medical authority, who is entrusted with the administration of the whole.

As we have just observed, however, there occur circumstances in which provision and equipment sufficient to meet the requirements of more than a portion of the casualties that are inevitable, cannot be brought with a force as part of its regular establishment. The Americans have shown a most noble example under such circumstances in organizing at their own expense, under the superintendence of a Sanitary Commission, a supplementary system of relief,—so extensive, and so efficient, that it may well be taken by Britain as a model, whenever our own country may again be involved in war.

CHAPTER XIII.

ON MEDICAL ARRANGEMENTS GENERALLY FOR A CAMPAIGN.

Nature of the expedition—Theatre of war—Points for consideration—Ratios of wounded—Ratios of sick—Materiel—Scale of equipment—Medical officers—Field Inspector—Sanitary officer—Divisions and brigades—Divisional Commanders should consult with their P. M. O.—Field hospital—Regimental surgeons—Place for the P. M. O. of a force—Specific orders necessary—Selection of officers—Arrangements prior to embarkation—Landing before an enemy—Preparations for an advance—Organization and order necessary—On the march—During battle—Field hospitals—With a besieging force—Occupying a town—Besieged—Assault—Retreat.

NATURE OF EXPEDITIONS—The nature of the preparations required for an expedition, must necessarily depend upon that of the service to be performed, and of the territory about to form its theatre. As Dr. Millingen observes, expeditions may be to a neighboring state or distant land; they may be exposed to burning heat or to an intense cold; they may be to a country where both these conditions exist at different periods of the year, as for instance, that to China. They may be to a country that is healthy, or to one the very reverse. They may moreover, consist of one large force, or include various smaller bodies, all of which are intended to act independently of each other.

THEATRE OF WAR.—The nature of the arrangements too, must differ according as to whether the destination of the expedition be a continent or an island, whether the country be hilly or flat; whether there be good roads or mere pathways; whether it be wooded or open, swampy or dry; whether it be

intersected by numerous canals and rivers, or otherwise ; and finally, whether the inhabitants are civilised or barbarous. All these considerations will be found to influence greatly the nature of arrangements for administering the medical affairs of an expedition.

Points for consideration.—These points having been duly considered in reference to their bearing upon transport, accommodation, feeding and clothing of the men, the preparations to be made, naturally divide themselves into the following heads, namely :—

1. The general fitting out of the expedition, with reference to the probable requirements on service, and the difficulty or otherwise by reason of distance, of maintaining the various requirements sufficient for all purposes.

2. The manner in which medical equipment, officers, attendants, purveyors, and stores of all kinds, including field equipment, are to be distributed among the ships conveying the troops.

3. The nomination of medical officers to particular duties.

4. The selection of men suited to the nature of the service to be undertaken.

5. The preservation of health on board ship, and the fitting up of sufficient vessels as hospital ships.

6. Arrangements for disembarking,—it may be in the face of an enemy.

7. The establishment of a basis of operations as a depôt for stores, for equipments to supply requirements thereafter ; to receive and dispose of sick and wounded, and to maintain a sufficiency of medical officers and attendants of all kinds, to meet requirements in the front.

8. The requirements of divisions, brigades, and regiments proceeding to the front.

9. Arrangements during an action.

10. Arrangements after an action.

11. The possible contingency of a retreat.

The nature of materiel and its amount, as well as the proportion of medical officers and establishments generally to be provided, varies according to the rate of sickness and of casualties to be expected. The first of these again, depends upon the nature of the climate and other characters of the country: the latter, upon the military prowess of its people.

Ratio of wounded.—Some examples are elsewhere given of the ratio of casualties, that may occur in one action, as well as of what has taken place in a succession of fights, following close upon each other.

It must always be remembered however, that it is not the removal alone of wounded from the scene of action that has to be accomplished: but that it may be necessary, under certain circumstances, to take them on a considerable distance with the force, or at any rate, to maintain them for a longer or shorter time, until they can be properly disposed of.

Dr. Millingen, taking his experience from the battles during the Peninsular War, considered that, in an army of 30,000 strong, there should be means for moving from the field 800 men, at any one time. He also was of opinion that, the above numbers would give 5,000 to 6,000 wounded, exclusive of those left by the enemy, should, as he remarks, "victory crown our arms."

This estimate of Dr. Millingen, gives a rate of 20 per cent. of wounded to strength, and in modern warfare, must be considered moderate.

Expected ratio of sick.—The ratio of sick for which on home service, accommodation and other arrangements are provided, is 10 per cent. In the French army, the actual ratio of sick to well is 45·5 per 1000, in the Prussian 44, in the British 40. In India, the ratio for which arrangements were, under ordinary circumstances, nominally made, was 15 per cent.: but more recently, there is a probability of this proportion undergoing diminution, as the presumed improvement in the health of the troops there, is

believed to render accommodation for a larger number, unnecessary.

It must be considered however, that the above proportion of sick are only those that, under ordinary circumstances may be looked for, and that the numbers above these that may be anticipated, are to be looked upon as specially the result of the service on which the troops are engaged.

Equipment.—According to Dr. Millingen, the equipment of the medical department of an army should be divided into 1, Station hospital, stores and equipments. 2, Intermediate hospital ditto. 3, Field ambulance ditto. 4, Regimental, heavy and light ditto. 5, Personal, general, and staff equipment.

The regimental equipment should consist according to him, of (1,) twenty complete sets of bedding for a corps of 800 men, (2,) a medicine chest, (3,) a canteen.

These should embark with the regimental baggage, and be intended for winter quarters. Twelve complete sets however, should fit upon a light ambulance cart to accompany the regiment.

Regarding medical officers on service.—In organizing an hospital establishment for actual service, the principal medical officer has to consider and make arrangements, so as to have complete the number of medical officers in each of the hospitals already enumerated : and also, to arrange, so that each be retained in its state of completeness, by regular reinforcements—to supply casualties that may be expected to occur.

Field Inspector.—Under the principal medical officer, should be an officer of high rank, whose duty should be in the medical department, somewhat similar to that of the chief of the staff to the military. The duties of the principal functionary, being entirely devoted to the administration of the whole, the Field Inspector should be in a position to see that the arrangements are perfectly carried out, to arrange details, to see to the arrangements in regard to

divisions, to arrange disputes and misunderstandings that are not of such a nature as to require reference to the Head: and to superintend the preparation of statistics.

Sanitary officer.—A sanitary officer is now specially authorised for an army in the field, and sufficiently explicit directions for the performance of his duties are contained in the medical regulations.

Divisions and brigades.—To each division of the army should be a Deputy Inspector General; to each Brigade, a Surgeon Major, or senior staff Surgeon, as an administrative officer. Thus, each particular portion of the army would be complete in itself, as regards medical staff: and, in the event of the formation of field forces being necessary, a regiment, a brigade or a division, could at once be detached; taking with it, its own administrative and executive medical staff, yet without interfering with the efficiency of the other portions of the force.

Specific orders necessary.—These officers should be respectively informed, in a clear and unmistakeable manner, as to the precise duties they are expected to perform: for, as Dr. Millingen observes, where a specific duty is not pointed out to each individual. apathy and neglect must ensue.

Selection of officers.—In organizing an expedition, the fitness of particular medical officers for their various positions is a point that demands the gravest attention. Thus, as Dr. Millingen suggests, those of sedentary habits, should be appointed to permanent stations: whilst active, energetic and enterprising surgeons, are best calculated for the field.

Strength of medical officers.—It is always desirable, if possible, to give an actual standard of comparison; and in regard to medical officers, this is obtainable from the proceedings of the Crimean Commisson.

From these we learn, that in 1854, Dr. Smith detailed the following strength of medical officers for an

army of 30,000 men, ordered to proceed to Turkey under Lord Raglan, namely:—

Inspector General	... 1
Deputy Inspectors General ...	... 4
Staff Surgeons, 1st class ...	... 12
,, ,, 2nd ,, ...	... 13
Staff Assistant Surgeons ...	... 48
Chief Apothecary	... 1
Dispensers	... 3
Purveyors	... 3
Purveyors clerks	... 6
Medical clerks	... 1
Total Staff	... 94

Regimental medical officers.—In addition to these, each Infantry regiment had 1 Surgeon and 3 Assistant Surgeons.

Each two squadrons of cavalry, one Surgeon, and one Assistant Surgeon.

Each troop of horse artillery, one Assistant Surgeon.

Each field battery, one Assistant Surgeon.

For the artillery generally, there was one principal medical officer.

Thus, there was not quite one medical officer to 150 soldiers, if we deduct the officers here named, who were not actually professional. When therefore, it is borne in mind, that the average rates of non-efficiency by sickness among medical officers, is usually, under such circumstances as these, about fifty per cent.: and that, during the two years this war lasted, no fewer than fifty-four medical officers died; we cease to wonder at the inadequacy of the medical staff on that occasion to meet more than a tithe of the demands then made upon it. Large, indeed, as were the numbers sent to the Crimea, it is now apparent that they should have been nearly doubled.

Ideal establishment.—The ideal establishment, laid down by Dr. Millingen—and he had much

experience on active service, is somewhat as follows, *viz.*—

Say the strength of the army is 30,000 men,—this would be formed into 6 divisions—12 brigades—40 battalions. It would be attended by 12 Assistant Surgeons, and 300 bearers in the first line of assistance. Forty Surgeons, 68 Assistant Surgeons, 24 spring waggons, 40 long cars in the second line. Twelve Staff Surgeons, 24 Assistant Surgeons, and whatever additional transport may be available in the third.

Prior to embarking.—The various duties on embarkation and at sea, are described in the chapter bearing upon ships. It is therefore, only necessary in this place, to observe that prior to embarkation, the responsible medical authority should see that the requirements deemed by him needful, have been provided; or that they are in a fair way of being so.

It may be well for him also to bear in mind that his own superiors, and the public look more to the fact of certain results having been attained, than to the means employed to a specific end. These means should be straight forward and open; yet the medical, or indeed any other officer who would succeed, must be prepared at all risks to do so: and to sink all considerations of a minor nature, in the one great object of contributing, as far as in him lies, to the success of the service upon which he is about to enter.

The regulations of the army direct that prior to embarkation, a strict inspection should be made of the troops. It may be well, in this place to urge the necessity of this duty being performed with great strictness. Men, weakly in constitution, or effected with hernia, varix, or diseases of the bones, joints or integuments, would speedily become non-effective upon a campaign; and thus would not only be themselves subjected to much suffering, but they would necessarily occupy much of the means of transport that should be available for casualties solely attributed to service.

Landing in front of an enemy.—Dr. Millingen gives some excellent directions, as to the duties of the medical department on the occasion of a force effecting a landing in front of an enemy; a short epitome of these is here given, with such occasional remarks, as have been dictated by personal experience.

Each man, he says, should have a good meal before entering the boats. He should have with him two or three days' rations of salt pork, cooked. This is better than beef, as it is more savoury, and can be heated up. Some spirits diluted with water should be put into the men's canteens.

The Field hospital corps of ambulance will disembark, with the equipments.

Each medical officer of the Field ambulance, or regimental staff will land—their respective orderlies carrying the leather haversac, and field case (that is now, a field companion).

The staff of the hospital ships will remain on board, and make all arrangements for the reception of probable wounded. It is clear also that, either some of the boats should be kept available for bringing off the wounded, or small steamers should be placed under the orders of the P. M. O. for this purpose.

Regimental medical officers will accompany the last boats of their respective corps. It seems to me however, that a few Assistant Surgeons, with some appliances, should also land with the first bodies, so as to be available at once in case of collision with the enemy.

The flats of the hospital ships, should drop along side the divisional and brigade head quarter ships, and take on board, the field staff belonging to these.

At the same time that they proceed on shore with these, the ambulance staff and hospital corps follow: the men of the latter, with stretchers folded up and ready.

These shore-going boats, to have abundant supply of fresh water for drinking purposes, and for dressing wounds.

On landing, the regimental medical officers follow their corps; the ambulance ones remain with that establishment.

The brigade medical staff will attend to, and send off to the hospital ships any men who are wounded in the act of landing, and left by their regiments.

It would also facilitate matters, were some of the hospital-ship medical staff to accompany the troops on shore, and there attend the wounded while being conveyed back to the vessels.

A landing having been effected, a flying ambulance must start to the front, if the force advance; the divisional and brigade medical staff accompanying it. And it is no less necessary, that a depôt hospital should be established at the nearest and most convenient point.

Organization and order necessary.—In disembarking in an enemy's country, it is essential for the success of subsequent operations, that the same degree of regularity and organization in regard to hospital and transport for sick be observed, as is necessary in those for provisioning the army. The want of this was painfully made manifest in the Crimea, where, in one instance, troops landed unprovided with any means of conveyance for the men, who almost immediately afterwards became affected with cholera. In another instance, as mentioned by M. Boudin and already referred to in these pages, the sick and wounded were not taken charge of by the Commissariat, nor were they recognised by the Purveyors, until admitted into hospital. Thus, while lying by the road sides or on the field, they apparently belonged to neither of these departments; no wonder then that mortality was fearful.

The hospital ships however, should be made as much use of as possible for the reception of sick and wounded: and cases placed on board them, should not be re-landed except in the event of their recovery.

Dr. Millingen very properly points out that, whether during disembarkation of a force, the ambulance horses

land or not, those of medical officers who are entitled to them, should land. It is in fact, quite as necessary that medical officers of the higher grades have the means of rapidly proceeding from point to point to direct the administration under them, as it is for any other staff officers : and much more so than for some of these.

Example of Alexandria.—A good illustration of medical arrrangements prior to, and immediately after, disembarkation, occurs in the account of the landing of the French in 1798.

In preparing for this expedition, Baron Larrey took care while yet at Toulon to assemble the necessary number of ambulances. He applied to the medical schools of Toulon and Montpellier for professional men : and thus obtained about eight hundred, many of whom had served in the army of Italy : each regiment was, in addition, provided with its own medical officers. Three divisions of ambulance were then organized ; one for each division of the army, and one for the centre.

M. Bourienne tells us that during the voyage from Malta, Bonaparte often complained bitterly of the imperfect manner in which his fleet had been prepared for sea ; of the encumbered state of the ships of the line, and frigates ; of the great number of transports, of the bad outfit of all the ships, and the weakness of their crews ; all of which matters are mentioned in this place, as a warning against similar inconveniences being permitted, when ships and soldiers similarly engaged, belong to Britain.

At one o'clock on the morning of 2nd July, they first landed at Maraboù, three leagues to the west of Alexandria ; having experienced a smaller loss than was anticipated.

Two hours afterwards, that is, at three o'clock, they marched on Alexandria, the walls of which were scaled with comparative ease : and as soon as the capture of the city had been effected, the wounded were accommodated in a Capuchin convent.

When, after the advance upon, and capture of Cairo, it was ascertained that 20,000 Ottomans had disembarked at Aboukir, Baron Larrey established two large hospitals at the former place, while Napoleon proceeded with his force towards Alexandria. In the action which followed, the French had 800 wounded, 40 of these requiring amputation.

On the return of the French army to Cairo, they found the place in insurrection, and in virtual possession by 50,000 Mamelukes. An assault was made, but without success, the French losing 200 wounded: subsequently however, the attack was more successful: the city was retaken: yet the circumstance deserves to be noted as illustrating a danger, to which troops, and especially sick in a city in an enemy's country may, at any time be liable.

On 1st March 1801, the fleet having on board the force under Sir Ralph Abercrombie anchored in Aboukir Bay. For several days the state of the weather prevented the possibility of landing. By the 7th however, all preparations were complete: and on the morning of the 8th, at two o'clock, the first division, five thousand strong, assembled in boats one hundred and fifty in number. The troops descended silently from the transports, and took the places assigned to them in the boats: the French on the heights, two thousand strong, posted in a semicircle about a mile in length, with twelve guns at one side,—the castle of Aboukir on the other.

The boats remained for a time in the middle of the bay, menacing different points of the coast: at last, all being assembled, the signal was at nine o'clock made to advance. The boats, each laden with fifty men, instantly moved forward, the armed vessels on their flanks, cannonading the batteries on shore.

The French allowed them to come within easy range, and then opened fire. Silently the boats approached; the sailors rowing with uncommon vigor, the soldiers sitting silent and steady, their arms in

their hands: when they reached the fire, several boats were sunk, the loss among their crews being very severe. The others pressed on: the prows of all the first division struck the sand at the same time. The troops instantly jumped into the water, rapidly advanced to the beach, and formed before they could be charged by the enemy. They rushed up the steep heights with fixed bayonets, and carried them. In an hour, the whole division was established on the heights, though weakened by five hundred men killed and wounded.

Preparations for an advance.—Considering the manner in which a military force is usually formed: that regiments have to be collected from different stations, and embarked at different ports: that supplies and equipment are in like manner shipped at different places, and under various authorities, it becomes apparent that means should be taken to test the working of the various establishments, before actually commencing operations in an enemy's country.

There may indeed be occasions, when to do so would be impracticable: and with this knowledge beforehand, the embarking authorities should see that each regiment,—the head quarters of each brigade and division, proceed on board their particular ships, complete in staff, servants, medicine, appliances, camp equipage, ambulance and means of transport—if it be practicable to do so; the reserve stores of all kinds being with the staff on board the divisional hospital ship.

There should be one officer on board each vessel, who having seen these various establishments put on board, and being provided with a list of all, he will thus be held responsible for the correctness of the whole.

Establishing a base.—On the occurrence of the war in the Crimea, there was some attempt made to test the efficiency of establishments prior to entering upon actual operations. A more complete plan was adopted on the occasion of the China War in 1860, when the entire force was landed, and the sufficiency of establishments actually tested, before proceeding to

the seat of hostilities: and to the remarks on that expedition, the reader is referred.

It may be well also to remind the reader that, when the Duke of Wellington arrived at Mondego Bay, with his force of about 13,000 men, he began to disembark on the 30th of July 1809. Yet it was not till the 9th of August that he felt himself in a position to commence his advance.

Presuming that the force has effected a landing, obtained a footing, and that the requirements of the wounded have been met; further arrangements for prosecuting the campaign inland are to be instituted.

If the point be intended to form a basis of future operations, a medical officer of rank: and sufficient staff should be detailed; and steps taken to establish a depôt and general hospital, and arrange for disembarking troops who may subsequently arrive,—or embarking those who may be received non-effective from the front.

Proceeding inland.—It is clear however, that with a view to organize the various establishments for proceeding inland, to arrange for supplies, to apportion transport, equipage, &c., a longer or shorter time, depending upon circumstances, is requisite. Much may be done during it therefore, to arrange for conveyance of the sick and wounded of the force, with reference to the description of transport available in the country.

It is almost needless to observe that, should the military authorities find it necessary after the first landing has been effected, to increase the force; the medical arrangements must be increased in proportion, to meet probable requirements, both as regards equipment and officers.

A liberal amount of accommodation should also be provided at the basis for sick and wounded who may be expected from the front. It may so happen that existing buildings may be found sufficient for this purpose, but on the other hand, it is equally likely they may not. In the latter case, huts which should

always form part of the equipment of a force, should be erected, unless tents may suffice. It is obvious also that to economise carriage, arrangements should be made, so that Commissariat waggons conveying stores to the front, should be made available for taking back their compliment of sick.

Such were, indeed, the arrangements made at the commencement of the war in the Peninsula. In addition to the large general hospital and depôt, that as we have already seen, were established at Lisbon, other large hospitals were formed at Coimbra and Celerico as the army advanced; their principal objects being to fulfil the purposes of what are elsewhere described, as "intermediate" hospitals.

Sir James McGrigor in describing the hospitals so formed, informs us that at Coimbra, they occupied numerous churches, convents, and monasteries; and were upon a scale so extensive, that it took him a whole week to inspect them. He also mentions the fact, that he was convinced of the necessity of the army being provided with the materials for a number of wooden huts, so that they might be put together as circumstances required; and that on his recommendation, Lord Bathurst caused materials for these, and carpenters for their erection, to be dispatched from England.

Some standard may be useful for the spare accommodation which should thus be kept prepared for emergencies. It may therefore be reckoned at the rate of 20 or 25 for every 1,000 men in the front, so that for an army of 10,000 men, accommodation, beds, clothing, medical and purveyors establishments, should always be kept complete for at least 250 sick.

The hospital ships must, from time to time be emptied, so as to be again available for the reception of men sent from the front. To effect this, those on board them should be sent home as fast as possible. If the distance be too great for these vessels themselves to be sent, with due consideration of the requirements

of the force, some other vessels must be engaged for the purpose.

A sufficient number of bedsteads and bedding, to meet all requirements, should form part of the equipment of an expedition; and these should be placed in the hospitals to be formed at the basis of operations. If, however, by any chance they should not be available in sufficient numbers, boards and trestles must be provided. As elsewhere observed, the sick and wounded should be raised from the floor in hospitals.

The advance.—On the advance of the army inland, a chain of communication with its base of operations, becomes as necessary for medical, as for military reasons. As stations or halting places are obtained, each should successively be provided with spare waggons and carts, as well as means of administering aid to sick who may have to be left there.

The Commissariat carts employed in bringing up supplies, should take back sick and wounded, when required to do so.

Necessity of communication between military and medical officers.—It would be well were the military and medical authorities of forces employed in expeditions, aware of the great benefits that arise from free communication between them: and the great evils, even extending to the serious embarrassment of the operations—that follow a contrary course.

Military officers in charge of brigades and divisions, do not, on all occasions, inform their principal medical officers of the intended operations of the force. The natural result is that medical arrangements are in such a case not made, to suit the newly created circumstances of the force, and inconvenience, more or less, soon follows:—nor is this all,—instances upon instances could easily be mentioned, where a severe reprimand has appeared in orders to the medical officer, for the omission for which the Commander was solely and alone responsible.

That there are many exceptions to this, is most readily conceded. Some general officers studiously take the principal medical officer of the force under them into their confidence, in designing operations about to be undertaken : and the advantage to both of such a measure is incalculable. The medical officer is thereby enabled to mature his arrangements, while the Adjutant General and Quarter Master General are maturing theirs : and thus, the means of transport, accommodation and proper treatment, of probable sick and wounded, are completed.

Sir James McGrigor often alludes to the fact that he daily waited upon Lord Wellington with his report of sick and wounded ; together with details of their regiments : the numbers dead, and the numbers fit as convalescents to accompany the force : and he states in his memoirs, that on these occasions Lord Wellington communicated to him a notice of the intended moves of the army. Thus, when Lord Wellington announced to him the intended movement upon Badajos, Sir James McGrigor was in a position to issue orders to the purveyors and apothecary, to have in readiness depôts of their respective stores ; and to the superintending medical officers of divisions, to see that each corps sent in requisitions for such medicines, materials and instruments, as they required. By the time the army moved onwards, all these arrangements had been carried out, and a depôt for all kinds of hospital stores established at Elvas.

Major General Sir Edward Lugard, K. C. B., while in command of a force during the operations against the Indian rebels in 1858, was so courteous, as on that occasion to communicate his intended movements to the writer of this volume,—who was then senior medical officer with it,—and now takes the opportunity of recording the great obligation he was under, as well as the great facility thus obtained for completing necessary arrangements of a departmental nature.

It is easy to perceive, how the neglect of such precautions might not only peril the success of a movement, but actually tend to bring about a terrible disaster to a force: were for instance a severe action to occur, and there not be sufficient transport for the wounded, the whole force might be paralyzed, or the disabled have to be abandoned to their enemies. Surely therefore, the necessity is evident for most stringent orders being given to military commanders, to make in communication with the head of the medical department, the necessary arrangements prior to entering upon active operations; except of course, in the heat of action, when emergencies are apt to arise—to meet which, nothing but practical experience on the part of the latter, as on that of the former can qualify him.

Medical officers on duty.—In every field or general hospital—with each division and brigade respectively, one or more medical officers should be on duty for the day. With a force in motion, one should be daily detailed for the advance guard, one for rear guard, and one in waiting; whose duty shall be to accompany any force temporarily detached for the purpose of attack.

Regimental Surgeons.—The Surgeon of each regiment makes his own arrangements in like manner, for the distribution of the medical officers directly under him. He should see that wherever the regiment goes—there, one of the medical officers shall go also, accompanied by an orderly, carrying a field companion: with such means of transporting to the rear, and of succour for wounded, as may be at his disposal.

Place for P. M. O. of a force.—The proper place for an administrative medical officer of a force, be it large or small, is with the Commander: so long as active service is going on. Each should also have the means of conveying orders to the executive medical officers in charge of hospitals and regiments: and of directing the distribution of means of transport as necessities arise.

Position of hospital during an advance.—The precise position of the hospital establishment on the line of march must depend much upon the physical characters of the country, the nature of the establishment employed, and the character of the inhabitants.

It may be taken as a rule however, that the nearer this establishment is to the regiment or corps to which it belongs, the more available it will be for immediate use when necessity arises: at the same time it is not to be forgotten, that the presence of large trains of wheeled conveyances, or of establishments such as are in use in India, interferes very seriously with the efficiency of the force.

Arrangements that would be sufficient on an ordinary march, would be unsuited to a state of war. In the former case, the hospital establishment of each regiment can, as is the custom in India, either follow the corps, or march along the open country on one of its flanks. In other instances the whole is sent on in advance during the evening preceding the march of the regiment, by which arrangement, the sick are enabled to have the benefit of a sound sleep.

It is evident that these arrangements would not be judicious on a march in a hostile country or for the purpose of meeting the for in battle: while then it becomes essential that the probable movements of the army be not hampered, steps should be taken to have with, or near each corps, a sufficient establishment to meet immediate emergencies,—the greater part of the establishment must be held available in the rear of so as to take up its position with regiments, brigades and divisions, when the time for action shall have arrived.

Sick and wounded greater than the transport for them.—During an advance through an enemy's country it may so happen, that from frequent collisions with the foe and from the ordinary effects of sickness, the number of sick and wounded accumulate to

such a degree, as to exceed the available means for their conveyance onwards. Doubtless this would be of comparative little consequence among civilised nations, between whom a Convention has lately declared that all sick and wounded and the establishments connected with them, shall be neutral; although even in such a case it is not to be expected that any commander would permit his consideration for the helpless among his enemies—to sacrifice for their benefit provisions, stores of all kinds, and means of transport—all of which are urgently demanded for the successful prosecution of his own plan of operations:—not to speak of hampering his force by such immense trains, as would under such circumstances become necessary.

In a country peopled by savage or uncivilised races such a scheme is utterly impracticable. In India for example, during the operations for the suppression of the sepoy mutiny—to have left the sick and wounded, would have been to have doomed them to atrocities, too horrible to contemplate: and yet, on more occasions than one it occurred, that the numbers helpless from sickness or from wounds, were larger than the means of transport could accommodate: and that a continuance of the advance throughout the rebellious districts was imperative.

In such an emergency as this, the measures adopted on that occasion, were in fact the only ones practicable, namely:—to occupy every available conveyance; and having obtained a strong escort of cavalry; to make a rapid retreat to the nearest existing general field hospital: and having there deposited the sick and wounded, to rejoin the effective force,—making arrangements at the same time for forwarding to the front such supplies, transport, &c., for hospital purposes, as may have been found disposable.

It is obvious, that with a vigilant and enterprising enemy, and a difficult country between the army and such a point, the difficulties to be encountered may be great or even insurmountable. It is therefore easy

to perceive, how not only the success of an army, but even its existence as such in a hostile country, depend upon the efficiency of the means for taking charge of its sick and wounded.

During the war in the Peninsula, this point has, on more occasions than one, decided a Commander in accepting or declining battle: and the circumstance that tended in a great measure to the disasters that befel our troops in Affghanistan, was the accumulation of sick and wounded beyond the capabilities of the means of transport.

During battle.—The instructions laid down by Dr. Millingen in regard to the position of medical officers during an action, although valuable so far as they go, are scarcely full enough: an epitome of them however, will here be given, followed by such remarks as may be deemed necessary.

He observes, that until an army forms up for battle, medical officers should follow their corps with their proportion of the hospital ambulance. If casualties occur, they are to be attended to, and the patients sent to the rear—the medical officers moving on; when the force forms up for action, the ambulance to form its lines of assistance.

If the force gain ground, the first and second lines of medical assistance to move up. The third line to follow as soon as the wounded have been disposed of.

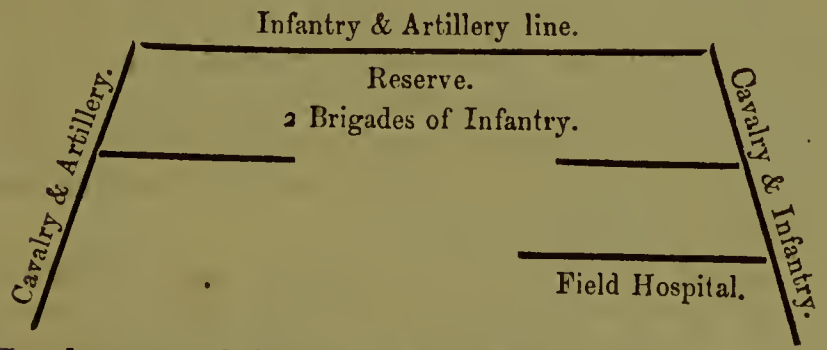
If the action be adverse, or the troops retreat, the 1st and 2nd line to be moved, but without precipitation to the rear; the medical officers to form on the 3rd line. It is at all times necessary to make arrangements, so that in the event of a reverse, the wounded may be removed in safety to the rear.

While it is essential that a certain proportion of medical officers should during an action, be near enough to the columns engaged, to render immediate assistance to those who require it; these medical officers should attempt no more than the application

of such dressings as may be necessary, until the arrival of the wounded man at the nearest hospital in the rear.

A medical officer may often be of service in binding up a shattered limb in such a way as to avert much suffering to the patient during his transit to the rear; he may be called upon to tie a wounded artery, and under some circumstances, to remove a bullet: or even to use the trephine. Practical experience alone gives the tact which decides at once the necessity for, or extent of interference; and under no circumstances is decision more required, than at such times as are being now alluded to. Trivial interference however, and needless probings of wounds, and examination of splintered bones are to be reprobated. They give unnecessary pain; take up time; and worst of all are useless.

Field Hospital.—Where there is only one field hospital to an entire force, as is usually the case in India, the manner of disposal of it during action is fairly represented by what was done in the battle of Goojerat, thus:—



In the case of forces however, to which there are brigade, division, and other hospitals of communication attached, as are described under other heads in these chapters, each one should be held complete in itself: and free communication kept up between the various ones on or near the field.

As sick or wounded accumulate, they should be from time to time sent to the rear, provided the nature of

the campaign admits of such a proceeding. It often happens however, that this cannot be done: as for example, in an advance through an enemy's country, in view to forming a junction with, or to operate in concert with a separate force; and when, with the advance of the army, the country in its rear is left in the possession of the enemy.

Instances are elsewhere given of the occurrence of a succession of severe battles within a few days: and the medical officer in charge will do well to be at all times prepared for a similar circumstance, although to be so, may possibly tax his ingenuity and self reliance to the very utmost.

With a besieging force.—Dr. Hennen, evidently with reference to the medical arrangements during the prosecution of a seige, observes that "it will be necessary to appropriate some place of accommodation for the purposes of a receiving hospital." This he says, should be a large building near the entrance of the city or town where the fixed hospitals are situated. If such a building does not exist, a barn, tent, or hut should be used for the purpose; and if neither, the open bivouac. The evident object of such an establishment is to provide the wounded, with such attendance and comforts as they may require, prior to being moved further to the rear; and for these purposes there should be an ample staff of medical and purveyors' establishments.

In regard to the general arrangements on such an occasion, Dr. Millingen remarks that, with the exception of the troops required for the duties of the siege, the rest should be cantoned, relieving those who are in the field every second day.

Field hospitals, distinguished by a black flag by day, and reflecting lanterns by night, should be formed in the rear of the approaches.

For the reasons elsewhere given, the presence of a medical officer with the advanced party is essential, whether this be in the trenches—at an assault—or

the after operations, when an entrance into a town has been effected.

The means of speedy removal to the rear of the wounded, should always be left clear, as far as circumstances will permit; and the bearers should be made to maintain as much as possible their relative position with reference to the troops engaged, so that it may be practicable to know whereabouts to seek for them.

During the operations which led to the capture of Lucknow, a large field hospital was established, so soon as the army had taken up its position near that city. Many of the men, wounded during the siege operations, were taken direct to that establishment: as a rule however, soldiers beseeched to be taken to their own regimental hospitals, to be there treated as long as possible. Their wishes were attended to when it was practicable to do so, and it was only when a column of pursuit of the rebels was formed, that the sick and wounded, much to their own chagrin, had to be transferred from their own regimental into a general hospital.

On that occasion, one medical officer of the 10th regiment in which the author then served, accompanied it on its roster of duty to the front; the hospital was situated in camp at a distance of probably three miles from the city, but not altogether out of range of the enemy's guns, because the nature of the ground upon which the force was encamped, did not admit of its being so.

The surgeon, although for the most part in the regimental hospital, visited from time to time the front, with a view to personally make himself acquainted with the working of the hospital arrangements there. During the day time, no difficulty was experienced in removing the wounded to hospital by means of doolies, but at night it was not deemed safe to attempt doing so. They had therefore to remain at the front till morning, receiving such attendance as it was practicable to give them.

Arrangements when occupying a town.—The facilities for properly disposing of sick and wounded during military occupation of a town, must depend upon the circumstances of the town itself; as to whether it is in a civilised or barbarous country, as to the nature of its buildings,—whether they be large and spacious, as churches, public halls, and places of business; or small, crowded, and inconvenient.

The material of which those buildings consist must also be taken into account; as to whether it be stone, brick, clay, wood, or bamboo work. So also the circumstance of a town being surrounded or not by a wall must be taken into account, as these may materially affect the selection of places for the sick.

Dr Millingen observes that in towns where garrisons are likely to be retained in occupation for some time, gardens should be prepared in the neighbourhood, in which the men could not only find healthful occupation, but might also raise a sufficiency of vegetables to render them in this respect independent of other resources.

On the entrance of a force into a town or city for the purpose of holding it in military occupation, the first duty is to select suitable buildings and positions for accommodation of the troops, and for hospital purposes. Then to apportion buildings for guards, privies, stores, cook houses, out offices, and the various other purposes incidental to an army.

In all these, the responsible medical officer should be guided, in so far as military requirements permit, by a just view of their respective bearings upon the health, and consequently the efficiency of the whole.

It should be considered with reference to the efficiency of the force, and readiness with which particular portions of it might have to act upon the defensive, or to take the field, whether sick ought to be treated in regimental, or in hospitals formed upon the general plan.

Much will also depend upon the circumstances as to whether the force is concentrated or distributed

at distances throughout the town. And very much will depend upon the town under occupation being in a civilised or barbarous country; the nature of the buildings, and of the available appliances for sick being vastly different in the two cases.

Under no circumstances however, should it be forgotten that it may become necessary at any time to move the sick either onwards or towards the basis of operations: and therefore the establishments must be ever held ready, and arrangements complete with this view; whether it may have to be effected by land transport or by water.

The greatest vigilance is necessary to prevent the troops being infected by disease from the populace, whether in the form of exanthemata, typhus, or typhoid fever, ophthalmia, or venereal.

It is well known that during the Peninsular War, not only our soldiers, but our officers ran serious risk of being rendered inefficient by the systematic attempts made towards their infection by the latter disease. Whatever ideas or opinions may be entertained in the United Kingdom regarding the propriety or otherwise of applying quarantine measures to venereal disease, it is clear that in the case of an army in the field, or in military occupation of a city, our only consideration comes to be expediency, and the efficiency of that army. Hence, the same strict surveillance over this source of weakness should be observed by the officers, both medical and military, as against all other matters that tend to impair its efficiency.

Besieged.—In the case of a force besieged in a town by an uncivilised race, who know not; or at least do not practice the laws of humanity towards the disabled, the hardships and dangers become greater than when the enemy is civilised,—inasmuch as while in the one case, the buildings occupied as hospitals are always spared: in the other, they are almost invariably, if ascertained, made the object of special attack.

The circumstances of the British forces besieged for a period of three months or more in the citadel of Lucknow, form a good illustration of this. That force had with daily decreasing numbers to perform every kind of duty; and every individual in it, male and female, had to perform a certain amount of work for the safety of the whole.

Fortunate it is, that in times of great difficulty such as that occasion was, all classes of British gladly submit to a system formed with the view to the benefit of all: and should a body of our troops be again placed as they then were, it is to be hoped the same devotion which was then shewn by every person, may be again evinced.

The building or part of a building least exposed to fire, should be selected for a hospital; relays of persons told off to collect the wounded; to cook—wash—attend to conservancy, carry on the work in the wards, and so on. The burial of the dead must be carefully attended to, and means taken to protect the wells from pollution, and from becoming exhausted; and to collect water whenever practicable.

In fact, such measures must be taken as the circumstances of the case permit, and the ingenuity of the responsible officers dictate; the one great point to be held in view, being the determined continuance of the defence.

The medical arrangements for an army in a besieged town, like all other arrangements must depend upon the resources of the place, the circumstances of the time,—and the tact of the officers concerned in turning these to advantage. It is impossible to give more than a very general view of what measures are under such circumstances the best.

For an army besieged in a town, situated in a civilised country, the experiences of the Peninsular War hold good. They may be thus epitomised. Place the sick and wounded in large buildings that are easily discernible; distinguish these by a black flag by day, and

reflecting lanterns at night, so that the place may be distinguished by the enemy.

In regard to supplies, if there has been time to bring with the force those belonging to it, these must be husbanded. It has been suggested that with a view to save grain and forage, all spare animals should be killed and salted. If the siege promises to be protracted, gardens should be sown, so as to enable the troops to have green vegetables. And it is clear that for all other requirements, the town itself must be looked to, especially for such as clothing, bedding, and the usual requirements of men sick and in health.

The same sanitary principles which are applicable to barracks, should, as far as possible, be adopted in regard to troops in besieged town, it being at the same time apparent that the various resources must, as far as practicable, be taken advantage of.

During an assault.—Dr. Millingen recommends that in the event of a breach being made by the enemy, and an assault be imminent, the medical officers and hospital corps should assemble near the point of attack, with their means of transport; and with torches, if at night. Under such circumstances, it does not appear possible to give more definite directions in regard to succour to the wounded, than to remark that the best must be done for them that is practicable in such an emergency. They must, as a matter of course, be removed as speedily as possible to the hospitals, but as is well remarked by the author just quoted "the situation of the wounded in an assault is most melancholy, heaped up with dead, amongst dirt and ruins, frequently wet through from cossing the ditches,—and most severely injured."

During a retreat.—Dr. Millingen's directions are that the sick and wounded should precede the army by twenty four hours, and that convoys should not halt so as to clash with the movements of troops. He observes that where roads are good, a spring waggon

and two long carts should move on between the rear guard and rear of the column; and in a foot note, makes a suggestion, which in the present day strikes the reader as very peculiar.

"It has often struck me," he observes, "that if a small pad was fixed to the valise and crupper of the light cavalry, sufficiently large to enable a man to sit upon it, they not only could move with rapidity bodies of rifle men, to cover a retreat, but could also bear away with them many a wounded soldier. I believe this was the plan adopted by the first Voltigeurs in the French army, who in addition to their pieces, carried a pole which enabled them to vault behind the light horse when pressed by the enemy's advance"!

In organizing the medical arrangements for a retreat, reference must be had to the nature of the country, and also to the probability of the enemy making an attack from the flank. The plan recommended by Dr Millingen is excellent, so far as it goes; but in addition to the measures he recommends, it is necessary to provide for regimental establishments.

All those, not immediately required by particular corps, should be collected: and with the heavy baggage placed in such a part of the line, as that about one-half the force shall be in front, and one-half in rear; sufficient transport being with the rear guard to bring up stragglers or men who may become non-effective. It may be observed in this place that for some days before the retreat from Burgos began, it was apparent to Sir James McGrigor, as it was indeed, to all other officers of intelligence, that a retrograde movement was inevitable. He therefore, got from the commissary general all the carts and mules that came up with provisions for the army, and in them sent back to Valadolid every man who could bear transport to that place. The hospital there being speedily filled, carts and mules, as well as other conveyance, were daily employed in moving the sick and wounded to Salamanca, and from the latter place to Ciudad Rodrigo,

thence to the Pise hospital building, previously erected near the Douro,—whence they were finally sent to Oporto, and thence embarked for England.

In India, where the bearers with doolies can run along side the column, they should be upon the "reverse" flank : in that country however, whenever a retrograde movement is made, it is usually undertaken for strategic purposes ; and is of inconsiderable extent.

On the occasion of a retreat before a pursuing enemy, the question assumes an aspect of terrible importance, and especially if that enemy be uncivilized. In such a case, a plan similar to that adopted in India, as already mentioned is the only feasible one ; for the helpless must be taken care of to the utmost. In civilized nations however, it is to be hoped that the result of the late International Congress will, in all future wars, render the sick and the wounded secure from the horrors to which in bye-gone times they were exposed during a retreat; and that as almost all civilized nations have agreed to consider the sick and wounded neutral, those of a discomfited or retreating army may, it is believed, together with their medical officers,—or rather a portion of them, and their attendants—be safely allowed to fall into the hands of the enemy. For the reasons already stated in this chapter however, doubts are entertained as to the full success of such a scheme.

CHAPTER XIV.

FIELD ARRANGEMENTS IN FRANCE.

Prior to the time of Larrey—Inadequacy of ambulances alone—The system—Ambulances—Allowance of officers—Advancing—Ambulance volante—In action—Wounded—Depôt d'ambulance—Establishment—Arrangements—Voiture d'evacuation—Routine—Canteens—Field companion—Extra stores—Horse furniture—Field equipment—Extra ambulance—Reserve—Provision for sick—Proportion of sick—Proportion of medical establishment.

PRIOR TO THE TIME OF LARREY.—Before the time of Larrey, the ambulances employed in the French army had, during a battle, to remain about a league from the front, while the wounded had to be left upon the field until after the combat.

He however, in the words of his biographer, depressed and mournful at the privations to which the wounded were thus exposed, introduced the ambulances volantes.

According to him the cadre of persons attached to it was 340 individuals. To each division there were 12 light carriages, and 4 heavy. These carriages of two and four wheels, on easy springs, were furnished with matrasses for the wounded, for whom during an action, they were to seek upon the field.

So great an interest did the Emperor Napoleon take in these ambulances, that he caused them to manœuvre before him, and spoke of them as one of the most happy conceptions of the age.

INADEQUACY OF AMBULANCES ALONE.—That these ambulances, however excellent, as no doubt they were, did not in the idea of their inventor supersede the necessity of taking advantage of other means that might be available, is apparent from the fact that the

little cars of Biscay were utilized by the army in Spain,—these being not only very light, but well adapted for bad roads and mountainous defiles.

The system.—At present, the ambulance system is represented during a campaign by (1.) Ambulances,—(2.) Temporary hospitals—and (3.)—Convalescent depôts.

Ambulances.—Ambulances are organized hospitals intended to follow the troops in all their movements, being divided during an action into a moveable ambulance and a depôt. They should convey articles of dressing, comfort, medicines, instruments, and appliances.

Each ambulance is for the most part supplied with such articles of bedding and clothing as are likely to be required; such as a matrass, pillow, coverlet, three sheets and three caps, for each person it is intended to accommodate; one-tenth the accommodation of the whole being set apart for officers.

The ambulance for each division of cavalry consists of (1.) Its own medical officers. (2.) Three officers of "Administration." (3.) Twelve orderlies, whose duty it is to render aid whenever necessary.

For a division of infantry the allowance is 6 medical officers, 3 dispensers, 5 officers of the purveyor's department, and 17 orderlies.

Cutler.—To each ambulance is a cutler, under the orders of the principal medical officer.

In these ambulances, the establishment of which is instituted with reference to the number of sick and wounded that may be anticipated to occur, the system of management is precisely that of the permanent hospitals, with the single exception of dieting the sick.

Advancing.—With an advancing army, it becomes necessary that day by day a basis of operation for the ambulance be established: but in this, much must depend upon the nature of the service in which the force is engaged.

Ambulance volante.—The portion of the establishment intended specially for service during action, is the ambulance volante; this consists of two demi-sections. With the first demi-section should be the principal medical officer of the division. 1, medical officer. 1. Purveyor and 5 orderlies. With the second demi-section, one surgeon, one superintendent of orderlies, and 5 orderlies.

Each of these, consists of an ambulance conveyance, properly fitted up as already described, with bedding, clothing, medical comforts according to a regulated scale, and with litters for the conveyance of eight wounded men. In case however, of the country not being adapted for wheeled conveyance, it is intended that panniers from the ambulance shall be given in charge of an orderly—the panniers secured upon a transport mule, and the orderly mounted upon one of the horses of the ambulance.

In action.—During the progress of a battle, these flying ambulances are established as close as possible to the line of action, in the best position available,—or better still, in a large building, where an abundant supply of water is procurable; the place selected being distinguished by a red flag.

From this point the officier d'administration keeps in view the most advantageous manner of disposing of the carriages: and apportions the orderlies in the manner best calculated to ensure prompt attention to the wounded.

Wounded.—The less severely wounded are attended in the first instance, by the regimental medical officers. They are then either detained with their regiments, or sent by conveyances for the purpose, *viz.*, voitures d'evacuation, either direct to the depôt d'ambulance, or to a hospital.

Depot d'ambulance.—The other portion of the active section is formed into a depôt d'ambulance to which the wounded are directed to be brought.

The establishment of each depôt d'ambulance consists of 1 P. M. O., 4 medical officers, 1 Purveyor, 2 ward masters, 10 orderlies. Of materiel it consists of 1 ambulance waggon, containing all presumed requirements of surgical appliances ; 30 matrasses ; 30 stretchers; 60 coverlets; 10 sets of "furniture complete;" with bedsteads, 10 litters, 12 spring carriages for conveyance of wounded, instruments, appliances, medicines and utensils.

Arrangements.—On the arrival of wounded at the depôt d'ambulance, a medical officer and a purveyor take care in concert to ensure every assistance being given to them. After the first dressing, those who are fit for removal, are sent to the nearest civil or military hospital, those only who cannot be removed, are permitted to remain with the depôt d' ambulance.

Voiture d'evacuation.–To each voiture d'evacuation is attached an intelligent orderly, capable of attending upon any accident that may happen during the journey. He is furnished with a statement of the number of the cases, and of the articles that may be needed on the way.

Accompanying each wounded man is a statement of his case, the operation performed, &c. This is given to the Purveyor and the medical officer taking him in charge.

Routine.—When the ambulance moves, the Brigade Major, or in his absence the Purveyor in Chief gives to the Adjutant General and Quarter Master General of the division, notice of whither it has gone, and whence it has moved.

In cases of urgency, applications are addressed direct by the Purveyor or chief of the service, to the ambulance of division ; or to the nearest military hospital as may be most convenient.

Canteens.—On entering upon a campaign, each regiment is provided with regimental "canteens" in proportion of one pair to each, or for two squadrons. These canteens are carried by a mule.

Field companion.—Each battalion has with it a case with lock and cover. This contains field

instruments and dressings. In it is also a small tin case divided into compartments; each compartment containing such medicines, instruments and dressings, as are most likely to be required on the field.

This seems to be similar to the "Field companion" used in the British service, and like it, is carried during action by an orderly.

Extra stores.—With a view to make provision for all requirements of an unusual nature, the following quantities of the articles named, were supplied to the French army in the Crimea; the strength of that army being, say 45,000, namely:—

Flannel waistcoats	1,37000
Hoods (*a Capuchin*)	70,000
Woollen gloves	70,030
Gaiters, woollen and sheep-skin ...	70,000
Half gaiters, (*Gachias*)	70,000
Sheep-skin cloaks	15,000
Cotton shirts	280,000
Shoes, pairs	290,000
Leather gloves	24,000
Cloth gaiters	25,000
Boots (ankle)	6,500
Boots	24,000
Drawers, pairs	21,000

Horse Furniture.—In addition to the above, there was a full supply of all articles necessary for grooming and taking care of the horses belonging to the expedition.

Field equipment.—Of field equipment there were sent the following, namely:—

Sacs tente d'abri	160,000
Coverlets	215,000
Tents of various kinds	8,000
Large flaggons	40,000
Small flaggons	150,000
Wooden bowls	43,000
Sauce-pans	43,000

Extra ambulances supplied.—It was also deemed advisable to supply canteens d'ambulance for 12,000

men, independent of the 45 regimental ones : that is, in fact, a reserve over and above the ordinary one, equal to one-fourth.

Reserve.—To meet all requirements that may be looked for as probable, there should be a reserve of ambulances equal to the total reserves for each corps.

Provision for sick.—The means of providing for the sick and wounded on the campaign, that were embarked with the French army for the Crimea, were as follows, namely :—

	Sick.
12 moveable hospitals for 500 sick, each ...	6,000
1 depôt hospital for 1,000	1,000
In reserve, complete, for 750... ...	750
Independent of a depôt hospital, there was ready means for 500	500
Total sick provided for ...	8,500

That is, for about 25 per cent. of the whole, a proportion which large as it was, now appears too limited.

Proportion of ambulance.—Let us take an ambulance for 3 corps ; each corps composed of 2 infantry and 2 cavalry divisions, the carriages required would be as follows :—

1st Infantry division	5	Carriages.
2nd „ „	5	„
1st Cavalry division	2	„
2nd „ „	2	„
Total for 1st corps ...	14	„
The double for the 2 other corps...	28	„
Half of these two quantities as a reserve for the 3 corps... ...	21	„
The half of which last will be the reserve at Head Quarters ...	10	„
Total for the 3 corps ...	73	„

PROPORTION OF MEDICAL ESTABLISHMENT.—The French medical establishment is as follows:—

For an army of 10,000 men		5,000	and	1,000.
Senior med. off.	1	1		0
Senior dispenser	1	1		0
Surgeons, staff	4	2		1
Asst. Surgeons	10	6		1
Officier d'administration	1	1		1
Adjutant ditto	6	3		0
Orderlies. Sergts.	6	4		1
Orderlies. Corporals	8	4		1
Orderlies. Privates	90	55		23
Totals	127	77		28

CHAPTER XV.

MEDICAL ARRANGEMENTS FOR THE WAR IN CHINA.

Preparations—Strength of the force—Coolies—Doolies—Stretchers—Boats for canals and rivers.
Huts—Cases of comforts—The weakly left—Increased scale of rations—Landing at Talienwhan—Landing at Pehtang—Hospital ships—Their proportion—Advance—Proceed inland—Alum—A general hospital—Field equipment per man—At Pekin—Occupation of Tientsin.
Conclusions drawn from experience.

China—Arrangements for.—Among some of the most valuable arrangements entered into, and supplies issued for the expedition which left England for China in 1859, were the following, *viz.*—

1. Tents and marquees for officers and men.
2. Flannel clothing and woollen socks, knee-boots, water-proof cloaks, and sheets.
3. Lime juice, preserved meat, beef slightly salted, preserved potatoes and other vegetables : ale, porter, rum : coffee, roasted and ready ground : meat, flour, ovens, and bakers. When meat was poor, larger quantities were sanctioned as issue.
4. Quinine wine.
5. One day's ration only of food to be issued, if possible.
6. That men have breakfast, or hot coffee before beginning a march.
7. Soyers' camp kitchen supplied.
8. Iron store houses sent out.
9. Boxes not to weigh more than lbs. 100, each.
10. Spare cacolets and litters (100 each,) pack-saddles, bridles, &c.
11. A large supply of disinfectants was sent out.

Strength of the force.—The entire force including marines amounted; to British, 12,000: natives of India as troops, 8,425; natives of India, as camp followers, 2,600; Chinese coolies, 2,800; total 25,833. One regiment, (87th) = about 800 men, 2 batteries of artillery = 160, and 3 black corps = 2,400, were left behind. For the expedition, there were employed 95,000 tons of shipping.

Coolies.—To each regiment proceeding on service, 400 native Chinese coolies were attached, for the purpose of conveying equipment and hospital establishment. They were superintended by an officer, two sergeants, and thirty old soldiers. Twelve native physicians were entertained for them.

Doolies.—Six hundred doolies were made up at Hong-Kong. The Indian pattern ones weighed lbs. $130\frac{1}{2}$: but the new ones made on the spot were only lbs. 58, and could be carried by two men.

Stretchers.—Stretchers were made with a moveable top so as to afford shade from the sun. These stretchers when not in use, could be folded up, together with the pole.

Boats for canals and rivers.—For transport by canals and rivers, gunboats and flat-bottomed boats of different kinds were used.

Huts.—A supply of Manilla huts was obtained, and held ready at Hong-Kong, for sick or wounded who might be sent from the front.

Cases of comforts.—Assorted cases of comforts, were sent to individual regiments, and a similar arrangement might with advantage have been made with regard to medicines.

Weakly left.—Before advancing from Hong-Kong, all sick and weakly men were left behind.

Increased scale of rations.—The men who went to the front were put upon an improved scale of rations, and provided with lime juice.

Landing at Talienwhan.—The force landed for a time at Talienwhan, in order that its organization might be tested. On its re-embarking, there being

no houses fit for hospital purposes, a ship was therefore converted into a floating one, and occupied at once. Hospital marquees were also pitched, and a hospital established on shore.

Landing at Pehtang.—On first landing at Pehtang, a small steamer was made use of to convey the sick from shore to the hospital ships.

Hospital ships—their proportion.—The hospital ships were for the British "Mauritius" and "Melbourne." "Sir William Peel" and "Lancashire Witch."

For natives and followers, there were four additional vessels fitted up for hospital purposes, *i. e.* :—One vessel for every 4000 British. One for every 3000 Asiatics (Indian and Chinese) or say, in brief, one for each division.

Advance.—On the advance inland from Pehtang, the men had with them 3 days' salt provisions. A small hospital was left with other stores under a guard, to receive sick from the front. In their operations through mud and wet, the troops having to bivouac; a midnight meal of coffee and bread, or of tea was given : and at night an extra glass of grog.

That the regimental and perhaps divisional hospitals accompanied the force, appears from the fact of the wounded in the first action fought, having been immediately attended to.

The next advance was made by means of gun boats up the Peiho River; sick and wounded to the number of about 200 being first sent to the Hospital ships, a basis of operation was at the same time made of the captured forts.

Proceed inland.—The body of the force then marched inland; each man carrying his knapsack; except those of one division whose knapsacks were sent by the gun boats.

Alum.—Alum was freely used to clarify the water obtained only from the river.

A General Hospital.—A general hospital was formed at Tientsin prior to the first advance from that place.

Field equipment per man.—Each man had now a blanket and a great coat, wore a flannel shirt and a cholera belt.

At Pekin.—On reaching the capital, temples and empty barracks were occupied by the troops. Sick were thence sent down by river in native boats, to Tientsin: and by gun boats from the latter place to the ships. The short land journey, 7 miles to the boats, was performed by means of doolies, cacolets, and carts.

Occupation of Tientsin.—The army of 3,000 destined subsequently to occupy Tientsin was first carefully weeded of sick and weakly: houses and public buildings were then taken up for it.

The conclusions arrived at by Dr. Muir, c. b., from the experience of the war in China, may be briefly enumerated thus:—

1. That in a campaign, the regimental and the general hospital system must be both worked.
2. That a certain proportion of ships for the sick must be employed.
3. That the transport should be under an independent officer of rank; that the ordinary allowance should be given to each department, and that the baggage waggons might be so designed, as to suit this purpose, and also that of an ambulance.
4. He thinks hospital ships should be more under military, and less under naval command then they are.
5. That the dooly or litter form the best transport (when human labour can be made use of).
6. That the new panniers, convertible into an operating table are excellent.
7. That the field companions are invaluable.
8. That medicines and comforts should be put up for the field in assorted packages.
9. That the new scale of hospital diets is too complicated for use on service.
10. That flannel clothing is best suited for service.

11. That quinine as a prophylactic, has not yet been tried so as to give reliable results.

12. He thinks the present scale of supplies too large. But it should be borne in mind, that the China campaign was short, that it took place in the most favorable portion of the year, and that in no action were the casualties numerous. He remarks however, that the medical comforts are needlessly varied.

13. He states that medical stores of all kinds sent from England, whether addressed to the military store or purveyor's department, should be kept separate from the heavier munitions of war.

14. That much of the field equipment: as for instance bedsteads, might be much ligther than they are.

15. That medicine chests are an encumbrance, and should be left behind.

16. Cork mattrasses and water-proof covers do not answer in hot climates.

CHAPTER XVI.

FIELD ARRANGEMENTS IN WESTERN AFRICA.

In 1848—Transport for sick—Canoes—Villages as halting places —Bowers—Fresh water.

In 1864—Provisions— Medical officers—Diet— Dr. Gardiner's account.

West coast of Africa.—In conducting the medical administration connected with a force operating near the coast line of a densely wooded and almost pathless country, such as is the west coast of Africa, it is evident that the measures necessary are very different in their nature from what would be applicable to an open country, intersected by numerous well-made roads and other means of communication.

In 1848.—It may be well to note the nature of the arrangements actually adopted on an expedition along the coast of Guinea in 1848. On that occasion, a force was quickly got together, and taken along the coast to a distance of upwards of 100 miles. It was necessary to charter a vessel for conveyance of warlike and commissariat stores, as well as for that of fresh water: and as the troops levied for the purpose, proceeded along the beach which formed the only means of communication, this vessel kept in the offing, within signalling distance.

Transport for sick.—The means of carriage for sick that were provided, consisted of hammocks slung upon poles; each end of the pole being supported on the head of a bearer: the contrivance itself similar to what in India is called a "dandy." No difficulty was experienced

in rigging up contrivances of this kind, as they were required; and, as in all barbarous countries, individuals of the very people against whom the expedition was undertaken, were readily obtained on hire to give us every assistance.

Canoes.—At some parts of our route, the bush extended to the sea beach—so thick that a road through it had to be cut to enable us to continue our progress: at others, rivers of large size interrupted the advance, as for example, the Encobra near Axim. Here a number of canoes, that had been provided beforehand and taken in tow by the vessel, came towards us by the mouth of the stream, and enabled us to cross.

Villages as halting places.—As village after village was reached, the inhabitants fled,—leaving us in possession: and here temporary halts, were made; our own commissariat being considerably replenished by supplies obtained on the spot.

Bowers.—Tents were not required under such circumstances: only on one occasion was artificial shelter needed, and a few hours sufficed to enable the natives to run up bowers of branches and grass, to protect them from the elements.

Undoubtedly the greatest want was that of fresh water; for only at a few and distant points could it be obtained. The plan we adopted consisted therefore, in obtaining a supply from the ship when forced to do so, and then the manner of sending it on shore was somewhat rude: a cask filled with it was simply thrown from the vessel into the sea while the tide was "making." It thus got speedily washed on shore, and persons being in waiting to receive it, it usually arrived in safety.

In 1864.—During the operations undertaken against the Ashantees in 1864, we learn that for a fighting force of about 450 men, a transport corps of about 1,000 strong was organized. These men seem to have conveyed all stores required by the combatants.

Provisions.—So far as the scale of provisions given to the men of the West India regiments employed on that occasion is concerned, it seems to have been liberal : thus each man had lb. 1 of biscuit, or lb. 1 of flour, or lb. $\frac{1}{4}$ of rice ; lb. 1 of salted or of fresh meat, or lb. $\frac{3}{4}$ of preserved fresh beef without bone. Fresh, or preserved meat was issued every other day ; the issue of biscuit, flour, or rice being varied as often as circumstances would permit.

There is no information available as to the water supply. This however, as the force advanced inland, became more satisfactory than on the former occasion it had been on the coast.

Medical officers.—With regard to the more purely medical arrangements : it appears, that for an entire strength of 1,400 troops there were at all times 6 medical officers, and at times 8 and 12 ; no doubt the troops being themselves African, they suffered comparatively little, except from the dracunculus ; but the proportion of the medical officers non-effective by sickness, was probably at no time less than fifty per cent.

Diet.—It seems that there was on that occasion no regular hospital diet, but that from the medical comforts, the sick obtained whatever was necessary. The purveyor seems as far as can be gathered, to have in this manner issued a diet consisting of bread lb.1 ; beef or mutton lb. 1 ; or fowl oz. 12; or fish oz. 12 ; tea oz. $\frac{1}{4}$; or coffee. 1 oz ; sugar oz. 2 ; vegetables oz. 4 ; rice oz. 3, with pepper, salt and butter. Thus it would not appear that much objection could be taken to these arrangements.

Dr. Gardiner's account.—In the Departmental Blue Book for 1863, is a report by assistant surgeon Gardiner, in which that medical officer gives some additional information regarding the recent expedition towards Ashantee.

He in that report mentions, that as regards transport, all stores for the expedition had to be arranged

in parcels of lbs 60 in weight, to enable them to be carried upon the heads of men; that in some cases larger and heavier weights, slung upon a pole resting on the heads of natives, one in front, the other behind, were carried: four men were sometimes thus employed, by placing transverse pieces of board before and behind.

Hammocks and bearers were supplied at the rate of fifteen per company; these followed to pick up men who were unable to walk. When the sick increased in numbers, they were sent to the coast as fast as hammocks and men could be procured for their conveyance. It was hoped that the river Prah itself could be made available for the purposes of transport, but this was found to be impracticable on account of the rocky nature of the bed of that stream.

The roads did not always admit of two persons walking abreast: they were in fact mere forest paths; the troops marched an average distance of 14 miles per day; one half the distance being performed in the morning, the other in the evening: and so dense was the forest through which the route lay, that on a village or other cleared space being reached, the light of the sun was felt to be oppressive,—as if a dark room had just been left, and the persons entered the dazzling glare.

Before commencing the afternoon march, the men received a ration of grog, in which a dose of quinine was also given; this was continued during a week, then left off for eight or ten days, then resumed, and so on.

The roads, when the periodical rains set in, became flooded; slight streams were converted into torrents, and these were found impassable, until canoes had been sent up from the coast: the sick had then to be ferried over, two and two. Accommodation along the line of paths there was none; drinking water was scarce, and for two days the men had none, except what they carried in their own tins.

Fresh vegetables and fresh meat were exceedingly scarce and insufficient, and until towards the end of

the expedition, the men were not supplied with bread, as there was no bakery in operation.

On reaching the left bank of the river Prah, the troops took possession of huts that had been already erected for them ; they immediately set to work to cut down plaintain trees and forest. On the ground thus cleared, *tentes d'abris* were pitched ; these however, were found to be unfit for permanent occupation ; the ground was damp, stumps of the plantain trees decomposed, and heavy rain at times fell.

The black soldiers who alone formed the expedition, began to erect additional huts; but being unacquainted with the requirements of the country, these were found incapable of keeping out the heavy rains that fell.

The huts erected for hospital purposes were speedily filled, and Dr. Gardiner states that there was not even at Cape Coast, equipment for more than 50 sick.

These particulars, in addition to those already given, will serve to explain the great difficulties by which the late expedition was attended ; and to point out to the army medical officer, those against which in this part of the world it is necessary to make provision.

CHAPTER XVII.

FIELD ARRANGEMENTS IN AMERICA.

In the Federal army—Hospital ambulance insufficient and unsatisfactory—Divisional system—Special instructions—Medical officers—Halt—Preparing for battle—During battle—Medical officers to the front—Preparatory measures—Field hospitals—Sanitary Commission supplies—Inadequacy of all—Railway ambulances—Transport ships—Hospitals—Extempore hospitals.
In the Confederate army.

The enormous magnitude of the armies engaged, and extent of country that was the theatre of operations during the civil war in America, have combined to render the experience gained there of extreme value; inasmuch as particular systems have been tested as they never were before, and both faults and excellencies that may not have hitherto been suspected, fully demonstrated. It is not now the object however, to do more than briefly allude to some of the points from which a lesson may most readily be learnt.

Hospital ambulance.—The following is the scale of transport for sick and wounded sanctioned by the United States Medical Board, *viz.*—

For less than three companies,—one two-wheeled cart for supplies, and one two-wheeled ambulance to each company. For three and under five companies,—two two-wheeled transport carts; and to each company, one ambulance as above. For a battalion of five companies,—one four-wheeled ambulance, five two-wheeled ambulances, and two two-wheeled transport carts. For each additional company less than ten,—one two-wheeled transport cart.

For a regiment of ten companies,—two four-wheeled ambulances, four two-wheeled transport carts, and ten two-wheeled transport carts.

Horse litters to be furnished to posts wherever they may be required for service, where two-wheeled conveyances cannot be used. Each litter to be 16 feet long, with a canvas bottom, the poles to be kept apart by head and foot pieces, dividing each stretcher into compartments of eight feet long.

The allowance of hospital attendants in the field, per company,—to be one steward, one nurse, and one cook; for each additional company,—one nurse; and for commands of over five companies,—one additional cook.

To each corps, three ambulances were attached: to each ambulance three men, namely—one driver and two stretcher bearers. Total, nine men to a regiment: commanded by a Non-Commissioned officer, mounted.

The regimental establishments when all consolidated by brigades, are commanded by a second lieutenant. The brigade ambulances when consolidated into divisions are commanded by a first lieutenant. Thus, the divisional strength is 1 first lieutenant, two second lieutenants, 15 sergeants, 135 men.

Three divisions consolidated, make one corps commanded by a Captain *under* the *immediate command* of the Medical Director.

To each brigade there is in addition to the above, one light medicine waggon, and one four-horse supply waggon.

On service, the ambulances encamp or park by divisions: the arrangement of the camp, grooming of the horses, and appliances to keep waggons and horses effective, being equal to those in an artillery camp. Minute inspections by officers are made weekly, discipline maintained, and the men regularly drilled in their duties. When a movement is ordered, the sick are all taken up by their respective divisions; the regimental waggons join the divisional trains, all following the divisions, and commanded by the ambulance officer; two medical officers, a steward, and nurses accompanying. Upon halting, the tents are pitched, and the hospital established.

When a battle is expected, and the division deploys into line,–the train halts in the rear. The stretcher bearers march into action with the regiments to which they belong. The Medical Director and captain of the ambulance corps is with the General commanding in the front. As soon as the position into which divisions are to be thrown is known, the medical officers communicate with the surgeon-in-chief of division. The hospitals are established, either of tents, or houses, or barns, if obtainable: the ambulances are drawn up between them and their divisions, and waiting orders. One officer of the ambulance train is with the division commander; one Non-Commissioned officer with each brigade. The medical officers who accompany regiments into action take position by brigades, in some sheltered spot. The ambulances are ordered up to it to take the wounded to the rear.

By another account of arrangements, it is stated that before an action, there is established in each corps, a hospital for each division; the position being selected by the Medical Director of the corps. The organization of each hospital consists of 1. A surgeon in charge, an assistant surgeon to provide food and shelter: one assistant surgeon to keep the records. 2. Three medical officers to perform operations, three others as assistants to them. 3. Additional medical officers: stewards, and nurses.

The duties of these various officers are still further detailed: thus, the surgeon in charge has general superintendence, and is responsible to the principal medical officer of the division. The latter details one assistant surgeon, whose duties are to pitch hospital tents, provide straw, fuel, water, blankets, &c., and organize a kitchen; the cooks, stewards, and nurses being under his orders. Another assistant surgeon keeps the records of cases, and sees to the interment of those who die.

The P. M. O. of division, under orders of the Medical Director of the corps, selects three medical officers as

operators, upon whom rests the responsibility of all important operations. Three other medical officers are also detailed as assistants to them. The remaining medical officers of the division, except one to each regiment, are ordered to the hospital to act as dressers and assistants generally.

It would appear that with reference to strength of troops, the allowance of hospital ambulance was originally at the rate of one waggon for every five hundred effective men. This was after a time modified ; one waggon being allowed to every 500, up to a strength of 1,500 : making in all three waggons. But beyond that strength, one additional waggon only was sanctioned for every 1000 in a brigade.

This allowance was found insufficient to carry the necessary equipment for regimental hospitals. Hence, these had to be broken up prior to the commencement of a march. They are said not to have worked in a satisfactory manner, but that is not to be wondered at when the reason appears. It would seem, for instance, that the waggon train conveying the regimental hospital equipment, sometimes went into camp, many miles in rear of the troops to whom it belonged,—while the sick were retained with their regiment. It is clear however, that this does not demonstrate the defects of the regimental system itself. It only indicates the faulty manner in which that system was carried out.

Divisional system.—As a substitute for this system, one hospital was established for each division—to travel in rear of the troops. This was called the ambulance hospital : attached to it were a surgeon and two assistant surgeons, one of the latter being *recorder*, the other providing food and shelter for the wounded : medicines were drawn from the brigade supply waggon of the division ; one waggon being laden with reserve articles of the kinds most needed during action.

Special Instructions.—The instructions regarding the arrangements for particular divisions were very

explicit, and so far as they could be carried out, satisfactory: here for example are a few:—

Three or four army waggons with tents and "flies" for shelter will accompany them. The remainder of the waggons allowed for departments, are to be loaded with regimental hospital property, and may or may not march with the troops, as they cannot be used until the troops go into standing camp. The ambulances each carry lb. 12 beef stock, 6 cups, spoons and plates: a lantern, candle, camp kettle, &c. One ambulance is given to bodies of under 200, two under 500, and three to stronger bodies.

Medical officers.—To this train of ambulances, hospital and army waggons, are 3 medical officers, as already noted, and 12 attendants. The whole to march in rear of the troops; picking up men who fall out.

Halt.—At night, as many tents as are required, are to be pitched under the orders of the surgeon; stretchers, bedsacs, blankets unloaded: medicine chest opened, and cooks set to work. Next morning, the sick are replaced in the ambulances, tents struck, &c., and the train starts in rear of the marching column.

Preparing for battle.—When the troops are forming for action, the Medical Directors and surgeons-in-chief of divisions make themselves acquainted with the ground: and having done so, they ride to the rear to locate the hospitals. They select the best and most sheltered places they can, and establish as far as practicable, free lines of communication for ambulance from front to rear; a matter which under some circumstances becomes very difficult.

During battle.—The ambulances having been unloaded, they will hurry to the front on the first blow being struck: as they proceed, they will suspend small yellow flags, so as to serve as guides for men able to walk to the hospital. Having arrived within about 200 yards of the front, the ambulances will halt in some sheltered place, to which the stretcher bearers will carry

the wounded. Two or three medical officers from each brigade will report themselves at this depôt, to make temporary dressings : but, if possible, no great operation is to be performed until the patient reaches the field hospital.

Each ambulance as loaded, will drive off to the field hospital ; and meantime, it is expected, that the tents of the latter shall have been pitched, operating tables, kitchens, &c., arranged. All medical officers of divisions, except those detailed to accompany their brigades into action, will now attend at the field hospital ; bringing with them their nurses, drummers, and bandsmen, to act as orderlies.

Medical officer to the front.—One medical officer of each regiment was not, as with us, sent to the front. Two or three to each brigade were deemed sufficient.

The writer from whom we quote, gives some particulars in regard to actual arrangements, prior to, and during, a battle, which may serve as useful guides under similar circumstances.

Preparatory measures.—Some recruits having joined immediately prior to an advance and become attacked with small pox, the cases of this disease were isolated. The sick and all men unfit to march, except those trivially ill, were sent to the rear.

All the waggons, &c., were inspected to ascertain that they were complete in every thing ; the purveyor was directed to have in attendance, waggons containing additional medical comforts. All necessary repairs had been effected in the waggons, a full supply of stretchers, guidons, &c., obtained. The men for service in ambulance corps examined as to their physical fitness ; arrangements require also to be made for army waggons to report at stated times at the field hospitals, so that wounded for conveyance to the rear may be held in readiness, and other arrangements made.

Field Hospital.—A very excellent suggestion is obtained from one of the arrangements adopted in

America, namely:—that medical officers, as they arrive, are sent with field hospitals, to obtain practical knowledge of their working, before being themselves put upon independent duties. The field hospitals accompany the army in its advances and other moves; the position taken up by them being indicated by a guidon during the day, and green lanterns by night, a method of distinguishing such places, that might with advantage be adopted in other armies.

Sanitary Commission supplies.—In addition to the Government allowance of transport with the army, there was with each division, an ambulance filled with the stores of the Sanitary Commission; and we learn, that on each occasion when an advance was about to be made, the sick and wounded were left behind. This arrangement much facilitated subsequent operations: but it is obvious, that it is only under exceptional circumstances that an army could adopt it.

Inadequacy of all.—Notwithstanding all means adopted however, both by the Government and by the Sanitary Commission, it is plainly stated that the means of land transport were inadequate for all the requirements of the army. The want of light spring carts with one horse, so constructed as to be readily drawn past, or through the army trains that obstruct the approaches to the battle field, was severely commented upon. Indeed it would seem that but few improvements have been effected in the ordinary ambulance during the war: and it has even been plainly asserted (Medical Times and Gazette, 23rd July, 1864) that vast numbers of victims of battle perished in consequence of the defective manner in which they were transported.

Railway ambulance.—Upon the various railroads communicating with the armies and hospitals: were twelve or more hospital cars in daily use, all fitted up with special reference to the comfort and safety of the patients. These railway ambulances have all the furniture and appliances of a good hospital; the beds are so adjusted by means of

india-rubber tugs as to give security and ease : there are special arrangements for ventilation and light : ample stores of bedding, clothing and comforts : a culinary apparatus, and ample store of water. They have moreover, the great advantage of being so fitted, as to run upon different gauges of lines of railway.

Those constructed under the directions of the Sanitary Commission, were 41½ feet in length by 8 feet 7 inches in breadth ; each carriage being capable of conveying 24 men in beds, 4 on sofas, and 6 on easy chairs : besides a surgeon and three attendants.

Transport ships.—Transport and hospital ships were provided in large numbers by the Federal Government. These were, however, in many instances overcrowded, and in numbers insufficient. In opposition to all sanitary rules, the sick and wounded in them were packed in three tiers of berths. Hence, it is easy to understand that one of the very ships which had during the Crimean war, been similarly employed by the British Government, and on that occasion, not deemed capable of accommodating 360 sick,—had now 1000 crammed into her.

In addition to these, a certain number of vessels were also fitted out and equipped for their purpose by the Sanitary Commission. These consisted of *a*, Sea steamers for passages outside, *b*, Coast steamers which have to make a harbour on the approach of bad weather, *c*, Coast steamers which should not run outside, and *d*, Sailing ships adapted to be used as stationary hospitals, or to be towed outside.

Hospitals.—A remarkable confirmation of what has been stated by Dr. Jackson ; and various writers on the medical history of the Peninsular War, in regard to the disadvantages of large hospitals, occurs in a communication by an American correspondent, quoted in the Medical Times of July 23rd, 1864. Writing from Fredericksburgh, he gives a sad account of the accommodation provided for the wounded : and the consequent ravages of pyemia, erysipelas, and tetanus.

He is convinced that in the then fine condition of the weather, it would have been far better for the severely wounded to have been left exposed to the open air on the adjacent hills, instead of being agglomerated in filthy deserted old buildings. Many of the hospitals established both by Government and by the Sanitary Commission, were undoubtedly magnificent institutions, but that certain evils arose from their very dimensions, is a fact that has often been remarked upon by correspondents on the spot.

Extempore Hospitals.—As is always the case on military service, hospital accommodation had often to be extemporised, and a very excellent contrivance of this description is described by some of the writers already quoted from. It consisted of a frame work of trees: the roof was formed by tarpaulins, the sides, of old tent canvas. We learn that this simple contrivance was a great success: and that from the readiness and completeness with which, by opening the ends and sides, ventilation could be effected, it was found to be the kind of hospital best adapted for the summer season.

Confederate army arrangements.—According to Dr. Chisholm, there are two kinds of ambulance waggons in use in the Confederate army, namely:—one of four wheels, and one of two wheels. The regulated numbers of these conveyances for a regiment,—are two four-wheeled ambulance waggons, ten two-wheeled, and four two-wheeled hospital transport carts.

He states however, that the authorised number has in reality, never been received: often there were no more than one waggon for conveyance of hospital apparatus, and one four-wheeled ambulance.

Dr. Chisholm speaks strongly of the injury to wounds caused by removal by these ambulances, but doubtless, this result in some measure arose from the insufficient amount of conveyance; for it is expressly stated, that during the war in Italy in 1859, where sick and wounded were removed long distances by

rail, an absolute benefit to them arose from this transportation.

We further learn that in the Southern army, the ambulance corps consists of two men from each company of a hundred men ; those of each regiment being under a sergeant : and it appears that the men are as far as possible, taken from soldiers who may have studied medicine.

CHAPTER XVIII.

FIELD ARRANGEMENTS IN INDIA.

Scale of transport—Ordinary marches—Field service—Madras Rules—Equipment—Transport of equipment—Wines—"Comforts", medicines, &c., how best arranged—Hospital bedding and clothing.

Medical establishment—Subordinate establishment—Servants tents—Carriage for do.—Tent pitchers—Hospital clothing—Carriage for do.—Hospital cots—Doolies—Medicines—Wines—Stationery—Cloth—Cooking utensils—Instruments—Necessity for a cutler—Operating tables—Water.

Actual amount of carriage—For a troop of artillery—A regiment of cavalry—A regiment of infantry.

Transport of sick and wounded—In hilly country—Authority of P. M. O. should be supreme—Litters—Sikh war, narrative of—Base—Field hospital—Threatened epidemic—Weakly men sent to the rear—Chilianwallah—Regimental hospitals—More men sent to the rear—Goojerat—Pursuing force—Regimental hospitals completed—Total sent to the rear—Medical depôt.

Particulars of the field hospital—Medical officers—Wounded—A standard of comparison—Wine from the Commissariat—Period for which stores are to be provided—Number of boxes—Casualties.

SCALE OF TRANSPORT.—The regulations regarding the scale of carriage and field equipment for regiments in India are different in the different Presidencies.

ORDINARY MARCHES.—During ordinary marches in Bengal, conveyance for sick is provided in the proportion of five per cent. to strength; it being understood that the severe cases are left behind by a regiment commencing its march; or if from particular circumstances they accompany it, that conveyance for such cases shall be obtained over and above the regular quantity.

FIELD SERVICE.—Under ordinary circumstances of field service, the amount of conveyance provided is in the proportion for the sick of ten per cent., but, under

particular circumstances, as for example on the recent expedition to Bhootan, conveyance was allowed in the proportion of 12 per cent., it being made up partly by doolies, and partly by dandies.

Madras Rules.—According to Madras Rules, the amount of carriage sanctioned, is in the proportion of ten per cent. under all circumstances ; being partly in doolies, and partly in carts, each of which carries four sick.

Equipment.—Under the regulations now in force, a regiment in India takes to the field, full equipment for sick, at the rate of 15 per cent. to strength.

There are allowed for the accommodation of this amount, 10 large sized "Regulation" tents for the sick : 2 more for the protection of stores, and 2 "palls" for other purposes. There is also a tent allowed to each of the Steward and Apothecary, and one to every two of the other grades of warrant officers connected with the hospital.

Transport of equipment.—For the conveyance of these and the stores, we have the following carriage, namely :—

For carriage of tents...	...	...	19 camels.
Hospital establishment	...	...	3 „
Apothecary's stores	...	...	7 „
Steward's stores ; *i. e.*, bedding, clothing, wines, &c.	On service...	41	„
	On ordinary march ...	25	„

Being in all, for a full regiment on service 72 camels.
For one on ordinary relief .....56 „

Wines, &c.—On proceeding on field service, a regiment is by regulation required to have in its possession for the probable requirements of its sick and wounded, liquors equal to the equivalent of 40 dozens of wine—one bottle of wine being considered equal to three of malt.

This estimate presumes that for every 1,000 sick in a force, there will be expended monthly 88 bottles of spirits, 485 bottles of wine, and 117 dozens beer.

"COMFORTS."—For the sick of one regiment the monthly expenditure of comforts is estimated as follows:—*viz.*—arrow-root lbs. 25, sago lbs. 25, sugar lbs. 75, bread or biscuit lbs. 36, tea lbs. 12, lime juice 4 dozens, barley lbs. 10, coffee lbs. 20, rice lbs. 30, and mixed spices 8 ounces.

For regiments therefore that are liable to be called out suddenly on service, and most assuredly for those that form parts of a moveable column, panniers with supplies according to the above-named scale should be always held ready.

MEDICINES, &C., HOW BEST ARRANGED.—Medical officers of experience in India, are of opinion that, for service, these medicines and equipment should be field arranged separately for wings of a regiment. By this means the hospital establishment would be ever ready in case of a detached force having suddenly to be formed.

It is also considered that even with the present organization in India, a regiment proceeding on field service in that country might, with advantage be provided with one or two couples of panniers, such as are used elsewhere; a pair of these weigh only lbs. 180,—are a light load for a camel or mule, and would be of inestimable service during action, and the desultory warfare in which regiments in that country have so often to take part.

HOSPITAL BEDDING AND CLOTHING.—So great has been the inconvenience in India that has practically arisen from the system of each regiment carrying with it the entire establishment of its clothing and bedding, that medical officers have applied in such circumstances for, and obtained permission to, have a certain proportion of it taken back into store: and have only retained the mattrasses with which the doolies are provided. This in fact, is an endeavour by them to adopt the system in use in the Home service.

Not only is it inconvenient and expensive to carry about in this manner the entire hospital clothing

and bedding, but the whole of these are not used, they are much injured by wear and tear,—and are, in too many instances, found from their bulk and difficulty of conveyance, a source of embarrassment during military operations. There is every prospect however, that before long, the system now in force will be replaced by one more efficient.

The only one advantage possessed by it is, that on field service, the present system enables a medical officer to form a hospital at any time, by merely detailing the necessary proportion of hospital equipment: but a similar facility might be equally attainable were the whole required for individual forces, arranged under a particular department for the purpose, as in the Imperial army. Regiments would then be left unhampered by unnecessary baggage: and yet, what might become actually requisite, would be readily procurable.

With regard to the actual requirements and arrangements during times of war, it is deemed that an account of what really has been done under such circumstances, will be far more serviceable as a guide than would a bare recitation of what is necessary,—and fortunately, such an account is given at length in the Indian Annals of medicine.

2ND SIKH WAR.—In his valuable report on the medical arrangements for the army of the Punjab, during the 2nd Sikh War, Dr. Rennie, C. B., gives details as to the establishment he considers necessary for proportions of 100,—200,—and 300 sick. These notes of his are so valuable, that they are here extracted, in so far as they refer to British troops.

For a general hospital and over and above the regimental establishments, he recommends the following, *viz.*—

MEDICAL ESTABLISHMENT.—1 field surgeon,
4 or more assistant surgeous, the senior to be medical store keeper.
1 apothecary.
2 assistant apothecaries.

1 steward.
2 assistant stewards.
4 or more apprentices.

Means should be available to have these reinforced as occasion may require.

SUBORDINATE ESTABLISHMENT.—

1.—*For Medical Department.*

...	100 sick	200	300
Head compounder	1	1	1
Assistant ditto	1	2	3
Head dresser	1	1	1
Assistant ditto	1	4	6
Shop coolies	2	3	4

2.—*For Stewards Department.*

...	100 sick	200	300
Native writer	1	2	2
Stewards servant's	2	3	4
Bheesties. Sirdar and 1 mate.	1	1	1
Bheesties. Ordinary	6	12	18
Sweepers. Sirdar	1	1	1
Sweepers. Ordinary	8	14	21
Ward coolies. Sirdar and 1 mate.	1	1	1
Ward coolies. Ordinary	20	36	53

3.—*Servants.*

Head cook ...	1	1	1
Ordinary ...	4	8	12
Head washerman	1	1	1
Ordinary ...	4	8	12
Clothier ...	1	1	1
Assistant ditto	0	1	1
Tailors ...	2	2	2
Barber ...	1	2	3

4.—*Tents.*

Field hospital tents	1	2	2
New pattern privates' tents, 16 men to each	6	12	18

No more than 8 sick or wounded men should be in one tent. Hence, this proportion is too small.

Staff sergeant's tents for subordinate establishment	6 ...	6 ...	6
Rowtees for necessary tents	6 ...	6 ...	6
Ditto small, at 2 per camel load	6 ...	6 ...	6
Tarpaulins for tents ...	9 ...	18 ...	26

5.—*Carriage for the above.*

Elephants	1 ...	2 ...	2
Camels	17 ...	46 ...	52

6.—*Tent pitchers.*

Clashies	15 ...	24 ...	30
Bildars	5 ...	5 ...	8

7.—*Hospital clothing.*

Suits	100 ...	200 ...	300

There evidently should be double the amount here noted.

8.—*Carriage for ditto.*

Hackeries	9 ...	18 ...	26

(3 camels=one hackery.)

Steward's stores for 50 sick are about a load for 3 hackeries or 10 camels; thus, in reality one camel may be considered necessary for equipment of every five sick persons.

8.—*Hospital cots.*

If stationary ...	100 ...	200 ...	300
Hackeries, if to be moved	5 ...	10 ...	15

9.—*Doolies.*

Doolies	100 ...	200 ...	300

Dooly bearers.

Sirdars	6 ...	12 ...	18
Mates	12 ...	24 ...	36
Bearers	600 ...	1,200 ...	1,800

10.—*For Medicines.*

Camels	2 ...	4 ...	6

Hackeries...	... 1	... 2	... 2
Banghy men, for carrying petarahs	2	... 2	... 4

11.—*Wines.*

For 2 months	... 30 doz.	60 doz.	90 doz.

Carriage for do.

Camels ...	... 3	... 6	... 9
Chests ...	... 6	... 12	... 18

12.—*Stationery.*

Rate per month, as for	... 1 regt.	2 regts.	3 regts.

13.—*Cloth.*

For bandage	500 pieces.	1000 pieces.	1000 pieces.
For dressing	400 „	600 „	600 „

Carriage for do.

Camels ...	... 1	... 2	... 2

14.—*Cooking utensils.*

Utensils as for	... 1 regt.	2 regts.	3 regts.

Instruments.—In the above, there is strange enough, no mention made of instruments: similar scales to the other articles ought to be brought of instruments and appliances,—with spare articles to keep up the amount with regiments, and to provide detachments going to the rear.

Necessity for a Cutler.—It is also very necessary that there should be a person available, who could repair these if necessary: and that as in the French service, he be provided with all requirements for his vocation,—and means of transport. He would be directly employed under the medical store keeper.

Operating tables.—There should be a supply of operating tables with general hospitals, and also with individual regiments, and of litters, if available: the most convenient mode of conveyance for these is by mules—one mule will carry 2 litters, and one operating table.

Water.—Mules or camels with ox-skins for conveying water should, also in India, be with each field hospital.

It is evident in the above arrangements that all comforts and purveyor's stores are supposed to be conveyed and kept in stock by the Commissariat.

ACTUAL AMOUNT OF CARRIAGE.—The actual amount of carriage per regiment or corps during the 2nd Sikh War, was as follows :—

1.—*Per Troop Horse Artillery.*

10 camels for steward's stores.
1 banghy bearer } For apothecary's stores.
1 camel }

2.—*For a regiment of Cavalry, viz., 3rd Lt. Dragoons.*

1 hackery } For steward.
23 camels }
1 banghy bearer } For apothecary.
7 camels }

3.—*An Infantry regiment, viz., 24th Foot.*

24 camels ... For steward.
13 camels ... For apothecary.

61*st Foot.*

1 hackery ... } For steward.
40 camels ... }
11 camels ... For apothecary.

NO RESTRICTION.—It is to be inferred from the above that no actual restriction existed in regard to carriage, and it is evident that vast quantities of stores were carried that could have been of no use. They could only have encumbered military operations.

TRANSPORT OF THE SICK AND WOUNDED.—Dr. Rennie considered that wheeled carriages might be substituted for doolies : and that in the Punjab, carriages on springs, each capable of holding 8 to 10 men sitting, might be used.

IN HILLY COUNTRY.—For the hilly tract north of the Jhelum, however, this would not suit, and for warfare in that part of India, Mr. Rankin proposed a kind of kajawah. In each of them, one, or under certain circumstances, two wounded men might lie. A train of 100 or 200 camels thus provided, would render an

army independent of other means of transport to meet casualties in the field.

Authority of P. M. O., should be supreme.—It seems essential in warfare in India, as in other countries, that the authority of the P. M. O. be supreme in matters connected with transport; and that correspondence and requisitions be simplified as much as possible, in regard to this and all other points of his duty.

Strength of the force.—Regarding arrangements for the 2nd Sikh campaign, Dr. Rennie informs us, that provision was in the first instance made for the probable sick and wounded of a force, consisting of 6,400 British, and 13,600 native troops, in the relative proportions of 200 of the former, or 3 per cent., and for 300 of the latter, or about 1·4 per cent. It is evident however, from the context that these were over and above the full regimental establishments.

Subsequently, the force was increased, chiefly by the addition of native regiments to about 25,000 strong, and accordingly the hospital establishments had to be increased in proportion.

Base.—The base of future operations having been fixed at Ferozepore, here it was arranged that the medical depôt and field hospital for the force should be formed.

Field hospital.—Some particulars relative to the nature of the establishments of various kinds that were here collected, may be of interest.

Thus, medical officers and medical subordinates were held in readiness to be sent to the front as desired; a store of wine sufficient for 5,000 British troops for six months, was held in reserve, as was a similar supply for the same period, of other articles of "comfort" that were likely to be required.

Attached to it there were also 383 doolies, with their allowance of men, namely:—26 sirdars, 52 mates, 2,520 bearers; and, in addition to these, there were for the conveyance of sick, 10 hackeries or carts of the country with four bullocks each.

Of tents there were the following, *viz.*—

New pattern soldiers' tents	17	...	2 for stores, 15 for sick.
Field tents, large	4	...	for sick.
Rowtees.	9	*viz.*,	1 for post mortem examination, 1 for steward's office, 1 for cooking, 1 for dispensary, 5 as privies. Small privy tents—6 for medical subordinates. Staff Sergeant's tents—4 ; Sepoy pall tents 6, *i. e.*, tents made of four palls each, making a total of 24 palls.

The other establishments included operating tables and medicine chests, made so as to fit into each other, 20 sets. Each set forming a load for a camel.

Of means of transport for the sick and wounded, besides the doolies and hackeries already mentioned, there were 50 charpoy litters, capable of being used as doolies on the field, and as bedsteads in tents. There were also 4 hackeries of four bullocks each for the conveyance of medical stores : and 8 elephants for conveyance of the large hospital tents. Of camels, there were 204 for the transport of tents and stores : but it is clear that the medical officer had by his previous experience been taught, that in India no means of transport that has hitherto been discovered, is for the conveyance of hospital tents so certain and rapid, as that by elephants.

Wine, beer, and other articles of "comfort" had been obtained from the Commissariat department ; the P. M. O. took care however, to see that the quantities of each article were sufficient, and the means of conveyance of them strictly satisfactory.

Similar steps were taken to see that there were no short comings in the numbers of servants : namely, cooks, tailors, washermen : the usual hospital servants, a harness maker, blacksmith, carpenters, &c.

Spare articles of equipment were seen to ; including a large supply of nails, rope, deal wood, light, fire, and tinder.

The whole of the medicines and stores connected with the field hospital, were packed by way of testing the establishments: and we learn, that they were so in 94 boxes, thus forming loads for 47 camels.

The fact was also borne in mind that whatever supplies were likely to be needed in the front, during the succeeding six months, would have to be supplied wholly by this hospital.

The field hospital being thus arranged, and other medical establishments brought into working order, these were ready to take their part in the operations that were about to take place; and the first occasion on which they were tested, soon occurred at Ramnuggur. The tents of regimental hospitals had not come up, and here, on the field, a part of the field hospital was pitched for the reception of sick and wounded,—officers and men. On the following day, when the action of Soodalpore was fought, however, this hospital instead of following the army, remained as it was, on the left bank of the Chenab; receiving wounded from the front.

Threatened epidemic.—Fear began to be entertained that small pox was about to attack the troops: a part of the field hospital was therefore arranged for the reception of cases of that disease. Means were also taken to send to the rear all sick and wounded; thus 51 Europeans and 22 natives were in this way sent, and the hospital was soon cleared. Having been cleared, it crossed the Chenab and joined the main army.

Chillianwallah.—In the jungly ground on which the battle of Chillianwallah was fought, the doolie bearers would not go forward; hence, the wounded suffered severely, and were left on the field.

Regimental Hospitals.—The advantage of having regimental hospitals, became on that occasion apparent; each was able to afford some aid to the wounded of their own regiments.

As soon as possible after the action, and in order to lighten the army for the further operations that were

before it, arrangements were made to send to the rear all the wounded and weakly men. Accordingly there were selected with this view, 267 British, 360 native sick, and 40 officers,—from the eight English and thirty native corps that formed the original force.

This party had to be provided with clothing, bedding, hospital servants, medicines, instruments, Commissariat supplies, tents, doolies to the number of two hundred,—four medical officers (much too small a number) and medical subordinates. This was accordingly effected by the field hospital, without crippling regimental establishments.

Goojerat.—During the battle of Goojerat, the field hospital was pitched in rear of the right reserve, until it having become necessary for military purposes to form the attacking force into a new line, the hospital was moved to the rear of the artillery park. Here all sick and wounded of native as well as British regiments were received; those of the enemy, who were left upon the field, also receiving every attention.

After the action, a third detachment of sick and wounded was sent to the rear, consisting of 131 British, and 180 natives. Thus, there were disposed of in this manner, in the five months, from 1st November to 31st March, 449 out of a force of about 6,400 British,—and 562 out of a force of 13,600 natives; being a ratio of about seven per cent. of the former, and about 4 per cent. of the latter.

Pursuing force.—The column sent in pursuit of the Sikhs towards Peshawur, was in addition to regimental establishments, furnished with 91 doolies and 2 medical officers from the general field hospital. A field hospital for this force was also formed, capable of receiving 300 to 400 sick.

Connected with it were 1 field surgeon, 1 medical store keeper, 11 assistant surgeons, 1 sub-assistant surgeon: or, in fact, establishments in these respects of about equal to that for three regiments and a half.

Thus provision was made over and above that of a regimental nature, for about 5 per cent. of sick, taking the estimated strength at 25,000. It is evident however, that the hospital establishment on this occasion would scarcely have been sufficient, had the retreating enemy stood at bay. The total number of doolies with the hospital was but 420. On a previous occasion 790 men sick or wounded had to be sent to the rear: thus had a similar necessity now occurred, regimental establishments must have been taxed beyond their capabilities.

So also the staff of medical officers would have been insufficient, had an action of importance taken place. Had for instance a similar number of casualties again occurred, there would have been but one medical officer to 57 sick or wounded; even presuming, which is not likely, that all of them would have continued fit for duty: whereas at least one to thirty-five cases should have been provided.

CHAPTER XIX.

FIELD ARRANGEMENTS IN NEW ZEALAND.

Value of experience gained—Aspect of the country—Military character of Maories—Rate of sickness—Rations—Cooking—Tents—Bedding—Clothing—Boots—Gaiters—Transport—Hospital arrangements—Hospital diets—Purveyors.

VALUE OF EXPERIENCE GAINED.—The late military operations in New Zealand have been fraught with value to the army medical officer, who desires to turn to account hereafter the valuable experience furnished by that war; for as elsewhere observed in this volume, the particular arrangements entered into to meet the requirements of sick and wounded during a campaign must be modified to meet the physical aspects of the country in which the operations are carried on,—as well as the national characteristics as a people of the enemy against whom they are directed.

In both these respects New Zealand may be said to have opened up a new field: and as we shall presently see, the nature of the arrangements that were required in order to meet the conditions attendant on the campaign, were in their nature, more or less different from those that became necessary either in war against an European enemy or an Asiatic, whether Indian or Chinese. That some degree of similarity between the conditions of military service here and in Africa exists, will be seen on reference to the chapter on the latter; but it is to be observed that one very great and material difference exists between the circumstances of the two countries, inasmuch as the climate of the one is salubrious beyond any other country in the world: that of the other, deadly in a like proportion.

In preparing this chapter, the author has been courteously favored by Staff Surgeon Home, C. B., V. C., with the information upon which it is based: this medical officer was field surgeon during the war against the Maories: and thus had ample opportunity of becoming acquainted with the nature of arrangements, as made by Inspector General Dr. Mouat, C. B., V. C., principal medical officer in the command; the author also consulted the Report by the latter, published in the fifth volume of the Departmental Blue Rook.

Aspect of the country.—The country in which the war was carried on, presented great difficulties to an invader: it for the most part consisted of fern covered plains, cut up by winding ravines, the sides of which were usually covered with wood, and at the bottoms of which ran sluggish streams, that every now and then spread out and formed morasses.

In these morasses, the New Zealand flax, and a high grass called Toi-toi flourished; here and there, patches of forest occurred; the trees and "bush" were covered with wild vines or "bush ropes," as they are called in the country; thus rendering the forest quite impenetrable either for native or European, except by the slow operation of cutting roads or pathways through them.

The fern varied in height: on good rich soil it was high enough to conceal a man on horseback, but ordinarily was not more than three feet high. The labor of skirmishing through such "cover" was incredibly severe; a hundred yards of such work would exhaust a weakly man; and, in this kind of warfare, our soldiers while skirmishing, could not at times see the men on either side of them.

In the valley of the Waikato river and at Wanganui, the army in its march had to follow the native tracks, all of which lead with undeviating straightness, and by the shortest way over the tops of hills and down ravines; there were in the first portion of the

campaign, no other roads than these: and, although after a time, the river itself came to be used as a medium of communication, it is stated that at the outset of the operations, the one great difficulty to be overcome, was in regard to transport.

The villages of the natives occur at intervals along the banks of that river: adjoining each village was a piece of cleared and cultivated land, sufficiently large to provide for the wants of the villages: and in the river, were at each a number of canoes that became available for transporting stores and men, so soon as the places fell one by one into the hands of our troops.

These villages also afforded some small store of potatoes and fruit, but in other respects became sources of injury to the force: men would keep rummaging among the deserted huts, and carrying away with them blankets found lying about: they became thus infected with severe and inveterate forms of itch.

Military characteristics of the people.—The New Zealanders as a people are said to be deficient in all military qualities, except in indomitable intrepedity. They seldom give quarter to an enemy, although instances are recorded of the most chivalrous conduct on their part, in this respect; they themselves when wounded and brought to our posts, give themselves up to despair: and unless speedily restored to their friends, pine and die.

The men are armed with double barrelled smooth bore muskets: their custom was from their hiding places to endeavour to shoot down with the first barrel, whoever approached them, failing in this, the second barrel was reserved; meantime the startled soldier fired wildly; the Maori had nothing to fear; he aimed steadily and at leisure, and thus were many of our men and officers lost. No person could tell what tuft of fern did not conceal a Maori: and hence, the only chance a single officer had in traversing from post to post, was by riding the fastest horse procurable.

In addition to the musket, many carried the tomahawk, with which, in single combat, they are said to have often been able to successfully contend against a soldier armed with the rifle and bayonet. A well directed blow of their national weapon is necessarily fatal.

Another peculiarity of the people during the late war, which deserves to be mentioned here, is that it was not only the manhood properly so called of the country, who took the field against us: but all classes joined, and both sexes, women and children, old men and boys, were all in the field: those who were unable to bear arms, were employed in carrying stores for them, who could.

Sickness.—With reference to the rate of sickness among the troops, Dr. Home observes, that although the climate of New Zealand is a splendid one: yet there were many cold days, and that occasionally the occurence of rain was the cause of much discomfort to the men employed on service: and not only so, but that it produced dysentery and rheumatism among them.

During the first year of the campaign, there was very little sickness; the average rate whether in the field or in quarters, being about 3 per cent. In the second year however, it increased considerably. As the army advanced, it became necessary to secure communication with the rear; posts were therefore established, and redoubts erected at distances of about ten miles; and inside these redoubts, detachments of troops were encamped, the baggage animals occupying "lines" outside. The men so left, suffered considerably from fever during the second year of the war. Some cases of hepatic abscess, and of sun stroke, also occurred.

As will appear under its proper head, the troops were supplied with a most liberal ration, one result of which doubtless was the circumstance that only one case of scurvy occurred among them. This is a very striking fact when contrasted with what took

place at the Cape of Good Hope, and is of such frequent occurrence in India, not only when troops are in the field, but when occupying quarters in cantonments.

Rations.—While the troops were employed in the field, the severity of the various duties they had to perform was so great, that the insufficiency of the ordinary ration speedily was rendered apparent; an increased scale of rationing the men during active service was accordingly adopted.

This scale consisted of the following articles and quantities, namely :—

Fresh meat lb. 1, or salt meat lb. 1, bread lb. $1\frac{1}{2}$, or biscuit lb. 1, potatoes lb. 1.

In case good potatoes were not at any time procurable, then preserved potatoes, 4 oz. If these were not obtainable, then rice, 4 oz., or compressed vegetables, 1 oz., or peas, $\frac{1}{3}$ of a pint.

In addition to these, each man had a daily allowance of onions, $\frac{1}{2}$ oz., or if onions were not procurable $\frac{1}{12}$ oz. of mustard, or $\frac{1}{3}$ oz. of pickles.

The daily quantity of tea issued per man, was $\frac{1}{6}$ oz., sugar 2 oz., coffee $\frac{1}{3}$ oz., pepper $\frac{1}{36}$ oz., salt $\frac{1}{2}$ oz. : and one gill of rum.

For the purposes of lighting, candles were issued at the rate of one for every five men ; and, for cooking, lbs. 10 of wood were allowed daily. It was seldom however, that the latter was required, as fuel abounded every where, and the men helped themselves.

Cooking.—Cooking was performed by means of camp kettles, the lids of which formed frying pans. According to Dr. Home, what is called the "Flanders" camp kettle, is too heavy for service, such as they were engaged on.

It does not appear that regular cooking places were erected; the men extemporised places for the purpose, and no inconvenience occurred from this arrangement.

Tents.—Tents were not used ; at least they were not in the early part of the campaign ; substitutes for

them were formed in gipsy fashion, or rather in one copied from the Maories; two blankets and a piece of stick as a ridge pole formed a *tente d'abri* which answered very well and kept out rain.

Later, after possession of the Waikato river had been obtained, and a basis of operations established, bullock and horse drays accompanied the different columns; but it was necessary for the troops, as they advanced, to clear roads for these conveyances, to travel along. Facines and bundles of fern thrown into marshes, formed a road across them: and ravines were crossed by cutting roads down one bank and up the other.

A plain statement of facts such as here given, will communicate a clear idea of the difficulties under which medical as well as military arrangements for a force are made, and executed under such circumstances. After it had thus become practicable to bring up tents for the use of the troops, the ordinary bell tent was issued in the proportion of one to every 15 men. This only admitted of each occupant having 40 cubic feet of space, an amount altogether insufficient for sanitary requirements: it was therefore subsequently altered.

In 1865, *tentes d'abris* of the new pattern were issued in the proportion of 3 per company: these were used by guards and picquets: and, as Dr. Home observes, the advantages to the men of this arrangement cannot be overstated.

Bedding.—Little or no provision in the shape of bedding was required; the men in health could readily obtain fern in any quantity, and this made an excellent and comfortable bed. Each man had his own blanket, and in winter, a second was issued to him.

The sick and wounded when being sent to the rear, were often similarly placed upon fern: when in hospital, slips brought on for the purpose were filled with the same material, and additional blankets from the hospital stores were given to them.

The common encamping blanket of the country was found to be coarse in material and insufficient

to maintain warmth. Dr. Home thinks that the blanket used by the bushmen, would be a valuable substitute; consisting, as it does, of a railway rug having a coating of india-rubber upon one side. It is more than questionable however, if such an article would be found any better adapted for use during war in New Zealand, than it has been said to be elsewhere. In other countries, nothing is found to answer so well as a thick English blanket.

Clothing.—Dr. Home states that the best dress he has ever seen used by British troops, was that adopted in New Zealand: it was a modification of the ordinary costume used in the Colony, and consisted of a serge "jumper" of loose fit, and blue serge trowsers. The men marched easily in this dress; it speedily dried after getting wet, and while light in material, it was at the same time warm.

It is stated that the white cap covers and white belts worn by the soldiers, by rendering them more distinct marks for the muskets of the Maories, were thus the cause of the loss of life unnecessarily. Both descriptions of equipment ought therefore to be abandoned while troops are in the field, and substitutes given, whose colour is less distinct.

Boots.—The description of boot that was found best to answer all purposes, was the "Daubeny." Its principal peculiarity is that the sole is very broad, and thus the foot has full play.

The importance of issuing boots, already prepared with hob nails, is noticed by Dr. Home. He observes that the necessity for this is apparent: the exertion in climbing hills, especially after rain, is excessive, unless the men wear hob-nailed boots. Dr. Mouat in his Report states that 25 per cent. of admissions into hospital were from foot soreness—a circumstance which clearly indicates how ill adapted the boots used by the men, were to the requirements of service.

Gaiters.—Gaiters such as are issued to the troops, would appear to have only one fault; they are too short.

Dr. Mouat thinks, they should be made longer, so as to protect the knee, but not impede its movements.

Transport.—It appears that when the force commenced its advance, the only means of transport then available, consisted of stretchers, one of which was allowed to every 50 men; that is, at the rate of two per cent. of strength. At that time there were, as stated by Dr. Home, but two horses in the force : that is, the charger of the general officer commanding, and that of his aide-de-camp. No other officer was mounted, for the reason that grass could not be obtained on the fern covered plains, and there as yet existed no means of conveying forage ; every person, officers and men, had accordingly to carry their own baggage upon their backs.

A road was speedily completed, along which wheeled conveyances could travel : as however, the country on either side of this road was held by the enemy, the waggons that daily brought supplies to the front, had to be accompanied by strong escorts.

After a time also, the Waikato river itself afforded a valuable means of transport, albeit, a somewhat dangerous one ; inasmuch as canoes and boats employed upon it, were not infrequently lost while crossing the bar at its mouth : and their crews, whether friendly natives, or British soldiers, drowned.

Towards the end of 1864, some large and cumbrous waggons were brought out by the military train ; the first of these that was taken into use however, after a few days' work broke, and became unserviceable. The plan on which they had been built was unsuitable for New Zealand. Another small one horse cart was also brought out by the military train, but, according to Dr. Home, it too was unsuited for carrying sick or wounded men ; it jolted them too much.

The description of *ambulance* that was found most serviceable under all circumstances, was the common American express waggon ; it weighed about 4 cwt.

and was capable of being loaded up to 10 or 12 cwt. It carried 4 or 5 men, and admitted of two of these lying at full length. It had good springs, was covered by a canvas top, and had the great advantage of being capable of being carried by men across a ravine or difficult part of the road. It was drawn by two horses yoked tandem fashion, and could follow the troops wherever there existed a native foot path.

Cacolets and mule litters were sent out from England, but proved useless; no horses in New Zealand could carry them up the steep slippery hills, nor could the restless, "bucking" horses of the country be trusted to convey sick or wounded men in this way.

A Commissariat transport corps, extemporised at the time, took charge of all draught animals and wheeled conveyances; this corps was under the charge of a military officer, and to him the field surgeon sent requisitions for the amount required; it being the further duty of the surgeon to see that individual regiments and detachments were supplied with their proportion; this plan is said to have worked admirably.

As an illustration of how sick and wounded were transported, it may be noted that the first action occurred at a place distant about eighteen miles from Wanganui: to which place in consequence of a change of base, for further operations having been made, it was necessary that the wounded should be sent. This was accordingly done in the only two ambulances then available, and partly in bullock drays filled with fern, on which the injured men were placed upon beds.

Further on, the force marched along the coast; and was accompanied by flat-bottomed steamers, which, in fine weather, entered the rivers, brought in stores, and took back the wounded; as however, the mouths of the rivers on the western coast have dangerous bars, the steamers could only occasionally enter them.

The wounded men, during an action, were removed on stretchers by "idlers," or by bandsmen: but as

stated by Dr. Home, a methodised plan for so doing, would in the event of an European War, be an urgent want.

These stretchers were generally carried by men told off from the ranks for the purpose, and who followed the respective regiments.

Hospital arrangements.—The plan of the campaign involved an advance up the Waikato valley. The position at which the Maories made their first stand, was at a distance of 38 miles from Auckland: and subsequently they occupied during their gradual retreat, positions in succession, at distances of twelve or sixteen miles from each other.

Hospital equipment of all kinds was sent out from Auckland, and an hospital of considerable size established at the first point of contact with the enemy from it: tents, and all other requirements were sent on, and smaller hospitals formed as the force advanced, until the troops had obtained possession of the river; after this had been effected, the equipment and stores required for the advance beyond the river were sent round by sea, in vessels, and up the stream, thus leaving the intermediate establishments intact.

These hospitals were managed entirely upon the footing of general ones; sick and wounded from regiments indiscriminately were received into them, thus leaving the regiments entirely unencumbered; and medical officers, staff or regimental, were appointed to positions and duties solely according to fitness for them.

At the particular points where hospitals were established, huts were erected for the purpose; these were easily supplimented, when necessary, by marquees and bell tents. Into each marquee, 8 men were placed, or if severely injured, a smaller number.

During the time the army was advancing, the plan was that, on arrival of the force at the point where a camp was to be pitched for a longer or shorter time, the field surgeon received over from the Assistant

Quarter-Master-General, a space of ground centrically placed, on which the united hospital tents of all regiments constituting the force were pitched.

When an action came to be fought, the plan adopted in regard to medical arrangements, was to retain the hospital upon its original ground, merely sending to the front the means to afford to wounded men immediate succour: they were then removed to the hospitals, and as each successive advance seems to have been only to a distance of a few miles from the previous position, there appears to have been little difficulty in making provision as mentioned for the wants of the wounded.

Dr. Home considers, and perhaps justly so, with reference to the nature of the operations in New Zealand, that the system of regimental hospitals was unsuited to their requirements: that in fact it became necessary as the war proceeded, to abrogate it, and introduce entirely that of general hospitals. It must be observed however, that warfare in this country is exceptional in its nature: comparatively small extent of territory was gone over, and regiments do not seem to have been called upon to act singly, as is so often the case in war elsewhere.

It may not, indeed, be necessary that when different regiments are brigaded together, each regiment should have its own fracture box and operating tables: and it could be so arranged, under these circumstances, that the stores only that are needed shall be conveyed with the respective regiments; these details however, do not affect the system of regimental hospitals, which, although, perhaps not always adapted for New Zealand, have been found so invaluable elsewhere.

Hospital diets.—At fixed hospitals, the regular system of diets was in use: at the smaller hospitals however, this does not appear to have been practicable; there, the ordinary rations for the men in hospitals were prepared for them in different ways: and all depended upon the ingenuity of the medical

officer, as to how far these could be so cooked, as to meet the requirements of sick men.

The "extras" used, were obtained on requisition from the purveyor's department at the nearest post, and an account of their expenditure sent in monthly by the medical officer: after a time, stewards were appointed, who performed this duty.

Purveyors.—Dr. Home states that he never saw a purveyor *in the field*, and that in order to avert an otherwise inevitable break down, medical officers took charge of purveyor's stores *among their own private baggage*. He pertinently remarks in connection with this matter, "the truth is that all real responsibility rests with the medical officers for every thing connected with the care and treatment of sick or wounded men, and this responsibility they cannot shake off: to give them responsibility without power, that is, power to order the purveyors as much as a military man orders a Commissary, is unjust."

CHAPTER XX.

MALARIA.

Theory of malaria—Marshes—Indication—Submerged marshes—A submerged marsh better than bad drainage—Miasmatic diseases—Interval between exposure to malaria and its effects—Malaria from turned up soil—Malaria most injurious at night—Early parades—During sleep—Malarious plains—South Holland—Walcheren—Rocky soils—Port of Spain—Baiæ—India—Height—Example in China—Sicily—India—England—Jamaica—Altitudes—Malaria prevented by heat—Destroyed by fire—Interrupted—By water—Dense vegetation—Thistles—Sunflowers—Trees—Guards against malaria—Prophylactics.

THEORY OF MALARIA.—Several of the more recent writers, among whom is Dr. Hammond, incline to the theory that malarious diseases are propagated by the presence of minute poisonous fungi in the atmosphere. In confirmation of this view, Dr. Hammond records the fact that he himself contracted an intermittent fever from inspecting musty hay, and that he was attacked by head-ache and pyrexia after looking among old books.

A further confirmation of this theory is given by Dr. Salisbury, who states that during the civil war in America, the existence of camp measles has been a source of anxiety; men leaving their homes in good health, becoming speedily attacked with that disease. This author states that they were so, after handling or being in contact with straw in a state of partial decomposition: and that he detected upon the straw, particular spores, which gave rise to the disease. He even went further; inoculated himself and his wife with these supposed sporules, and the production of camp measles was the consequence.

This author very naturally conjectures that other diseases may be found to be produced by a like cause: of which hay asthma may be one.

It is clear however, that the morbific influence commonly recognised under the name of malaria is not what is here described: that which under the name of marsh miasm has long been acknowledged to be given out in low lying damp localities,—that which hangs about in fogs over damp alluvial soils.—or that which although not tangible to sense or chemical re-agents, produces intermittent, remittent, and continued fevers,—cholera,—diarhœa and dysentry,—various disorders of the nervous system:—and deranges the formation and action of the blood in persons long exposed to its effects.

It is to this influence, whatever its specific nature may be, that the term malaria is usually applied. Dr. Angus Smith is of opinion that it is produced by putrescence going on in the soil,—that it is increased by alkalinity, and decreased by acidity; but it does not appear that the correctness of these views has been established.

Marshes.—As is well known, swampy localities are fertile sources of malaria; all swamps, however, are not malarious, as for example, those containing vegetable formations in progress of change to peat.

Indications.—The usual indications of a malarious soil are the presence of marshy vegetation,—of batrachian reptiles,—of many insects,—of insectivorous birds,—of scolopacidæ,—and, in India, of the paddy bird, or ardea.

Submerged marshes.—When however, a swamp is completely covered by water, malaria is not extricated therefrom. It is apparently absorbed by the water, and although itself not disseminated in the atmosphere, may exert its effects upon persons who make use of the water so impregnated,—a fact which should be borne in view, during marches near localities of this nature, where water thus saturated, is alone procurable.

A submerged marsh, better than bad drainage. In the process of the evaporation of surface water of

these marshes, the malaria which had been retained in the water covering them becomes disseminised in the atmosphere, exerting its usual effects upon persons exposed to it: so that a locality which was healthy, while a jheel, lake, or lagoon existed, may, on these becoming converted into an ordinary marsh, be rendered extremely inimical to health.

This fact has an important bearing upon army hygiene: the medical officer should in such a case ascertain from the engineer how far such a locality can be completely drained, and if it cannot be so, better leave it alone.

Miasmatic diseases.—That class of diseases to which the term miasmatic has been applied, appear to be most severe when surface water, the result of heavy rain saturates the subsoil. Heavy rains however, are less injurious to health than a wet or damp soil surcharged with organic matter under high temperature.

Interval between exposure to malaria, and its effects.—Malaria may, under certain circumstances, exert its effects very rapidly, and after but slight exposure to it: thus, it is stated that fever may be induced within half an hour after exposure to it, and that a single inspiration, or the space of a few seconds is sufficient for the purpose.

In France and Italy instances occur of labourers dying instantly from merely sitting or lying down upon the ground. Probably however, the interval between the reception of the malarious poison, and the occurrence of its specific disease, may be generally considered to be about a week

Malaria from turned up soil.—There are numerous examples of malaria being given out in a virulent form from the soil being newly turned up either by ploughing or by excavating sites for buildings; so that if practicable, when troops are temporarily located in such localities, the surface of the ground should be as little disturbed as possible.

At Hong-Kong for instance, some parts of the island were rendered so extremely unhealthy during the process of clearing what is now the site of Victoria, that they had for the time being to be abandoned.

This applies to rock or soil that had never before been disturbed. It is comparatively easy to understand why soil saturated with organic decomposing matters should, on being disturbed, give out most pernicious influences, and why cholera and fever are thus occasioned by turning up the soil of old graveyards.

Instances are recorded, however, of localities previously healthy, becoming the scene of malarious disease on the soil being turned up: hence it should be at all times a rule with officers of troops in motion, to be extremely careful not to disturb the surface of unknown localities more than is necessary.

Malaria most injurious at night.—Morning and evening fogs formed on low ground are pernicious in their nature from their holding miasmata in solution. This is what induces the evil effects attributed to night air.

So well are the effects of exposure to these influences in particular localities in India understood, that travellers during all but the dryest part of the year avoid proceeding at night through them. This is particularly the case as regard the tracts of low jungle that exist at the base of certain ranges of hills.

Early Parades.—In countries where malarious influence exist in a very powerful degree, as on the western coast of Africa and at Hong-Kong, residents dread exposure to the early morning air, and as a rule avoid exposure to it: and it may be fairly questioned if the practice of holding parades in the very early morning in some of the more unhealthy parts of India, has not been in a considerable degree the cause of sickness among the soldiers. If, in fact, in avoiding the effects of the morning sun, the men were not subjected to influences still more dangerous

for it is acknowledged that bright sunshine, and a temperature above 80°F. render malaria innocuous.

During sleep.—The greater liability of a person to suffer from external influences during the period of sleep than when awake, is generally acknowledged. This liability to become affected by malarious influences is especially great: and hence those who must from any circumstances traverse notoriously malarious districts at night should be careful not to sleep during the period of transit.

Malarious plains.—But malaria may not only exist in damp or marshy localities: under certain circumstances it is powerful on sandy alluvial plains on which little or no vegetation is to be met with.

South Holland.—Thus in South Holland, in August, 1794, after a very dry and hot summer our troops suffered severely from fever, yet the soil was a level plain of sand with perfectly dry surface, and without vegetation; save a few stunted heath plants.

Walcheren.—So at Walcheren in 1809. In an army of 43,521 men, 18,000 either died or were invalided in three months, and within five months the entire force was almost destroyed by fever. The entire island, except a few mounds of sand on the western shore, is a dead flat, the soil consisting of white sand with about a third part of clay. A very important fact requires to be noted however in connection with this circumstance, namely, that the surface of the island is considerably below high water mark, and is protected from inundations by dykes.

Rocky soils.—Dry rocky soils in some localities are, under certain circumstances, liable to outbreaks of fever, and other zymotic diseases: of these we have examples in the island of Ascension Gibraltar, the Ionian islands: in America near the Orinoco, and in various parts of India. One cause of the peculiarity is said to be the extent to which these absorb heat, rendering their surface of a much higher temperature than the air over them.

Port of Spain.—According to Dr. Parkin, Port of Spain in Trinidad, is hemmed in on each side by a swamp, yet the residents and even strangers enjoy a comparative immunity from fever. If the same persons however take up their abode for a single night on the La Vantile hill in the immediate neighbourhood, which overlooks the bay of Trinidad, they will certainly suffer from fever in its severest form; even a Creole Spaniard dare not sleep upon that hill a single night.

Baiæ.—So at Baiæ, a French army of 28,000 men was by the effects of malaria in a few days reduced to 4,000.

India.—In some parts of India similar results occur, although in less terrible a degree: thus in Scinde and the Punjab all the ordinary malarious diseases prevail, more especially intermittent fever. neuraligic disorders, cachexia, &c., and yet the tract of territory is very dry and bare,—the soil for the most part sandy alluvium upon clay,—or as is the case in the instance of Kurrachee, upon magnesian lime stone.

Height.—In a concentrated form malaria is believed not to reach a greater perpendicular height than thirty feet from the surface of the ground: hence the obvious cause of the superior healthiness of upper storied rooms in districts where it abounds.

This is not to be confounded however with the height above the sea level, as for instance, on mountains, to which its influence extend: or up to which it may be wafted by winds that sweep across places where it is generated.

Example in China.—It is considered to be more powerful in valleys and hollows than upon elevated sites: yet it could seem that low hills which rise abruptly from flat malarious plains are really more unhealthy than are the plains themselves. This is remarkably the case at Canton where "the heights" in rear of that city, upon which our troops were stationed

in 1860 and 1861, were found to be far more unhealthy than the plains themselves. So much indeed is this found to be the case in China, that the natives as a rule do not erect their dwellings upon elevations of inconsiderable height.

Sicily.—In Sicily, according to Pickford, out of seventy-six unhealthy towns and villages, thirty-five are situated upon hills and declivities. It is there believed that not only do the warm south winds produce, but readily waft upwards among the hills the malaria of the emanating districts.

India.—Among the hills in India, valleys are extremely unhealthy on account of malaria: the concomitants of alluvial soil, periodical rains, and a powerful sun producing this condition. The operation of the poison may indeed be less intense than in the plains, yet be sufficiently powerful to be dangerous.

England.—Somewhat similar cases occur in England; thus the inhabitants of Greenhithe and Northfleet are almost exempt from intermittent fever, while those on the hills beyond suffer much from the disease. A similar circumstance occurs at Weymouth, and in the marshy districts in Sussex.

Jamaica.—A more striking illustration however occurs in reference to Fort Hildane, Porto Maria, Jamaica. The promontory upon the point of which it is situated, is 150 feet above the level of the sea, and 200 feet across. Its faces are perpendicular, washed on three sides by the sea, and to all appearance healthy, being merely a mass of chalk: yet while at the base to leeward amongst Mangrove swamps the inhabitants are healthy, the troops in the fort suffered so severely from fever that it had to be abandoned.

It is possible that in all these instances, geological formation may have influenced the cause of sickness, and while it is important to know that elevations are not necessarily more healthy than plains, it is no less

important to be aware that under particular circumstances removal to a small distance, and trivial elevation, renders the person exempt from the influences of malaria. Thus at Accra on the Gold Coast, the low range of hills behind the settlement, enjoyed the character of being almost exempt from malaria: hence this was a favourite resort for people who suffered from the fever of the coast.

ALTITUDES.—It is customary to state that malaria is limited by particular mountain elevations in different latitudes: of these, a few may be extracted from the writings of authors on this subject, premising that experience has not yet demonstrated the absolute correctness of these statements.

Thus it is said that in Italy in latitude 44 N., an altitude of 1,500 feet secures an exemption from paludal disease. In the West Indies, latitude 25 N., 2,510 feet are required for the same object; as however yellow fever occurred at Newcastle in Jamaica at an elevation of 4,000 in the year 1860, it is evident that the first estimate is very far under the correct one.

At Gibraltar in 36 N., malarious yellow fever is occasionally prevalent as an epidemic at an altitude of 1,439 feet: again a marsh at Erzeroum in Turkey in Asia, at an elevation of 6,000 feet in latitude 39 N., and another at Puebla in New Mexico at an elevation of 5,000 feet in latitude 19 N., have both been known to cause fevers: and we know that in India malarious and epidemic diseases prevail on the mountain ranges to a height of 6,000 feet and even upwards.

MALARIA PREVENTED BY HEAT.—The generation of malaria is suspended by perfect dryness, by a temperature below the freezing point, and to some extent at least, by the heat of a tropical summer. To the latter circumstance is doubtless attributable the fact that the period of prevalence of the dry scorching winds in Northern India, is that in which the troops are often most exempt from zymotic diseases.

Destroyed by fire.—From this it is easy to understand that malarious influence is destroyed by fire, a circumstance taken advantage of by the residents on the west coast of Africa, who during the most unhealthy portion of the year, burn charcoal fires in their apartments for some time before retiring to rest. This practice is also in part recognised in India : the sanction for charcoal being burnt in the soldiers' barracks during a certain number of hours daily in the rainy season, having been for some stations conceded by the local Government.

Interrupted.—It is capable of being borne onwards by the wind, but its progress may be effectually interrupted by hills, forests, expanse of water, or by numerous buildings, as for example a city; hence it often happens that large towns in tropical countries are absolutely more healthy than the districts around them. This is illustrated in the case of Rome, and of the larger towns in the United States of America, all of which are more healthy than the surrounding districts.

By water.—A small expanse of running water is sufficient to prevent the passage of malaria across it, hence according to Dr. Kirk the explanation of the phenomenon often observed of an epidemic, as of plague or cholera extending along one bank of a river, while the opposite entirely escapes.

During the prevalence of the fever which destroyed our army at Walcheren in 1809, the screws of ships and at somewhat under a distance of 6,000 feet from the shore, were exempt from the disease. A distance of water surface of 3,000 feet is believed to be sufficient to form a barrier to malarious poison. According to Dr. Eatwell, the troops on board ship at Hong Kong, 400 yards from shore, escaped the fever that was destroying the men of the 55th regiment on shore at West point. So also at Amoy in the case of the "Thomas Granville," a distance of three quarters of a mile from the shore was an effectual barrier to the

fever poison. It is believed however that salt water is more effectually so than an equal expanse of fresh.

Dense vegetation.—Dense vegetation, such as obstructs free perflation of the locality, conduces to the accumulation of malaria: low lying jungle, especially if mixed with trailing and creeping plants, such as exists around the foot of many hills in India, possesses these characters to a great degree.

Thistles.—Some kinds of vegetation however are not only not injurious, but are actually beneficial in destroying or rendering innocuous malarious emanations: thus for instance, according to Pickford (p. 973) it has been remarked that in the campagna of Rome, if the labourers cut down certain bushy thistles that there grow abundantly, fever is the consequence.

Sunflowers.—Several localities in America have, according to a writer in the Western Lancet, from being malarious, been rendered healthy by planting sunflowers in them.

Trees.—The advantages of belts of trees between a barrack and pestiferous marsh are now universally acknowledged. The dismal swamp in America, where ague is never seen among the inhabitants, is covered with evergreen trees of large and lofty stature, St. Stephano, and Campo Salina, in the Pontine marshes became unhealthy in consequence of cutting down some trees.

Many medical officers would seem in the crusade they wage against the existence near a barrack of every green thing, not to be able to disassociate in their mind, low brushwood or vegetation which conceal emanations and prevent free ventilation from trees, which while permitting free currents of air and beautifying the locality, destroy or attract malaria, and thus add to the healthiness of their neighbourhood.

It must be recollected however that much depends upon the character of the trees themselves, those that give off branches from the lower part of the stem or

have dense foliage, acquire from these causes somewhat the nature of brushwood, and so well is this understood among the natives of India that they avoid sleeping under such, as for example, tamarind, the *neem* tree (*Melia*), &c.

Guards against malaria.—The inhabitants of South America successfully withstand attacks of endemic diseases, by covering the nostrils and mouth with a veil: and so sift the air from all morbid particles.

The light bed curtains such as are in common use against musquitos in the tropics are sufficient also to protect a person against malaria: and from the attraction for it of woody fibre, the simple measure of covering the mouth and nose with a pocket handkerchief, while a person is in the act of passing a malarious locality, is observed to be a sufficient safeguard against its effects.

Malaria.—If obliged to sleep in a malarious district, a linen or cotton handkerchief should be worn over the face, or a charcoal respirator: as recommended by some authors, "keep the doors or tent sides closed, do not drink water that has not been filtered, have fire to windward if possible, smoke a little tobacco, use a little malt liquor, and in the early morning take a cup of hot coffee before starting on the march."

Prophylactics.—In all countries the prophylactic power of certain measures against particular diseases is acknowledged: one of the most general is that of quinine against fever. On the west coast of Africa, quinine wine has for many years been issued to sailors on expeditions in the rivers and lagoons that there abound. In China a similar practice was adopted both as regards the navy and the army, and in India the administrative officers of the army medical department have advocated its use, not only as a safe-guard against fever, but also against cholera; the belief seeming gradually to gain ground, that there is in reality much closer connection between these two diseases than has hitherto been supposed.

CHAPTER XXI.

EPIDEMICS.

Epidemic influences—Sporadic cases—Modes of propogation—Local origins—Epidemics and epizootics—Plants—Insects—Rates of progression—Sanitation defied—Propogation of infection—Infection adheres to walls—Cholera from decomposing dead—Infection adheres to masses—Epidemics from different foci—Infection—Affinity between zymotic diseases—Aggravation of diseases and introduction of others—Liability of residents and non-residents—Liability to after attacks—Height of epidemic influence—Meteorological conditions—Measures on occurrence of epidemics—Ophthalmia—Spirit drinking.

EPIDEMIC INFLUENCES.—Of the actual nature of epidemic influences, no more is known, than there is of so called malaria. Why any particular meteorological condition in conjunction with filth and sanitary defects will cause small pox in one season or locality, scarlet fever at another, or cholera at others, is a complete mystery. Experience teaches us however, that with such concomitants, one or other of these will be produced.

Dr. Chevers cites instances to prove that the poison of typhus may at almost any time be brought into existence by crowding human beings in close ill-ventilated apartments. Miss Nightingale could, according to her own account, smell the poison of small pox being developed : and the spontaneous occurrence of the disease in isolated cases in China, has been recorded by various writers upon naval and military hygiene.

SPORADIC CASES OF DISEASE.—The fact that sporadic cases from time to time occur of diseases that periodically break out in epidemic form, affords strong confirmation of the ever existing influence upon which these depend. Thus, isolated cases of small pox are

not infrequent without the occurrence of that disease in epidemic form. At Gibraltar, occasional cases of yellow fever are in like manner met with, and in India,—more especially Calcutta, a sudden death by cholera, every now and then, shows with terrible clearness that the disease is amongst the inhabitants, albeit, not as an epidemic.

According to Sir John Pringle, air corrupt and putrified (from overcrowding) is of such a subtle and powerful a nature, as to rot and dissolve hearts of oak: and walls of buildings have been impregnated with the poisonous matter of fever for years: as for example, the prisons of England and Wales, prior to the reform worked by John Howard and others. Dr. Hennen moreover, states that some villages in Portugal that had been occupied as hospitals during the Peninsular War, became so saturated with contagion, that a few hours residence in them produced head-ache, fever, bilious vomiting, or diarrhœa.

Doubtless, there are some circumstances which lead us to conclude that the morbific influence by which several epidemics are propogated;—more especially cholero, small pox, and ophthalmia, are of animal origin: and examples are given by authors, of pus cells, in some instances having been detected in the atmosphere of wards. Notwithstanding these facts however, it is to be feared that the true nature of these influences is among the points that have yet to be discovered.

Dr. Kennedy relates in the Dublin Quarterly Journal of Medical Science for 1863, a case of disease, having all the characters of measles that was apparently produced from the fungi of musty straw; and in the American Journal for 1862, is a communication showing the prophylactic power, which the inoculation of straw fungi exercises over the human frame when exposed to the contagion of ordinary measles,—similar no doubt to that of inoculation with small pox, against that disease.

Modes of propogation.—Dr. Barber considers that there are four modes by which the poisons of commicable disease originate and spread, namely, 1. By diseases which develope in decomposing animal matter. 2. Those that spread by transmission of one particular poison, from one person to another. 3. Those that spring from the absorption of matters secreted in the course of common diseases. 4. Those that spring, as it were directly, from what seems to be dead vegetable matter.

Whether the epidemic influence is an ever existing entity, that may be lighted up by favoring circumstances into activity, or merely a condition produced by certain agencies, is a point that lies more in the province of the speculative philosopher, than of the army medical officers. It is well however, to cite a few examples of the circumstances under which epidemic diseases may occur.

It is well known that the recently dead by some diseases, become more dangerous sources of the malady than they had been during life ;—of these the dead by small pox and by metria are well known examples ; but there are many instances of similar results occurring at long intervals after death.

Local origins.—When in 1794, yellow fever prevailed in Philadelphia, Dr. Bush proved that the disease originated in the city itself, that it was produced by the exhalations from the gutters and the stagnant ponds in the neighbourhood of the city ; he was, as we learn, " most shamefully persecuted by the authorities" whose interest it was to prove that the disease had been introduced by the brig " Commerce," which on 25th August of that year arrived from St. Mark.

Dr. Paris observes that in the expedition to Quiberon, in 1795, several transports crowded with horses had their hatches shut for a considerable time in a storm. Some of the animals were suffocated, and among the survivors, Glanders was engendered.

In connection with this, Dr. Paris adds, " It is worthy of remark that diseases engendered by congregation, are apt to become contagious ;" and, in 1804, when about two out of every three inhabitants of Gibraltar attacked, fell victims to yellow fever, it was remarked that the epidemic first began to rage in the lowest quarters of the town, and those most filthy and crowded. In its progress it was found most easily propogated by air impregnated with animal exhalations : and that the chief seats of it were the houses of the poor, and quarters of the town where filth most abounded.

In the airy quarters, on the contrary, where the houses were neat and clean, the occupants suffered very little, and infection did not spread from person to person.

Epidemics and Epizootics.—It is almost needless to remark that a particular disease may rage among the human population, and yet the lower animals remain free from it,—and that inversely, an epidemic may rage among the lower animals while the human species escape ;—of this latter we have common illustrations in the pleuro-pneumonia of cattle, the small pox of sheep, and in the rinderpest now prevailing in England. Instances are recorded however, where an epidemic influence once set up, it destroys alike persons and animals ; for example, Dr. Chevers mentions that the form of plague which about 1850 prevailed in some of the hilly districts of India, destroyed alike the people, the rats, and even the snakes.

We elsewhere learn that in A. D. 940, the northern countries of Europe were ravaged by a terrible mortality among human beings and cattle : and there are numerous instances recorded in which morbific influences that were fatal to man, were no less pernicious to other animal creations. Of these it is only necessary in this place to remind the reader, that in the middle ages, and down to the eighteenth century,

the Val di Chiana was converted into a slimy marsh of unhealthy a nature: that not only was the neighbouring district rendered desolate, as regards human inhabitants, but, as we learn, the swallow even deserted it. Whether in this case the pernicious influence was primarily exerted upon the birds, or upon the insects that formed their food, is of course doubtful; but in either case the circumstance that the district was rendered uninhabitable by human beings and birds, bears a significance with it.

Plants.—Nor is it alone to the animal world that epidemics or pestilences are confined; they extend to the vegetable; sometimes being entirely confined to it, at others attacking plants, in one form, while men or animals or both perish, by disease in a different shape. Thus, Hugh Millar tells us, that in August, 1694, a dense sulphureous fog passed over Cromarty, and struck the half-filled corn with mildew; and from that year till 1701, the land seemed as if struck with barrenness. The pestilence which accompanied this visitation, broke out in November, 1694, when, as we are told, many of the people were seized with strange fevers, and sore fluxes of a most infectious nature.

Insects.—Several writers have noted that in India, the approach of cholera is preceded by a vast increase in the numbers of insects, especially flies. If, as is very probable, a septic condition of the atmosphere exists, causing a more rapid decomposition than usual, of animal tissues, this fact could be readily accounted for: but at any rate, however accounted for, the army medical officer should be prepared to note the circumstance, and take warning from it.

At the very time that this volume is being printed, much of what has just been above stated is taking place in England. Large numbers of cattle are weekly dying or have to be destroyed on account of being affected with an epizootic disease; nor is it alone confined to them; it is said that other quadrupeds

are effected with a similar, if not identical malady, and that insects of various kinds are apparently also affected by a disease by which their ordinary numbers are greatly diminished.

The investigations of Schrœder as quoted by Dr. Parkes, would seem to indicate that this septic condition of the atmosphere depends upon the development in it of countless germs of infusoria and vegetables. Of these germs, some have even obtained generic names, as for example—*Bacterum*, *Mycoderma*, *Torula*, *Vibrio*, *&c.*

Rate of progression.—The author of "Scenes and Legends of the North of Scotland," in his usual graphic style, traces the progress of cholera from country to country, at the ordinary rate at which the people in each travel,—thus, in Persia, where there is little trade, and neither roads, nor canals, the disease was a whole year in passing over three hundred leagues. Among the more active people of Russia, it performed a journey of seven hundred miles in six months. In Britain, it travelled through the interior with the celerity of the mail, and voyaged along the coasts with the speed of the trading vessels.

So in India, we have almost every year illustrations of the rate of progress of cholera from point to point, at a rate of progression almost identical with that of the intercourse among the people.

Sanitation defied.—It is not attempted now to be shown that the most vigorous attention to sanitation will of itself prevent epidemic influence: for there are innumerable instances that prove contrary; neither is it maintained that the most utter and complete neglect of sanitary rules will be in itself sufficient to give rise to them. We have illustrations of this in the condition of continental towns: and whoever during the late expedition to China had an opportunity of seeing the abominations of Canton, Shanghai and Tientsin, and the freedom of these cities from epidemic disease can bear testimony of the fact.

Experience proves however, that the epidemic influence once in activity, the disease is most rife and most fatal in those localities where sanitation has been least attended to. This is shown in the instance of cholera, typhoid, and typhus fevers : hospital gangrene, plague, small pox : and, in fact, in all those diseases usually classed as zymotic. This is now generally acknowledged : and therefore, if for a time we see dirty and neglected localities exempt from disease, that is, or may become epidemic, we are not therefore to suppose that when such a disease is by other favoring causes brought into activity, the locality in question will not suffer more severely from its ravages than will others that have been preserved in a more perfect state of cleanliness ; so much, indeed, is this the case, that with our present state of knowledge on the subject, it seems unnecessary to do more than allude to the circumstance. It is a most dangerous and pernicious belief to entertain, that cleanliness of habitations and localities is not essential to health ; we know many sad examples of neglect or indifference to this, being followed by terrible illustrations, in the destruction of those who wilfully omitted ordinary precautions,—and of how dangerous it is to neglect the means placed at our disposal, whether as individuals or communities, to maintain our persons and dwellings in a clean, and, therefore, a wholesome condition.

Propogation of infection.—As remarked by Dr. Millingen, contagious diseases that have proved most fatal, have frequently been traced to intercourse with prisoners of war. It therefore is important that they should not be put up with troops or even march with large bodies of them.

Infection may also be caught by troops either under authority, or clandestinely appropriating articles of clothing in towns or villages through which they pass. In China, an outbreak of small pox, which was fortunately prevented from extending to

any material degree, was distinctly traceable to the fact of clothing thus obtained being issued to them.

In India there are numerous illustrations of the propogation by means of personal contact of epidemics, —more especially cholera : and the manner in which that disease seems to adhere to large bodies of pilgrims in that country—attacking troops meeting these while on the line of march, has often attracted attention.

While we learn that tribes who do not congregate in masses, as in villages and towns, are comparatively free from epidemics, as for example, the Bedouin Arabs from cholera, it is interesting to study examples of the undoubted propogation of these by the intercourse between people.

Infection adheres to walls.—Morbific exhalations cling to walls ; Dr. Hammond, Surgeon General of the United States army, mentions that contagion is readily conveyed by means of clothing, furniture, walls, and especially bedding. He cites the occurrence of hospital gangrene, in the City Hospital, New York, where it re-appeared although the walls had been white-washed and new plaster put on : nor was it, until the entire walls were taken down and removed, that the taint was removed.

That it clings to ships we have many examples. Illustrations of this are given more in detail in the chapter on that means of transport, but as an additional one, the old "Dreadnought" may be here mentioned; that vessel having become so saturated with the infection of erysipelas that the hulk had to be abandoned for hospital purposes.

That it should cling to clothes is perhaps easy to understand, but that it should also adhere with great tenacity to camp grounds, where the infected may have temporarily halted, is perhaps more remarkable, although no less true.

Cholera from decomposing dead.—Dr. Moore gives an instance where workmen in India, in removing

soil, came upon the remains of a number of persons who had died of cholera. The disease attacked the workmen with great violence.

He also instances another body of workmen, who in cutting through an old graveyard, came upon a spring of apparently pure water,—many who drank of this, were within a few hours seized with severe cholera.

As is well known, the site selected at Benares, called Rajghât, is notoriously unhealthy. Troops even temporarily stationed there, suffered so severely from cholera, that it had to be abandoned, except as a place to be occupied under military emergencies. It was found to have in former times been used as a Mahomedan burial ground: a question may, it is true, be raised as to whether the disease arises here from infection from the decomposing dead: or merely, that the ordinary emanations from decomposing animal matter are the cause. Be the actual cause however, what it may, the fact is a sad reality.

With regard to small pox, an illustration of its propogation in a somewhat similar manner at Quebec, is related: a cemetery connected with that city, in which years before, a large number of the victims of small pox had been buried, was opened, and the result was the outbreak of an epidemic of that disease.

Hugh Millar too, gives some striking examples of the communicability of infectious or epidemic disease, from opening graves of persons who had many years peviously died by it.

He says—writing in 1834, that some eighty or a hundred years before that date, a fleet of vessels was in the bay of Cromarty, performing quarantine: many men in that fleet died, and the little mounds that marked their burial places, were at the time he wrote, known as the Dutchmen's graves.

About fifty years ago, he says, a half witted man was told that sums of money had been deposited in these mounds. That night he laid one of them

open, but found only human bones and fragments of woollen clothing. Next morning he was seized with putrid fever, and died a few days afterwards.

Miss Seward tells a similar story, except that instead of the disease being confined to one person, it was in the instance narrated by her, introduced into the village near which the graves were opened, and swept away seventy of the inhabitants.

That infection adheres to masses, is now received as an undoubted fact. It was not suspected however, until comparatively lately, although the history of campaigns has afforded many examples ; one will here suffice. During the occupation of Egypt by Napoleon's army, plague appeared in Kleber's division at Damietta. Its ravages increased after the siege of Jaffa, seven or eight hundred men being lost by it alone during the campaign in Syria. It is believed in India that cholera becomes localised at camp grounds by the excreta of persons affected with the disease, becoming percolated through the soil, and thus infecting the water ; a similar power may also possibly exist in the emanations from ground polluted with the fæces of cholera patients.

Epidemics from different foci.—The history of the cholera epidemic of 1861 in India, sufficiently shows that this disease may have several distinct and independent points of spontaneous origin, and yet spread by infection or by personal communication. It has now come to be ascertained also that the epidemic influence once brought into activity, travels by definite directions : and that for a body of troops to proceed within the sphere or line of progress of that influence, is to a certainty, to subject them to be attacked by the malady. The most recent example of this occurred at Mhow in the Bombay Presidency of India, where a detachment of troops having been so marched into the line of progress of the epidemic, they were all but annihilated by it.

In the chapter on localities, notice has been taken of the connection now allowed by the great majority of writers, to exist between the geological formation of a tract of country, and the liability of its inhabitants to certain forms of diseases, either as endemics, or occasionally raging in epidemic form. It is therefore, in this place only necessary in alluding to the subject, to remind the reader of the connection of coal formations and "trap" rocks with outbreaks of cholera; of the rarity of this disease in districts, the geological formation of which consists of laterite: of the fact that clay soils and alluvial tracts retain for a long time the germs not only of cholera, but of other so called zymotic diseases; not to speak of the connection which exists between ferrugenous soils in tropical countries, with deadly fevers: calcareous salts with goitre, and swampy alluvial districts with enlarged spleen and general cachectic habit of body.

Infection.—Some writers have of late years stated a theory that there is in reality no specific infection in existence: that when other favoring circumstances combine with neglect of sanitation to bring into activity the hitherto latent morbific influence,—that influence may manifest itself in the production of cholera, yellow fever, small pox, scarlatina, or in other form of zymotic disease according to accidental conditions of locality and climate.

Nor does this theory appear so vague, as it may at first seem, if we consider the phenomena of some diseases, more especially those of a non-eruptive nature. Thus, in India, the coincidence of epidemics of cholera and of intermittent fever is often observed; and at some stations in that country, as for example, Agra and Peshawur, the cold stage of the latter disease was on many occasions attended by diarrhœa, vomiting and collapse: so much so, that medical officers have stated in their reports, the apparent affinity that seemed to them to exist between the manifestations of these diseases.

There are not wanting medical officers too, who having seen epidemics of cholera in the East Indies, and of yellow fever in the West, look upon these diseases as closely allied to, if not identical with each other; and there are many circumstances which tend to the belief that the epidemics that have at various times ravaged India and other tropical countries, as plague, infecting fever and cholera, are but modifications of one and the same.

With regard to the eruptive diseases however, that occur as epidemics, there in reality does not appear to be anything which tends to indicate the identity of these, or even their affinity to each other; nor is there any circumstance which indicates really that the poison which in one person produces small pox, will in another give rise to scarlet fever, for example—or measles; on the contrary, it is incontestible that these different diseases may prevail simultaneously.

It is the obvious duty of the army medical officer however to act; and for his purposes, it is sufficient that he has to devise measures against the spread of an epidemic among the troops who are under his charge. For his purposes, therefore, the safest and most practical course, is to consider, that the *fomites* of each different kind of epidemic are ever-existing entities, against the operation of which, when brought into activity, his ingenuity may at any time have to be exerted.

Petenkoffer traces the cause of cholera back to the organic excreta of cholera patients: and believes that this organic matter acts as a leaven on an impure soil, in the neighbourhood of human dwellings: the special poison of cholera being a miasm produced by such fermentation.

How far this is or is not the case, it is not the object of these pages to discuss; suffice it that the theory herein involved, is the safest, in so far as practical purposes are concerned, for an army medical

officer to act upon. A very important point to be considered by him is the sphere of action of infection,—that is, the distance to which it extends, and at which it exerts its dangerous influence.

Approximately then, miasm or *fomites* from the sick may be said to decrease in intensity in a ratio equal to the square of the distance from its focus. According to the late Dr. Alison, infection does not extend to a greater distance than three feet from the person affected with the specific disease. These remarks however, refer more especially to the miasm of typhus fever; and in regard to infection generally, it may be said that the precise distance at which it is capable of exerting its effects is extremely uncertain.

With regard to the distance to which marshy emanations may extend by diffusion, Monfalcon, as quoted by Dr. Barker, has by calculation, arrived at the conclusion that these are in this way diffused to an extent of 1,400, or 1,600 English feet of elevation, and from 600 to 1,000 horizontally. In another part of this volume there occur more remarks in regard to the extent to which their diffusion is affected by the presence of water,—of wood,—and according to other physical characters, of a country or district.

Aggravation of diseases and introduction of others.—History incontestibly proves that several diseases have been introduced by troops of the various European nations into countries visited by them; thus, small pox, which subsequently seems to have destroyed vast numbers of American Indians, is believed to have been introduced among them by the white man. Quite recently, a peculiar low form of fever that extensively prevailed in Bengal, has unquestionably been introduced into Assam, and into Reunion by coolies imported into these places. In other instances, endemic diseases often prevail in a body of troops to a far greater and more fatal extent, than they do among

the Aboriginies themselves ; this is especially the case with yellow fever in the West Indies, and with cholera in the East.

It is equally true however, that especially on foreign stations, by the strict observance of regulations, a disease that may be ravaging the civil population, may under certain circumstances be averted from the troops quartered in the vicinity : and we know on the other hand that yellow fever has in some years, destroyed numbers of the military, and not affected the white civil residents of the place.

These facts, therefore, give every encouragement in rigidly carrying out the measures usually recommended with a view of guarding against the extension of epidemic disease from civil to military residents.

Liability of residents and non-residents.—Certain epidemics that affect our troops on foreign stations, are entirely confined to them, and other persons, not natives of the locality ; thus, yellow fever seldom indeed attacks an African, even when Europeans in that country and the West Indies, are being decimated by it. Cholera, on the other hand, attacks indigenous inhabitants, and foreigners alike ; being under certain circumstances more severe and fatal among the former than the latter.

Liability to after attacks.—An attack of certain diseases that occur as epidemics, renders the persons for the most part secure against a second : there are, of course, exceptions to this, but they are not numerous. Of these diseases, yellow fever is especially to be mentioned, the instances being rare, indeed, if they exist, of the same person having more attacks than one. Small pox, scarlet fever, measles, are other examples more or less defined of the same circumstances. But there are other diseases to which the fact of a person having suffered one attack, would seem to increase rather than diminish the liability to recurrence of those ; typhus fever and cholera are the two most striking examples.

Height of epidemic influence.—It is difficult to say what degree of mountain elevation, if any—is beyond the sphere of epidemic influence: thus during a recent epidemic of yellow fever in Jamaica, that disease became propagated in a severe form at a height of 4000 feet above the sea.

In India, cholera committed great ravages at the station of Murree, which occupies a site 7,400 feet high, in Lat 34 N. and 73 E.: and, in 1864, both this disease and small pox prevailed in a severe form along a zone upon the Darjeeling range, between 4,500 and 5,500 feet high.

From these circumstances, therefore, it is evident that too much stress should not be laid upon the assumed exemption of a body of troops from epidemics, from the fact of their being stationed at great elevation above plains.

Influence of meteorological conditions.—The influence exerted by atmospheric conditions, upon zymotic diseases whether in isolated cases or as epidemics should be carefully noted, and as far as practicable, mitigated by the arrangements of medical officers: thus cold and heat may be moderated by suitable arrangements in barracks and hospitals; pernicious winds may be excluded, and the effects of extreme dryness or extreme moisture reduced to the minimum of injuriousness.

The absence of sunlight seems to have an influence upon some diseases that prevail in an epidemic form: thus it has been stated that influenza selects the shady sides of streets; and in the sanitary history of towns, we have of late years, many examples of zymotic diseases being most severe and fatal in narrow courts, where, in addition to the presence of filth, these places had not the benefit of direct sunlight; we elsewhere notice how indispensable free exposure to sunlight is to the recovery of persons afflicted with these diseases.

Experience has shown that the prevalence of disease in an epidemic form frequently ceases immediately

on the occurrence of a thunder storm; there are instances however, where an outbreak of disease was immediately preceded by such an occurrence: as for example, cholera at Meerut in 1845. It is also customary to look for the presence of ozone in the atmosphere, as indicative of the existence of epidemic influence. From a very carefully made series of observations in the North of China in 1860 and 1861, however, it is clear that much confidence cannot as yet be placed in the presence or absence of that property, as influencing the tendency to epidemics, or to zymotic disease.

Measures on occurrence of epidemics.—On the occurrence of an epidemic of any kind among troops, the measures to be adopted comprise in the first instance, the isolation of the affected. Secondly, placing the patients in the most favorable circumstances for recovery; and in the third place, withdrawing the healthy, if military requirements permit, from the infected locality.

The latter is no new measure. It has from time immemorial been adopted in regard to cities of the plague. It is followed on the occasion of outbreaks of yellow fever in localities subject to that disease. It is put into force in schools and boarding houses in the United Kingdom, on the occurrence of scarlet fever and measles: and, in India, on occasions of outbursts of cholera, it has now become a recognised institution.

Under certain circumstances, it may be necessary to abandon the hospitals: these becoming on many occasions the chief foci of disease. For example, during the outbreak of yellow fever at Bermuda in 1864, the sick were placed in open air lodgings upon high and dry ground, in an atmosphere free from contamination: and, as is stated, the use of these measures was thoroughly understood.

On that occasion too, as in many previous instances, troops attacked by pestilence ceased to lose a

man from the moment they marched out of barracks, to bivouac on the turf: and live out of doors, free from the death dealing miasm of their close and infected quarters.

It is not only in regard to the individual sick themselves however, that isolation, or domestic quarantine is necessary. This is especially so in the case of their clothes and bedding: particularly as regards persons affected with small pox, measles, scarlatina, typhus, gangrene, and cholera. All these articles should in certain cases be destroyed: in others carefully fumigated and exposed to heat, and other recognised disinfectants. Tents in which the cases are treated, should be carefully disinfected, then exposed to the air for a considerable time. In India however, it is not deemed necessary that these should be destroyed: nor is it so by the United States Commision.

On many occasions throughout this volume, reference occurs to medical arrangements that were instituted by army medical officers of former times, for the improved sanitation of our troops. We are now, in too many instances ready to forget the extent of our obligation to these, instead of as we ought in many instances to willingly acknowledge how much we really are indebted to them, not only for devising these measures, but for showing us a noble example, as to how they were carried out to the great benefit of the troops, although often in opposition to strong adverse influence. It is therefore considered, that no further apology is required for noting the measures against epidemics, which from time to time, and under different circumstances, Sir James McGrigor is known to have taken.

At the time the expedition against the French West India islands was being prepared, the 88th regiment recently arrived in England in a very dilapidated condition, was with some other corps encamped near Southampton; much fever was at the time prevailing, and he feared that the constant arrival of troops

not in the cleanest state, accompanied by their families : as well as the habitual drunkenness and other irregularities of the soldiers, might lead to a speedy degeneration of the disease into typhus ; which it is now almost needless to observe, was at that time the scourge of the army.

Dr. McGrigor, by keeping the hospital sweet and well ventilated, not only gave it thereby so clean and cheerful an appearance, as to have attracted the notice of the officers, (Biography p. 43) but he seems to have attained the far more important object of having averted the dreaded outbreak of that fatal malady.

On another occasion he urged upon his Commanding Officer, (afterwards Field Marshal Beresford) that much of the sickness then present in the Connaught Rangers was attributable in part to the irregularities of the men ; but that the temporary barracks in which they seem to have been crowded together, were a nursery of disease : thus urging the same defects, that as we have seen, Dr. Brocklesby did twenty years previously, in regard to those at Chatham.

Sir James relates that the rebellion at Grenada having been quelled, the considerable force that had been sent to that island for the purpose, was crowded into insufficient buildings ; this circumstance added to their inactivity, and doubtless to the want of excitement, and to the consequent irregularities into which they fell, induced disease in " overwhelming force and with hideous mortality." On this occasion, he believes, that although the disease was not in its origin contagious, it was subsequently communicated in this way.

When the 88th regiment was embarking at Grenada, Dr. McGrigor carefully inspected each man, and withdrew every one who had the least appearance of disease or debility ; and he adds that he was scrupulously careful in this. The transport subsequently touched at Barbados *en route* to Tortola, at which latter island the force, naval as well as

military was appointed to rendezvous ; and, we learn, that in the few days occupied in the passage, yellow fever broke out on board ; nearly one-fourth of the troops being attacked by it, and the mortality being very high. We thus find in reference to this outbreak of yellow fever, an illustration of the necessity elsewhere alluded to in this volume, of the care that is required in embarking troops from infected localities, —and of the danger there always is in such cases, of the epidemic appearing after the vessel has proceeded to sea.

When in medical charge of Sir David Baird's force in Egypt, Sir James McGrigor before even a case of plague had appeared, made all necessary preparations for it, in so far as pest-houses, houses of observation, quarantine, and the formation of a *Board of Health*, or in other words a *Sanitary Commission* were concerned.

These arrangements were by no means unnecessary : for soon after, fever which occurred among the men of the 88th regiment, crowded as they were into small, dirty, old, ill-ventilated apartments, in Alexandria, assumed all the characters of the dreaded disease.

Another portion of the same regiment and the 61st, occupied Rosetta ; the men of both were there seized with plague : and, on this occasion, precisely similar measures were taken by Dr. McGrigor, that are now inculcated with reference to cholera. The sick were moved into the pest-house, the regiments were encamped upon a space of ground separate from the other portion of the force ; observation tents were pitched, and cases which there manifested symptoms of plague, were at once sent to the hospitals established for the purpose.

In every measure taken for the protection of the health of the troops under his superintendence, Sir James McGrigor has shown that he was an advanced sanitary reformer, as that expression is now understood, although then, it had not been invented :

and as the measures adopted by him in the very various circumstances of military life, in which he was placed, convey most valuable lessons to the army medical officer, it is considered that in a work such as the present is intended to be, something more than a mere bare allusion to the measures of this great authority is required. Hence, the frequent allusions to him and them that occur in its pages.

When the time had arrived for Sir David Baird's force to return to India, and all were ready to embark, a case of plague appeared in a native follower belonging to the 7th N. I., which corps had remained behind the other portion of the force to bring up stragglers. It does not appear that any of the sepoys of that corps were seized: yet so careful was Dr. McGrigor, that on his recommendation, it was left in Egypt during six weeks after the other portion of the force had sailed.

A very considerable time afterwards, when quartered at Canterbury as Surgeon of the Horse Guards Blue, the regimental hospital was found by him to be too small, and, moreover, ill-ventilated; gangrene had made its appearance, and affected nearly all the patients in it. Sir James did what we should do under similar circumstances; he took steps to vacate the building.

Meantime "the Blues" proceeded to Windsor, the wards in their hospital there were clean, large and airy, yet gangrene lingered among the men; the sick were therefore moved frequently from one ward to another: all sponges used in dressing were destroyed, and the malady ceased.

On referring to the medical history of the expedition to Egypt, we learn that the first occurrence of plague among our troops on that occasion was traceable to personal communication with the affected,—thus the Lazaretto at Alexandria first became infected by the admission into it of an Italian merchant suffering from the disease; and the guard there, consisting

of fourteen men speedily were seized, although upon different days by this terrible malady.

Further experience amply demonstrated what, indeed, had never been doubted, that the disease was communicated from person to person. Nor was this the case only among the living: for Sir James McGrigor at page 43 of his sketches, relates an unequivocal instance of a medical officer contracting infection, while performing *a post mortem examination* on the person of a victim of the disease.

The measures on that occasion adopted with a view to mitigate the spread of this disease may even now be studied with great advantage; and it is satisfactory to have to record, how very successful they were. The first was the removal of the sick from the building in which they were being treated into a larger and airy one; and the fumigation of the former by means of nitrous acid fumes.

Observation wards were established in the ordinary hospitals, from whence, so soon as symptoms of plague manifested themselves, the subjects were removed to pest-houses at a distance from the body of troops; in fact, at so great a distance, that it was feared some cases proved fatal in consequence of the fatigue occasioned during transport.

It was speedily rendered apparent that on the admission of a person infected with plague, that disease spread rapidly from him as a focus; as we have more recently seen yellow fever to do in the West Indies, and cholera in the East. In Egypt, as the epidemic extended its ravages, pest-houses were established for the treatment of persons affected with it; these hospitals themselves being placed in quarantine.

Personal cleanliness was inculcated, and Boards of Health, that is, Sanitary Commissions on a small scale, were established to devise measures of detail in regard to the preservation of the disease. In suspected regiments, frequent inspections of the men took place:

quarters of corps, hospitals and camp grounds, were frequently changed. Lamps and other means of fumigation were placed under the beds, and in the corners of observation wards.

Patients who had been treated in the pest-houses, and recovered from the disease, were prior to being discharged, carefully bathed; their hair was cut; all their ordinary clothes boiled, steamed and baked: and as an additional precaution, when a case of plague occurred in any of the small thatched regimental hospitals that had been established, the building was forthwith not only abandoned, but destroyed by being set on fire.

So successful were the measures adopted, that Sir James was induced to consider it to be a matter of no little consolation, that we know the means not only of excluding the plague from our own country, but that when our armies are stationed in the countries where the disease is endemic, we can arrest the progress of the contagion, and with certainty eradicate it: and it would be well were medical officers of the present day equally successful in eradicating other epidemics to which our troops are exposed.

It was not alone to measures in Egypt itself however, that his attention was directed: for with a view to prevent as far as possible the extension of the disease to India, he, preparatory to the return of the troops to that country, had quarantine stations established at Ceylon, Madras, Bombay, and Calcutta.

Ophthalmia.—Ophthalmia is one of the most mysterious diseases that attacks a body of troops: not the purulent ophthalmia which at the commencement of the present century affected our soldiers in Egypt, but that peculiar obstinate inflammation of the conjunctiva and sclerotic, now so familiar to most army medical officers,—both on account of its obstinacy, and the frequency with which soldiers are invalided on account of it: some with the cornea more or less completely destroyed,—some with granular lids, and

some with that remarkable irritability of the eye, and intolerance of light, which renders it next to impossible for them to open their eyelids.

Overcrowding and imperfect ventilation are fertile causes of this disease. There is much reason to believe that it becomes propogated among troops placed in barracks that had been previously occupied by men, among whom it had prevailed ; they not having in the interim been thoroughly cleaned and fumigated.

Once occurring in a regiment, the disease has a great tendency to become epidemic : and therefore, every means must be employed from the first to combat this tendency.

Every soldier should have his own wash hand basin and towel : promiscuous use of the bath must be interdicted : and when a soldier manifests the first signs of the disease, he must be removed to hospital, his bedding given to be washed: the part of the barrack room where had lain, vacated, cleaned, and white washed. At times the malady is confined to a certain company or companies: on other occasions it pervades the whole : in either case however, similar means should be adopted to check or suppress its further progress.

Among the many lessons we obtain from the experience gained during the wars at the beginning of the present century, are some that are of great value in regard to the management of this particular form of disease. Thus, we obtain from the history of its occurrence among our troops in Egypt, a remarkable llustration of the effectual influence of personal cleanliness, when combined with ample accommodation, in protecting the person against its attacks : for on that occasion, and while the affection prevailed to a great extent among the soldiers, it is on record that only one case occurred among the officers.

We have also, at a subsequent period, an illustration of one of the measures recently proposed to be for the first time adopted in India : namely, the establishment of special hospitals for the treatment and

proper segregation of patients suffering from contagious ophthalmia; when in the early part of this century, ophthalmia occurred as an epidemic among the troops quartered in England, Sir James McGrigor who was then at Portsmouth as principal medical officer of the South-Western district, had large hospitals and depôts for men affected with this malady established at Aldwicke and Silsea; and we learn that 1,000 cases brought from all parts of the United Kingdom were thus provided for. A similar provision would of course be made, were the disease again to occur in epidemic form.

Spirit drinking.—On the approach of an epidemic, soldiers, perhaps very naturally endeavour to fortify against its attacks by indulgence in spirits. That many evils arise both directly and indirectly from the practice is well known: and that it should be as far as practicable suppressed, is acknowledged.

Cholera.—The effects of spirit drinking in predisposing to cholera, are dwelt upon by Dr. Carpenter. He states that when Manchester was visited by that disease, the hospital nurses who were much addicted to alcoholic potations, died of the epidemic in such numbers, that a failure of the supply was apprehended. They were subsequently restricted to a small supply of liquor, after which not a single case occurred among them.

The Indian Cholera Commission however, states as the results of statistics collected by it, that in 1861, the soldiers stationed in the North-Western Provinces of India, did not show that among them there was any difference as to the liability to attack between the temperate and intemperate: but that the ratio of deaths to attacks was much greater among the latter than the former.

CHAPTER XXII.

SCURVY.

Among troops—At sea—Particular soils—America—India—Supposed causes—Lime juice—Anola—Popular remedies—Vegetables—Potash vegetables.

Among troops.—The first occasion on which the occurrence of scurvy in armies is recorded, seems to be in 1260, when it attacked the forces of Louis IX. in Egypt. In the 17th and 18th centuries, whole armies and crews of fleets would appear to have been destroyed by it.

The prevalence of a scorbutic taint in soldiers is now generally acknowledged to be far more extensive, than until within the past few years there was any suspicion of; it is now known that the ecchymotic spots, spongy gums, and "Bullock liver"—like ulcers described by old naval surgeons, are but manifestations of the disease in its more intense form: and that in the less severe states, the diathesis may show itself in a tendency to ulceration on the surface, in diarrhœa,—in general loss of health,—in ophthalmia,—or as was the case in the Punjab, in ulceration and destruction of the cornea, but without pain or suffering.

At sea.—That continued salt provisions, crowding, and partial ventilation, as on board ship, are the most frequent causes of the diathesis, is well known: but we now know that monotonous diet, whether at sea or on shore, will tend to produce this state of the system; and that, if in addition to this, troops who are deprived of potatoes and cruciferæ, and exposed at the same time to the combined effects of severe climate and imperfect ventilation, the liability to the affection becomes much increased.

Particular soils.—In places where the soil and water are impregnated with salts of soda, the disease is found to be endemic: and, in such, there is generally a dearth of the description of vegetables which exert an effect against it. Such, for example, is Aden and the desert tract including Mooltan, Delhi, and Lahore.

America.—According to the Sanitary Commission of America, malaria and scurvy were the chief sources of peril to the Federal troops along the coast of South Carolina. The occurrence of the disease among other bodies of the troops is also frequently alluded to by that Commission: whenever the men were exposed to severe toil and despondency, diarrhœa and dysentery are said to have been the forms in which it principally displayed itself; these diseases, we are informed, being most successfully treated by pickles, onions, lime juice, the mineral acids, nitre, and the liquor ferri nitratis.

India.—There is now little doubt that in India many outbreaks of hæmorrhagic dysentery, that have from time to time devastated our troops, whether in the field or in cantonments, have been in reality so many occurrences of scurvy; and that had the true nature of the malady been recognised, much of the terrible mortality thereby occasioned might have been prevented.

Supposed causes.—Formerly a sufficient cause of scurvy was considered to exist in the simple fact of a person being deprived of the use of fresh fruit and vegetables. It was observed, however, in the Crimea, that the Turks who ate little meat and much fruit suffered from this disease: and there are now numerous examples on record, where the malady has appeared, although fresh vegetables were supplied in abundance.

It may therefore fairly be presumed that this habit of body owes its origin to a variety of causes, rather than to any one in particular: and that among these, sameness of diet and bad cooking play an important part.

Other causes are to be found in arduous work,—fatigue,—want of sleep,—dirt,—crowding,—mental despondency, and the ordinary hardships incidental to a hard fought campaign: so that whenever troops are massed together under these circumstances, whether by land or by sea, we may henceforward look for it, but at the same time profiting by experience already gained, be prepared with the remedy.

With the light now before us, we know that to remove or moderate the scorbutic taint in an army, the only effectual measures are to modify the combination of circumstances upon which it depends.

Lime juice.—We know that formerly, sea scurvy was eradicated by the employment of lime juice together with an improved scale of diet and condition generally of the sailor. Although this anti-scorbutic was first brought forward by Woodall in 1600, and its efficacy demonstrated, yet, it was not till 1795 that Sir Gilbert Blane succeeded in getting it introduced as an item of the sailors' diet at sea: so slow were the naval authorities to adopt the recommendations of their medical officers.

Anola.—The natives of India are now known to suffer extensively from scurvy: and it may be noted in this place that their favorite remedy for the malady is a fruit which they term anola, that is, the fruit of the *Phyllanthus emblica.* This they consider infallible.

Popular remedies.—In the American army much benefit has been obtained by the use as a salad or greens of the *Chenopodium Album*: of the *rumex acetocella,* and of pickles and sour krout. Vinegar and molasses may be given as rations in that army whenever recommended by medical officers as anti-scorbutics: and we learn that the French in the Crimea found great benefit from a salad made of the *Leontodon taraxacum* with vinegar.

Vegetables.—In this army, want of vegetables is always adduced as the principal or only cause of the

malady : and it is as invariably mentioned, that the disease was checked by the liberal supply of these. Among other manifestations of it, we see enumerated, suppuration after wounds, pyemia, diarrhœa, dysentery and rheumatism ; all of which disappeared on the troops obtaining a liberal supply of vegetables. Indeed, the Sanitary Commission expressed an opinion that aged persons, women and children, could aid the cause of government very effectually by cultivating cabbages and other vegetables for the troops.

In all future wars we must be prepared to guard against the occurrence among the troops of this taint. This must be done by general attention to their hygienic condition, and especially by attention to the quality and variety of their food. Those fruits and vegetables that contain potass in their composition, are considered the most effectual anti-scorbutics, but while these are used, attention must be paid to clean linen, clothing, diet, fatigue and extent of crowding among the men ; always bearing in mind, that the scorbutic diathesis may manifest itself rather as modifying the symptoms of other diseases than as an independent malady.

List of potash vegetables.—The following Table of potash vegetables and fruits is extracted from Dobell's Manual of Diet and Regimen, *viz.*—

Vegetables.

Asparagus.	Lettuce.
Broad beans.	Mustard (green).
Brocoli.	Onions.
Carrot.	Parsnip.
Cabbage.	Peas (green).
Celery.	Potatoes.
Cauliflower.	Raddish.
Cress.	Spinach.
Cucumber.	Turnip.
Endive.	,, tops.
French beans.	Water cress.

Fruits.

Apples.	Nuts and filberts.
Almonds.	Oranges.
Chesnuts.	Pears.
Cherries.	Pine-apples.
Currants.	Plums.
Dates.	Prunes.
Figs.	Raisins.
Grapes.	Raspberries.
Gooseberries.	Strawberries.
Lemons.	Walnuts.

CHAPTER XXIII.

ELEVATED STATIONS.

In the United Kingdom—Cape of Good Hope—West Indies—Gibraltar—China—India—Physical characters—Plateau—Elevated valleys—Abrupt hills—Mountain ranges—Remarks regarding these—Extracts from Report of Royal Commission—Evidence of officers—Reports by medical officers—How hill stations may best be occupied—Remarks and arguments thereon—Classes of persons to be sent to them.

ADVANTAGES OF.—The advantages to the health of troops that as a general rule are gained from quartering them on elevated positions, whether in temperate or in tropical climates, are now universally acknowledged. In some instances, strategic considerations alone have decided the selection of such positions, but in others they have been adopted merely from sanitary considerations.

In the United Kingdom we have several barracks thus situated, as for example at Dover—at Maker near Devonport and at Edinburgh; Weedon barracks occupy an elevated position, but they have for some years ceased to be used for their original purpose.

At the Cape of Good Hope, our troops occupy higher and higher positions, the further inland they are stationed; that promontory, as is well known, rising in a succession of terraces, the extreme southern ledge of which is the bank of L'aghullas. On these successive terraces, our soldiers enjoy a degree of health equal to, if not superior to, what they do in their own native climate.

At Jamaica the use of a hill station was followed by a reduction of the annual death rate of from 130

per 1000, to 22 per 1000—and we learn that before this measure was adopted, persons suffering from yellow fever were frequently put in the way to recovery, by the simple process of having them removed to a more elevated position than that in which they had become attacked.

Medical officers who have served at Barbados during the prevalence there of yellow fever, must have a lively recollection of the greater intensity of the disease among the troops occupying the lower range of barracks than in those upon the Savannah; and of the great benefit to men who were out of health, obtained by their removal to the inconsiderable elevation of Gun hill. Those also who have been stationed at Hong-Kong must have had frequent occasion to remark the greater degree of health enjoyed by the residents whose houses were situated in the higher parts of the town of Victoria, than by those who resided nearer the sea level.

A few remarks on the subject of elevation as bearing upon health have already been made in previous chapters of this volume: and to these the reader is referred. It may be well however, in this place, to remark that although in some instances, as for example, on the Gold Coast of Africa, an elevation of 150 to 200 feet has often been found to make all the difference between a deadly and a tolerably healthy climate: yet there are as already stated, several well known instances, where elevated positions have been proved by sad experience to be far more unhealthy than those having a lower level.

Exceptions.—Of these, various examples have been given in the chapters just alluded to; among them, Gibraltar being a noted one. Notwithstanding the favorable position to all appearance of that fortress both as regards elevation and exposure to the sea breeze, as well as in its isolation from the mainland: not only is it notoriously subject to the more common epidemics that sweep along continents, but we

know that yellow fever has prevailed there with an intensity and fatality, not surpassed in any of the West Indian islands.

The fact of some positions of inconsiderable elevation in China being notoriously unhealthy, has been also alluded to. It may be fresh in the memory of some of the readers of these pages, how terrible was the mortality during the first China War, of our troops encamped on the higher part of Chusan,—and how thickly the graves of soldiers of the 26th strewed what still bears the name of "Cameronian hill"; true the islands known as the Pootoo group were, during the third China War selected as a suitable position for a sanitarium; but it is no less true that their adaptation or otherwise for the purpose, was not on that occasion tested by actual experience. Ships were found sufficient for all purposes.

In India there occur numerous examples of elevated positions being unfavorable to health: these are especially the faces of hills that rise abruptly from alluvial or jungle-covered tracts of country, and are themselves intersected by deep valleys that converge upwards: their sides covered by dense low brushwood. In such places malaria would seem to be conducted upwards as if by a series of inverted funnels, rendering their summits far more deadly than the more level tracts.

From these remarks, therefore, as well as from those that occur in preceding pages we perceive that the rule according to which elevated positions are more favorable to health than low ones, is by no means without its exceptions; nor is it easy, or indeed possible, without actual experiment upon persons, to decide before hand what places will prove healthy; what unhealthy.

Undoubtedly, physical characters such as have just been alluded to, as well as geological formations may in the generality of instances guide us towards a tolerably accurate conclusion; but that the results may

belie what theory indicates, is shown by examples already given, and is sufficiently well known to medical officers who have practical experience in the matter.

In India.—But it is with especial reference to our troops serving in India, that this question of elevated stations assumes its chief importance ; to its bearings in regard to that country, therefore, the following remarks must be particularly directed.

We find that these positions, as they are considered more or less adapted for troops, are of various descriptions, to each of which a few observations must be devoted, *viz* :—

1. *There is the elevated plateau*, of which the two best examples occur at Bangalore in the Madras Presidency, which has an elevation of 3,000 feet in Lat. 10 N. and Hazareebagh in that of Bengal, which is 1,750 feet above the sea, in Lat. 24 N.; at both these places the temperature is moderate as compared with that of others situated in similar latitudes, but less elevated : and experience has shown them to be particularly well adapted for occupation by regiments or soldiers newly arrived in the country.

It must not be supposed however, that at either of these places the troops are exempt from the ordinary diseases that affect them at stations more completely in the plains ; they suffer from all these, only in smaller numbers : and individual atttacks are less severe than in the latter. These stations are at times visited by cholera in an epidemic form: in fact, at the latter, so severe were epidemics of cholera in former days, introduced, as was believed by Hindoo pilgrims *en route* along the grand trunk road which then passed through the station, that for many years it ceased to be occupied ; more recently however, and since a new line of road has been opened at a distance nowhere less than twenty miles from cantonments, no further outbreak of the disease in epidemic form has occurred.

2. *Stations occupying an elevated position, but surrounded at an inconsiderable distance by ranges of hills*, or in other words, elevated valleys: of this nature are some of the stations in Central India, more especially Saugor, 1,940 feet high, and Jubbulpore 1,250 feet above the sea level; these occupy a kind of basin, the borders of which are formed by different spurs of the Vyndhya Mountain range.

It is not considered that Peshawur, the elevation of which is 1,056 feet, can be classed with stations of this description, inasmuch as it occupies a position the ascent to which is gradual and continuous from seaward. The country inland from it moreover, continues to ascend towards Affghanistan.

At the stations which properly belong to this category the annual variation of temperature is great; the summer heat intense; the diseases similar in nature and degree to those that prevail at stations on the expanse of India; and the liability to visitations of cholera great.

It is evident therefore, that as stations, places so situated are not desirable, whether we refer to soldiers who have served for considerable periods in the country, or for regiments newly arrived.

3. *Stations situated upon hills that rise abruptly* from, and are surrounded by level tracts of country; of this description, are the Chevaroy hills, and upheaved projections in the Madras Presidency, called Droogs; their elevation ranging to 4,000 feet and upwards. Various positions of the same nature occur in the Bengal Presidency, although there, the only one that has hitherto been occupied by troops is Parisnath: and it for too short a time to justify us in forming a decided opinion in regard to it.

With reference to the others however, there is evidence that the positions are subject to severe outbreaks of fever, and that they are at irregular intervals of time devastated by cholera. It thus appears that whatever be their advantages in ordinary

years, the general result extended over a series shows that the degree of health enjoyed by troops occupying them is not much, if at all above that observable in the plains.

As elsewhere observed, malaria and epidemic influences exert their effects in India at a great height above sea level; in fact there seems no good grounds for assigning any definite degree of elevation as indicating the limit beyond which these do not extend. It may be assumed however, from the experience of the past, that although epidemics have raged at a mountain height of 7,500 feet and upwards, yet, that elevation above sea level is comparatively free from the pernicious influences that affect our troops in the plains.

4. *The last description of hill* stations to be here alluded to, and the most important by far, are those which occupy positions at various points of the Himalayah range, at elevations varying from 4500 to 8000 feet above the sea, and in latitudes of 23° N. to 31° N.

At these stations the temperature more or less approximates to that of Britain: but at all, the annual rainfall is great; fogs prevail during several months, and thunder storms are of frequent occurrence.

Some of them have been occupied as sanitaria for troops for nearly forty years; others have been brought into use within the last twenty-five years, and even less; at some, soldiers in infirm health are alone quartered: at others, regiments have been sent from stations in the plains; at one or two, both descriptions of troops occupy barracks in close proximity to each other, and at all, there are officers who have proceeded thither on private leave of absence, or on account of ill health. Their wives and children, some in delicate health, some perfectly well, also repair to these places; some remaining there only during the hottest months of the year, some throughout the cold as well as the hot seasons.

The wives and children of a small number of non-commissioned officers and soldiers have occupied these

places under similar circumstances as the various classes just named. Medical officers in charge of convalescent depôts and of regiments, have in their respective annual returns and reports to the heads of their departments, given much valuable information in regard to the influence of the climate of particular stations of this description upon the health of the different classes of persons just enumerated: as well as upon individual diseases, and upon troops who have been sent thither to recruit their health as it is called, after having suffered from great sickness or epidemics at stations in the plains.

With few exceptions, these returns and reports are still available for reference; and it may be mentioned, have been read by the writer of these remarks, at least for the period embraced between 1842 and 1865: before giving extracts from them however, it will be well to select such paragraphs as contain the opinions of recognised authorities in regard to the influence of the climates upon various classes under the different circumstances already mentioned.

Opinions of Royal Commission.—The Royal Commission on the sanitary state of the army in India, is very explicit on the subject of sending troops in rotation to stations in the hills.

This Commission observes, that so far as health is concerned, the evidence before it was with a trifling exception decidedly in favor of mountain climates, especially during the earlier years of service. Hitherto it has been found that hill climates have been beneficial in certain cases of disease only, while in all others they are either of doubtful efficacy, or positively injurious.

The same Commission alludes also to the superior healthiness of inhabitants of elevated plains and mountain ranges: and to the experience obtained in the case of civilians and military officers who resort to the hills in order to recover from the exhaustion produced by service in the plains.

With reference however, to the evil effects exerted under certain circumstances by hill climates, and

especially those of elevations from 6,000 to 8,000 feet, the Commission remarks that although malaria is to a great extent absent at such elevations, troops proceeding thither from the hot moist plains, are suddenly exposed to lower temperation,—to cold damp air,—the result of which is that they become subject to other diseases (than those from which they may have been suffering), especially of the bowels and chest; the diseases of a colder climate are substituted for those of a warmer one.

Opinion of Sir J. Lawrence.—Sir John Lawrence states what is well known by medical officers to be the case, namely—that although men would be healthier in hills than on plains, yet there are constitutions which do not benefit by hill residence; and according to Colonel Greathead, although the men look better in the hills, the returns show no great difference as regards health.

Opinions of Medical Officers.—From reports by individual medical officers, there is, says the Commission, a general concurrence of opinion that healthy regiments or parts of regiments should be stationed on the hills, and that men who are beginning to suffer in health from service on the plains, should be sent to the hills.

The Report further observes that of the latter class, there is a considerable proportion in all regiments: many of whom if left in the plains, would become subjects of actual disease: and, in recapitulating the evidence laid before the Commission, it records that this evidence proves that hill stations are useful chiefly for prevention, but not always for the cure of disease; that they are suitable for children and for healthy men but not for unhealthy regiments.

Sir R. Martin, c. b., is of opinion that a great mistake has been committed, namely, the removal of troops whose health has been damaged in the plains to the cold damp mountain ranges, which are only applicable to healthy men and for the preservation of health.

Dr. C. Smith of the Indian Medical Service is of opinion that by occasionally sending men up to the hills for the hot seasons, you can keep up their stamina: but if you keep them in the plains, they lose that in a very few years.

Dr. J. Bird of the same service thinks that mountain stations should be occupied as prophylactic stations; in that way they will prove beneficial, making a proper selection of the men to be sent thither.

Opinions of Military Officers.—Brigadier-General Russell would send men to the hills at first; he thinks that were this done, they would enjoy nearly the same health as they did at home: but that after being a few consecutive years in the plains, the probability is they would not do so.

Colonel Campbell would send men to a hill station at first rather than afterwards; sending them to the highest point in the first place, and bringing them gradually down. He moreover remarks that men who have bad health in the plains, are very apt to get diarrhœa and dysentery. This view is also confirmed by the Report from Bangalore submitted to the Royal Commission. It is to the effect that hill stations are best adapted as a sanitarium for troops; that troops on returning from these to the plains manifest an increased liability to liver disease, dysentery, &c.

Colonel Greathead gives a striking illustration of the evils of sending an already sickly regiment to a hill station: he states that the 32nd regiment was sent to Kussowlie, weakened by fever, coming from Peshawur, and the men died like rotten sheep of fever and dysentery. Such is the expression made use of by this officer, and one that is perhaps more illustrative then elegant.

Colonel Herbert, c. b., now of the 54th regiment, and formerly of the 75th, gives in a letter to the Author of this volume, so graphic an account of the benefits derived by the latter regiment, by residence at a healthy station in the plains of India,

in comparison to what happened to others that were sent while sickly to a hill station, that it is deemed proper to transcribe his communication.

It is as follows :—

Fort William, December 29th, 1865.

My dear, Dr. GORDON.

With much pleasure, agreeable to desire, I give you the following facts which occurred under my own command in the year 1853. The 75th regiment then under command of Colonel Hallifax at "Umballa," and the left wing under my command at "Agra, were ordered to Peshawur;" the head quarters arrived there early in January, 1854, and I got there in February same year; we relieved H. Ms. 53rd regiment, ordered to the hill station of "Kussowlie,"—this regiment was in a fearful state of weakness from the effects of fever, ague, and other ailments, so much so, that few men were able to march. On their arrival at "Kussowlie," numbers of men died, in fact, it was stated, they were going out like rotten sheep: at the time, medical officers of long experience strongly urged that the plan of sending *unhealthy* corps to hill stations should be abandoned. The authorities said, if the regiments 32nd and 53rd, then about to be relieved at Peshawur by the 22nd and 75th, suffered, they would give a trial to the wishes of the medical officers; the 22nd went *home viâ* the Indus, December, 1854, relieved by the 24th. In November, 1854, the sickness of the 75th was so great, that most of the barracks were converted into hospitals, and actually the regiment did not muster 100 men fit for duty. In 1855, Sir W. Gomm visited the station, and found the regiment perfectly unfit for duty: and about the 1st of October, same year, by the strong recommendation of the Doctors,* we were relieved by the 87th from "Rawul Pindee." We literally had to be carried by elephants to that station, where we arrived perfectly helpless, and unfit for any duty in December; the march for a healthy regiment was only *ten* days, we took over a month, so you may see by this, the state of the corps. Our Surgeon, rather a free speaker, "Coghlan" died afterwards, before "Delhi, in 1857. On being asked by Brigadier now Sir S. Cotton, as to the state of the regiment, replied, "indeed, Brigadier! they are rotten." In January, 1857, we were ordered from "Rawul Pindee," after being a little better than a year at that station, and were relieved by the 24th from Peshawur,—a more healthy regiment could not be found in any quarter of the Queen's dominions; we marched out close on a 1,000 strong, and arrived full of health and vigour at Kussowlie, early in March; the 1st truly strong healthy corps, that ever marched into that station, fully proving the justness of the opinions of the medical officers. In conclusion, I beg to add from long experience in this country, I think it a bad plan to send a regiment to a hill station—as there are very many men, it does not agree with; I am fully borne out in this opinion, by many old friends of mine in the medical profession in this country. You can make whatever use you please of this, they are facts of an eye witness of many years' Indian Service: the 75th under my command marched to Delhi in May, 1857, and were the strongest and most healthy regiment there, and were able to do good service; so our hill tour was not for much more than two months and a half.

Believe me Your's Sincerely C. HERBERT.

* More especially of the late Inspector General Dawson, then P. M. O. in India.

Extracts from Medical Reports.—In their Reports, some medieal officers expressed themselves in a very decided manner in regard to the effeets of residence at hill stations. The following extraets are selected from some of these reports, *viz.*—

Of 29th Regiment.—*From the Annual Report of the 29th Regiment, stationed at Kussowlie, for* 1846-47.

"The superior salubrity of Kussowlie as compared with stations in the plains, apparently obtains more during the six hot months of the year—that is, from April to September inclusive, than during the remaining eooler months. To the reduced heat and absence of the hot winds is ehiefly due the greater healthiness of this hill climate. In the inereased cold of the winter months, the healthy aequire bodily vigour: but to the unhealthy, particularly those suffering from dysenteric disease, the winter season is fatal. The very eold and stormy weather in January and February noted in the "Meteorologieal Journal" of the Annual Returns, &c., hurried on a fatal termination in several cases of dysentery then under treatment.

In the quarter ending September, seorbutie disease appeared also amongst the women who had remained at Kussowlie during the Sutlej eampaign: it was evident that the causes of the disease existed also in the loeality, and the following may perhaps be a reasonable explanation of the eonneetion and operation of the two sets of eauses of the seorbutie affection here referred to, to be found in the events of the campaign and in the loeality.

For the privations, exposure and sufferings of the men during the campaign of 1845-46, I must beg to refer to the Speeial Report of that serviee. It is suffieient to remark here that suceeeding as they did to three years and a half of previous service in India, with two epidemies a year, they were sufficient to induce a strong tendeney to seorbutie disease in the men, as is shewn by the oecurrenee of the two cases of "Bullock's liver" disease amongst the wounded at

Ferozepore before noticed. Thus, it is at all events exceedingly probable that the regiments returned from the campaign with a strong tendency to scorbutic disease among the men. Had the regiment returned to an old station in the plains, it is probable that the tendency to scorbutic disease would have been overcome, and consequently never have attracted attention : but it so happened that the regiment returned to Kussowlie nearly a new, and moreover, a hill station.

Now, from the women, who had remained at Kussowlie during the absence of the regiment on the campaign suffering likewise from scorbutic disease, it is evident that the causes of their suffering existed in the locality; and with respect to the men, these causes were superadded to the tendency to the disease before their arrival. In consequence of the absence of a regiment from Kussowlie causing an almost total absence of demand for supplies at the station, and rumours at the station of the approach of the enemy the small Sudder bazaar of Kussowlie was nearly deserted, and the regimental bazaar as may be supposd after such service, was very indifferently supplied. Thus, when the regiment returned to Kussowlie, supplies of all kind were scarce : fruits and vegetables more particularly, for the hill produced none, and the demand for them was not immediately felt nor anticipated; consequently, excepting a few bad potatoes and an onion now and then, the men had no fresh vegetables of any kind. Together with this want of vegetables, the very miserable quality of the rations, meat and bread, must be adduced as auxiliary causes in the production of the scorbutic affection in question. It was not however, till after the cold and damp weather of the unusually heavy and protracted rainy season had existed some time, that the cases of *purpura* and of scorbutic affection of the gums exhibited themselves.

But to the list of causes already given, and which comprises deteriorated health from $3\frac{1}{2}$ years' sickly services in the plains of Bengal, are to be added the

privations, exposure and suffering of a very arduous campaign in the same plains, including the morbid agencies contingent upon two hard fought battles: then, the total want of any thing approaching to an adequate supply of fresh and succulent fruits and vegetables, together with a very poor quality of ration, meat and bread, and the coldness and dampness of the rainy season, to which the men were altogether unaccustomed. To this list of causes I would add the elevation of the station above the level of the sea. It has already been remarked in the preliminary section of this Report, that it is difficult to believe that an elevation which makes eleven degrees difference in the boiling point of water, can have no obvious effect upon the system: and the truth may be, that the blood more readily acquires a scorbutic taint in the rarified atmosphere of 6,000 feet above the level of the sea, than at more habitable levels."

Of 61st Regiment.—*From the Annual Report of the 61st Regiment, stationed at Kussowlie and Subathoo, for* 1852-53.

"The climate of the hills is not a very good one: for hepatic complaints generally, it is much better than the plains: but the cases although relieved are not cured, it requires some more radical change to effect this desirable end. In cases of recovery from fever, the climate of the hills is of the greatest advantage. A great number of men are still suffering from occasional attacks of chronic liver disease, but they are fewer in number, and more tractable than they have been for some years previous."

"I find the greater proportion of the men who have had dysentery in Peshawur, are those now affected with the peculiar bowel complaint of the hills. The admissions have been from chronic diarrhœa 335, during the year: of those 322 have been discharged, 9 remain, and 4 have died."

Of 32nd Regiment.—*From the Annual Report of the 32nd Regiment, stationed at Kussowlie, for* 1854.

"It has been used as a sanitarium since 1842. I doubt, however, as to its salubrity, more especially for troops, whose health had suffered much from fever and ague, as all those that came from Peshawur had done."

Febris Intermittens—This disease was very prevalent during the past hot and rainy seasons. This was nothing more than might have been expected, considering how much the corps suffered the two previous years at Peshawur from intermittent fever. The climate of hill stations is not well adapted for troops, the first year after leaving Peshawur,—stations with a more equable climate, such as Sealkote, Meerut, Agra, Rawul Pindee, &c., would suit them better the first year on leaving Peshawur."

Of 98th Regiment.—*From the Annual Report of the 98th Regiment, stationed at Dugshai, for* 1852.

"It was my impression when my last year's Report was made out, that the number in hospital at that time would be more likely to decrease than to increase, as the patients in hospital as well as the men occupying the barracks, were only a short time from the plains : and I then hoped that a hill climate would do wonders for all. Under this impression I stated that I considered the hospital large enough for the station, but as I have already said in the preceding page, I found that as soon as the rains commenced, patients flocked into hospital, which became overcrowded, and my hopes of the benefit to be derived from a residence in the hills, disappointed to some extent : for although the men of the regiment generally have benefitted wonderfully by this climate, yet most of those who had chronic diseases when they came to this station, became worse during the rainy season. Some of them died after lingering for a long period : several were invalided to England, and a good number must still be invalided before the regiment can show a clear bill of health, which ought pretty nearly to be the case after a couple of years' residence in this good climate."

"The other casualties occurred in men who had suffered much from the diseases of the country, and who came to Dugshai with impaired constitutions. The cases marked fever, were all of a complicated nature; in many instances the liver and spleen being affected, and generally the patient suffered from chronic diarrhœa, and in some instances, from chronic rheumatism or neuralgic pains. The cases marked as diarrhœa, were subject in the same way to some chronic affection of an organic nature, produced by fever and by the baneful influence of miasma, which affects the constitution in so many forms, and causes men to fall into a wretched state of anæmia, which, in too many instances, a residence in a hill climate has no permanent beneficial effect upon; and a sea voyage and a return to Europe is the only hope of a complete recovery to health.

"The appearance of the men generally is very much improved, and their health quite restored. There are still about 60 or 80 men confirmed invalids in the regiment; as soon as these are removed by death and invaliding, which will probably be the case this season,—the regiment will be perfectly healthy and efficient: and should it have the good fortune to remain another year in the hills, it will become perfectly free from men with chronic diseases; this very desirable state of efficiency and health, the 98th regiment has not been in since it left England."

Of 53rd Regiment.—*From the Annual Report of the 53rd Regiment, stationed at Dugshai, for* 1855.

"The climate of Dugshai is, generally speaking good, and suited to the European constitution; but the sudden change to such a climate from Peshawur does not appear a judicious arrangement; for instance, during the first quarter, the health of the regiment was particularly good, but on the setting in of the rains towards the end of June, a great number of both men and officers became affected with what is called "hill diarrhœa," and it was then remarked

that the worst cases occurred in those men who suffered from the fever of Peshawur,—complicated as that fever almost invariably was with affections of the liver and spleen.

Of 92nd Regiment.—*From the Annual Report of the 92nd Highlanders, stationed at Dugshai, for* 1860.

"Jhansie from whence the regiment marched to Dugshai, is as unhealthy a station as need be looked for: but from the day the regiment reached Dugshai, the health of the men steadily improved, as shewn by the continued decrease in the average daily sick list, even during those months which are usually most unhealthy: at the close of the year, the health of the regiment was as good as it would have been if quartered in Scotland."

"Passing the hot weather in the hills is merely a relief from the evil effects of the heat of the plains: but in order to recover perfectly from the effects of previous illness (more particularly fever), the bracing influences of a winter in the hills is necessary. Many cases are of course unsuited to it, such for instance, as rheumatic affections, especially these with a syphilitic taint: but the majority of the invalids, who are sent up to the hills for the hot season, would I am inclined to believe, be better fitted to spend the subsequent hot season in the plains, if they were allowed to remain in the hills during the winter instead of being sent back to the plains in the month of October, as is the case under the present arrangements."

"For those diseases for which the damp climate of the hill stations during the rainy season appears least suited, such as dysentery of a scorbutic character or in a strumous constitution, and for which a sea-coast sanitarium is not procurable, a suitable locality could I believe, be readily found on the banks of the Sutlej beyond the influence of the monsoon: and, as it is most sincerely to be hoped, that each year will add to the numbers of hill stations, it would be a most desirable object to provide a sanitarium for that

small class of diseases for which the ordinary hill climate is not suitable."

From the Annual Report of the 92nd Highlanders, stationed at Dugshai, for 1861.

"Dugshai is said to be one of the most healthy and re-invigorating of our sanitaria in India, and certainly in the case of the 92nd, it kept up its reputation. The robust appearance of the men at the time of their leaving the station, and the very small sick list (there being only 13 men in the hospital when the regiment marched down hill to Kalka, a distance of 18 miles), was one of the most convincing proofs of its salubrity. Like the other hill stations however, its climate is unsuited for those who suffer from diarrhœa, or dysentery, or hepatic diseases, and the nature of the country renders it highly desirable that men suffering from organic disease of lungs or heart should be kept in the plains."

From the Annual Report of the 42nd Regiment, stationed at Dugshai, for 1862.

"It is worthy of remark that during the march from Agra to Umballah, in the end of 1861, the fever almost disappeared from the regiment, to return during its halt of three months at the latter station; to disappear during the march to Dugshai, and for a few weeks after its arrival: to re-appear with increased violence when the regiment had been settled in quarters, and the novelty of the scene, and of arrival in the hills was over."

"The opinion given by me, in my Report last May, to His Excellency the Commander-in-Chief, is apparently contradicated by the opinion of Dugshai as a first year's residence in this report; but they are really compatible one with the other. I still consider that cold in the great majority braced the constitution and prevented frequent attacks of fever: but that in some instances, by preventing the action of the skin, it established a flux from the bowels instead, which occurring in debilitated constitutions,

too often proved fatal; some of those cases were saved by being sent to *Subathoo*. Now, as the pure fever was not a disease dangerous to life, and as we have a remedy all powerful in it, would it not be better to have more of that, which would be probable at Subathoo, and less of it complicated with visceral congestions and disease."

"I may add that having been twice President of Invaliding Committees at Nynee Tal, I found that a hot weather residence in the hills was not sufficient to remove a bad form of fever from the system.

From the Annual Report of the 42nd Regiment, stationed at Dugshai, for 1864.

"The various elements influencing health and disease have now been alluded to, and that they are on the whole satisfactory, though far from what they might be made, especially by improving the barracks, is seen from contrasting the state of health of the 42nd on its arrival in 1862, and, on its departure in November, 1864. It arrived in a perfectly broken down state after the severe epidemic of cholera and subsequent remittent fever at Agra in 1861: the hospital constantly full, 60 to 70 of the worst cases being all that could be comfortably accommodated in the old and bad hospital now removed; but this does not represent the whole amount of asthenia and debility then present: over 120 more were attending every morning for quinine and tonics.

It left Dugshai in November, 1864, in perfect and robust health, with only 12 sick, and this continued till the end of the year. But at what cost did it become thus healthy? 46 men died at Dugshai, and 77 were invalided to Netley; that is, during the period, 123 of 850 (not including 37 of a draft just arrived from England,) who came up from the plains, or about 14 per cent.—a very large proportion of death and invaliding. If Dugshai be the bracing and health-restoring climate it is said to be, and which it is, it ought to effect it at a less

expense of life and loss of service. It made the 42nd a healthy corps by killing off and invaliding all those who came up with weakened stamina and organic disease, and restoring and keeping in health all those who came up well, and but slightly or functionally diseased. Men debilitated by fever with weakened vital energy : and with the functions of the skin and bowels long accustomed to act in a certain channel from the continued influence of the heat of the plains, were unable to bear up against the sudden change into a cold and very humid climate, which hermetically sealed, as it were, every pore in the skin, and forced the blood from the surface capillaries into the internal organs.

That this is the character of Dugshai as a sanitarium, can be shewn from the Weekly Sick Reports. During the dry weather, after coming up in 1862, there was but little change from the plains, and health improved a little : so that as before stated, on the 13th June, the last week of the dry weather, there were only 59 in hospital and 120 attending : of the former, 11 were cases of fever, and there were none of diarrhœa. The first week after the rains began, there were 240 attending and 99 in hospital, of which 27 were cases of diarrhœa, and 29 fevers ; of the 18 deaths in 1862, 9 were from diarrhœa or dysentery, 4 from chest complaints, and 1 from hepatitis.

That the climate does not act thus on healthy or comparatively healthy men, is seen from the sickness in 1863 and 1864. Before the rains of 1863, the long cold weather had somewhat re-invigorated the regiment, and the influence of the rains was little felt in the production of diarrhœa ; there being a total increase of 12 sick only after the first week's rain, and 6 of 15 deaths in 1863, were from bowel diseases. In 1864, there was no diarrhœa, and only one death from bowel disease. The first wet weather struck down and debililated most of the men who died in 1863 and 1864, and many of the weakly men were sent for

change of air to Subathoo 12 miles off, but on a lower level by 2,000 feet, much warmer, and with less humidity, where they did very well. The same effect of the climate of Dugshai during a first year's residence was observed in the case of the men of the convalescent depôt (not attached to the 42nd regiment), sent up from various regiments in the plains in the hot weather.

From what has been stated, I think it may be said that Dugshai is a healthy station, and well fitted to preserve our regiments in the most robust state of health if sent direct from England, or after short periods of service in the plains. Those who are beginning to suffer, or whose constitutions have already been lowered by residence in the plains, will generally be benefited by a change to the hills. But to those originally diseased, or with constitutions greatly debilitated, a change to Dugshai will not be beneficial."

From the Summary of the Annual Report of the 82nd Regiment, stationed at Subathoo, by Staff Surgeon Major M. W. Murphy for 1863.

Dr. Fowler, Surgeon of the regiment, attributes the greater part of the zymotic disease in the regiment to the climatic peculiarities, and insanitary influences of the bad barracks to which the men were exposed for two years in Delhi, and which made a firm and lasting impression on the general constitution of the regiment : an effect which the removal to a healthier climate was insufficient to remove immediately.

One company of the regiment detached to Dugshai is stated to have been unusually sickly.

From the Summary of the Annual Report of the 42nd Regiment, stationed at Dugshai, prepared by Staff Surgeon Major M. W. Murphy, for 1863.

" Diarrhœa and dysentery are stated to have been occasioned by the latent effects of marsh miasma; the connection between ague and bowel affections was even noticed by the men of the regiment, who frequently volunteered the statement that 'the fever had gone to their bowels.'

Severe neuralgia principally confined to the course of the sciatic nerve, occurred it is stated in an extraordinary number of men convalescent from ague ; it seemed to be the ordinary termination of the disease.

Conclusions arrived at.—From these extracts, we consider it clearly established that the effects upon an entire regiment of removal to a hill station, is not only not always attended by benefit, but is actually productive of injury : that soldiers who have spent some years in the plains, require to be selected with great care, so that suitable cases shall be sent to the hills : and that without such careful selection, men are perniciously affected by the change.

It further appears that to obtain the full benefit of these stations, the measure recommended by Sir John Lawrence seems that most calculated to bring about this end, namely, to send to the hills weakly and delicate men (provided they are properly selected), and keeping all the strong and serviceable men in the plains ; for example, supposing a regiment was 1,000 strong, 200 or 300 might, as he observes, be sent to the hills, the remaining 700 or 800 being kept in the plains,

Advantages how best obtained.—A point of great importance for the consideration of Indian authorities, is the manner in which the advantages of hill stations can be turned to most account for the benefit of the soldiers in that country ; thus, unless a large addition take place to the barrack accommodation now available, it is apparent that but a small proportion of the numbers contemplated by the Royal Commission can be sent to them.

It is indeed to be hoped for the sake of our soldiers, that the state of Indian affairs will ere long admit of accommodation being provided for the proportion of these recommended by the Commission ; in the meantime however, the argument adduced by Sir Charles Trevelyan deserves to be duly considered. He observes, with especial reference to the barracks at Jackatallah

in the Neilgherrie Hills, that he doubts if the best manner of occupying them be by a single regiment as at present: the advantages whatever they may be, are confined to a single regiment; whereas, were selected men from different regiments sent thither, these advantages would be in a corresponding measure extended over the army.

Sir Charles Trevelyan further points out that the expenses attendant on a move of a particular regiment to and from a hill station are very great; almost all of which would be rendered unnecessary by having a permanent depôt, and sending thereto selected men.

A proposition emanating lately from home, might be taken advantage of in reference to hill stations. It has been proposed that instead of retaining in the United Kingdom the depôts of regiments serving in India, these should be sent out with the service companies, and thus made to be a reserve to their regimental head-quarters.

Were the proposal here alluded to carried out, the various depôts could readily be grouped together at individual hill stations; forming provisional battalions as they do at home. Not only could the young and delicate soldier undergo his drill at these depôts, and if need be, remain there until the strength of manhood had become fully established, but weakly men could be periodically sent from regiments, an equal number being sent from the depôt to take their place.

Another important end would be attained by the adoption of this system; the wives and children of soldiers could with greater facility than at present be sent to a hill station, and arrangements could without difficulty be made, whereby children would have all the advantages of elevated and cool climates, as well as being educated somewhat as children are in Britain. Health and life would thus be saved, and the children would in the cool air of the hills imbibe some of the physical energy of their parents.

It appears then that in order to give to the soldier stationed in India, the full advantages of hill stations; certain of these stations ought to be prepared for the reception of entire regiments arriving in India from home, certain others for weakly men, for recruits, and for women and children belonging to regiments that have been some time in the plains; in other words, there ought to be stations for occupation by regiments, and stations to be occupied by depôts, consolidated into provisional battalions.

With the increase of railway communication in India, and the completion of the system of transport* by the overland route, that is at present being matured, not only can men requiring change to the cool climate of the hills be readily sent thither; but in the case of sudden emergency, the soldiers who have for some time been in the hills could be rapidly brought to their respective regiments, or to any point at which their services may be required. Men affected with organic diseases, or those for whom experience has proved that the climate of the hills is not adapted, could at any time during a great part of the year be despatched to their own native country; thus not only would the health and well-being of individuals gain to a great extent by the arrangement, but the efficiency of the army would be increased, and undoubtedly a saving effected to government; inasmuch as soldiers who, as hill stations are at present made use of, succumb to disease or are permanently unfitted for military duty, would under the system proposed, be restored in many instances to the ranks: thus the pension list would be decreased, and all the expenses attending the enlistment and training of young men avoided.

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* The system of a regular transport service for India and China has for some time back been strongly advocated:—Among other writers who have brought the subject forward, is the Author of the present work,—See that on China and a pamphlet entitled "A System of Sea Transport for Troops" published in India, 1864.

Importance of the question.—The present is indeed a question than which there is really none of greater importance, whether we consider it in its bearings as one of sanitary science, or look at it as involving points of great military and political consequence. It is one therefore, from the consideration of which all opinion of a party or personal nature ought to be banished; thus, medical authorities should consider how far the measure proposed is calculated to save life and conduce to the health of our troops; military men, how far it is likely to economise soldiers and add to the efficiency of the disposable force; while the public policy demands, that the question be considered in its bearings upon the probable saving to be effected in the great drain upon population that the military occupation of India involves: and upon the possible influence that a continuation of a similar drain may exert upon our national prestige, and military influence among civilised countries.

Hence it is that the subject is here being discussed at the length it is, and that care has been taken to select from among writings upon it, such opinions as seem best calculated to maintain the importance of the consideration; and to point out most clearly what has been the result of the accumulated experience of many years.

Objections and replies.—It does not appear that an objection has at any time been raised on military grounds against the system of locating entire regiments at stations in the hills; the writer of the present remarks is aware however, that some officers consider that by the establishment of large depôts of the nature proposed, military discipline would be injuriously effected.

This latter supposed cause of objection demands a few observations in this place, for the present is precisely a question in which sanitation and the consideration of military efficiency of an army are indissolubly connected.

In considering therefore, in what respects military discipline is believed likely to suffer from the adoption of a measure so important to the welfare of individuals, and of the army generally as the location of a certain portion in elevated stations and a cool climate, instead of the hot malarious plains ; it is natural that we in the first place have some clear idea of what the expression " military discipline" really means.

Military discipline, we shall suppose, means one of two points, or both combined. It means either the maintenance of the troops in a state of efficiency for active service, and at the same time that degree of general neatness and smartness which is so desirable in a body of soldiers : or it means the repression of crime by punishments of various kinds,—by the removal of temptations,—by the establishment of means of recreation and instruction, by which it is intended to wean men from evil courses : or it means a combination of all these together.

To effect the former, a certain amount of drills and parades is necessary, but on the other hand how often is it not the case that much injury to the health of men is caused by excessive or unnecessary duties of this nature.

There does not therefore appear to be any reason why, with selected and discreet officers to command at hill stations, soldiers should not have as many drills and parades, and thus retain their efficiency as much as if they were in the plains. On the contrary, when we consider that the great majority of those who would be at the hills, are soldiers whose physical condition has unfitted them for undergoing the full amount of duty in the plains, the conclusion is natural that their efficiency would actually be enhanced by residence in a cool climate.

If the second point be taken into consideration, it is reasonable to enquire why should the same measures for the suppression of crime, and for the encouragement of the soldier to good behaviour that

are adopted in the plains, not be equally effective in the hills. Facilities for indulging in vice and crime can in reality be much more readily repressed in the latter than the former: for while in the plains, large bazaars and towns everywhere occur in the near vicinity of cantonments, and excellent roads afford the ready means of communication with them; there are at the hill stations that already exist, only bazaars of comparatively inconsiderable size: and partly from the precipitous nature of the hills themselves, and the restriction of the public roads to the military and civil necessities of the place, it becomes a matter of comparative ease to prevent the introduction into the stations of pernicious articles or persons, as well as the soldiers from wandering in search of either.

With regard to means whereby soldiers may be encouraged to good behaviour, there exist greater facilities for establishing these at depôts occupying hill stations than at places in the plains, more especially those at which single regiments are quartered: thus, libraries, institutes, and theatres can always be established on a larger and in a more efficient manner when they are upon the footing of those in a garrison, than when they are merely regimental; for in the latter case, the frequent moves to which a regiment is liable, necessitates that those of this nature be upon a very small and therefore inefficient scale.

Hence, on this view of the case, there appears no good reason why soldiers at depôts in the hills should be at any disadvantage, as compared with those in the plains: but that on the contrary, they ought with proper management to enjoy advantages which for the reasons just stated, are under the latter circumstances unattainable.

But as we have observed, military discipline may be held to consist in a combination of all the measures already mentioned: namely, of those that have in view the efficiency of the men as a military body, with those that aim at the repression of crime by means of

adequate punishments, and by measures which operate indirectly by their moral influence.

It is beyond doubt essential that to secure these combined ends, much care will be necessary in the selection of the military officer to command, and medical officer to take charge of the depôts or provisional battalions which it is the object of this chapter to show, ought to be established for a large proportion of our forces in India. It would however, be a poor compliment to and an unjust imputation against both these branches of the army, to raise a question that such officers are readily to be found; in fact, it is but fair to assert that no officer whose duties are of an inspectorial nature could have any hesitation, in from those personally known to himself, recommending officers who have special qualifications for holding such appointments.

In an early chapter of this work, some remarks were offered on the general management of the soldier; among other matters, it was there stated that much injury to health, and consequently to military efficiency, was often produced by duties of unnecessary severity, duration or frequency; that among the sources of personal annoyance to the soldier, and consequently to his discomfort and ultimate loss of health, were the state of surveillance in which he feels himself to be; and in many instances, the numerous duties he is almost hourly called upon to perform; these although individually of no degree of severity, yet by their frequent recurrence depriving him of that complete exemption which is essential to enable the bodily powers completely to recover themselves. The simile of the hardest stone being in time worn by the continual trickling of water upon it, may with propriety be applied as an illustration of the effects upon a soldier of duties, which trifling in themselves, leave him no sufficient time for rest.

It is unquestionable that in some regiments this state of affairs does exist: and that simple removal

from such condition is of itself all that a soldier requires in order to recover health that under them had become impaired; in this respect therefore, it may so happen that military discipline will in reality gain by the temporary withdrawal of men from a system that too often defeats the end with which it is being enforced.

It may possibly be, that there are other points connected with what is believed to constitute military discipline, against which the plan now being advocated is considered to act injuriously. If this be the case, let us bear in mind the fearful sacrifice in health and life at which India has hitherto been held; let us recollect that it is only by the adoption of the measure now proposed that we can chiefly hope to diminish this sacrifice: and therefore, if need be, rather that military routine be so modified as to accommodate itself to so vastly important a measure, than that the measure itself shall not be thoroughly and completely carried out.

Selection of troops for Hill Stations.—It seems almost unnecessary to remark that at the present time, and ever since the plan was first adopted of sending men to hill stations, much attention is and always has been bestowed on the selection of suitable cases for these places; not only do persons affected with certain forms of disease not derive benefit from residence there, but often return to the plains to be shipped for the United Kingdom, in a condition far worse than that on account of which they in the first instance had been sent to the hills: and as regards regiments, evidence has surely been adduced in the preceding pages of a nature to demonstrate the evil results that have, not in one solitary instance but in many, arisen from bodies of troops being sent to these places promiscuously, and without any or sufficiently careful selection.

The selection we have thus shown to be the essential principle according to which depôts at hill

stations should be supplied, must necessarily include troops situated under a variety of circumstances, to each of which class a few remarks must be devoted, namely :—

1. *Men actually ill,* as is the case at present with regard to this class, any change that might be necessary in the administration of the depôt would be inconsiderable. At stations where on account of the natural formation of the mountain range space for barracks is much restricted, invalids from various regiments might with propriety continue to be formed into divisions or companies as at present; each division being under an officer, and all under a commandant.

Depôts of this nature would with propriety occupy sites that are not adapted for more effective men; inasmuch as the men forming them, not being in a fit condition to undergo drills and military exercises, they therefore require but a small space as a parade ground; accommodation could therefore be provided for them upon the ridges of precipitous mountain spurs.

2. *Old soldiers* whose period of service for pension has nearly expired; who are either falling out of health, or having done good service, are from motives of humanity permitted to pass the last cold season of their service in a comparatively healthy climate, and thus removed from the risks to them as elderly men, of further residence in the plains.

As it is not intended to restore men of this class to military efficiency, so they might with propriety be attached to depôts to which men actually ill are sent, and be in every way treated like these.

3. *Weakly men* who although not suffering from actual disease, are debilitated by residence in the hot climate of the plains.

4. *Men of considerable service* in the plains, who either for their own sakes, or on account of the state of health of their wives or children may, from time to

time be allowed the privilege of spending a hot season in the hills.

The arrangements deemed necessary for these two classes of persons, may be considered together, as they are identical in nature, and in fact assimilate very closely to the depôt system at present in operation in the United Kingdom.

With individual regiments and battalions at their present numerical strength in India, it is calculated that to send 200 men from each to a hill station annually, would fulfil the object aimed at by the Royal Commission in its recommendation that one-third of the whole should be retained as a reserve in a mountain climate. These 200 men arranged into two companies by the process of what in regimental phraseology is called making up individual companies in rotation, and with the officers of these companies attached, might be sent at the commencement of each hot season; relieving other two that rejoin head quarters.

The number of regimental depôts to be formed into individual provisional battalions would naturally depend upon the available accommodation for barracks and drill grounds at particular hill stations; whether they be few or many however, is immaterial for the purposes of routine; as although the individual companies would remain under the command of their own regimental officers, the latter would on the one hand be held responsible for the proper fulfilment of their duty to their regimental commanding officers, and in all that refers to the general depôt to the officer commanding the whole; he being as already observed, selected purely on account of recognised fitness for his appointment.

5. *Detachments of recruits* on first arriving in the country. All experience has shown that the greatest risk to health and life in India, occurs during the first three years of residence there: that lads under 21 years of age are swept off in the greatest proportion,

and that many young men succumb or have their health permanently impaired during the process of being drilled, especially if they be so in the exhausting climate of the plains, who under opposite circumstances would, there is every reason to believe, grow into strong and robust men ; most unquestionably therefore, military policy as well as sanitary considerations and the dictates of humanity demand that provision for this class of persons be without delay made at hill stations.

The most convenient manner of making arrangements for these seems to be, to send them as they arrive to the depôts at which detachments of their respective regiments are stationed. It would not of course be necessary to send to these places all men who arrive in India under the general designation of recruits, because among such are men who, having been sent home on account of their health, have been completely recovered, and are *en route* to rejoin their regiments : others are transfers from different regiments : and some, men whose first period of service having expired, they have re-enlisted. Even among the men who actually are recruits, there are in every detachment a certain number who have reached mature years, or have undergone their complete drill at home ; so that in reality the proportion to be sent to the hills from each succeeding detachment, would be considerably smaller than at first sight might seem to be the case.

6. Regimental Depots.—With regard to the proposal recently discussed of sending to hill stations in India the entire depôt of each regiment serving in that country, the question would be very simple and easily answered in the affirmative, were no other than sanitary considerations to be taken into account. It does not appear evident however, in what manner other than according to the present system of having in the United Kingdom, the depôts of Indian regiments, the various requirements of the latter could be fulfilled :

as for example, the proper arrangement of military and pay documents of recruits and others joining; the completion of the kits, as well as the other numerous purposes that the present system fulfils.

In the event however, of the change advocated by some persons taking place, the system suggested a few paragraphs back is perfectly practicable; *viz.*, of having general depôts in the hills: each commanded by a selected officer, and these general depôts or provisional battalions constituted by companies in rotation from individual regiments: and it is persumed this arrangement could be carried out with facility.

7 & 8. The wives and children of soldiers.—That much has of late years been done to ameliorate the condition of these classes in India, as well as our other colonies and at home, is readily acknowledged: and that farther measures with the same view are contemplated, is also readily granted. It may not be deemed out of place here however, if a word be said to advocate the institution of arrangements whereby the wife or children of a soldier may when sick or in failing health, be granted some of the advantages enjoyed under similar circumstances by the soldier himself.

A soldier, it is almost needless to repeat, is at once under the circumstances mentioned, sent to a hill station or shipped to England according to the apparent necessities of his case; with but very few and rare exceptions however, his family can enjoy no such advantages; nay, in some instances the fact of a soldier being married deprives him of those that he requires, and his bachelor comrade partakes of: for as at hill stations as at present constituted, the accommodation for women and children is extremely limited, only a very small number of these can at any time be sent to such places.

The great mortality among the wives of soldiers is notorious: that among their children so great, that few indeed ever attain to adolescence unless their

parents happen to be ordered home and take them along with them; at hill stations on the contrary, children enjoy a degree of health superior to what the corresponding classes do at home, although from the nature of their training and association even there with the black population, their habits and energy, physical and mental, ever remain very different from what they would become in Britain.

Still, health and life would be saved: many lads would as they grew up enlist as soldiers: others would doubtless become artisans, and a certain number enter upon other occupations: girls as they reached womanhood would become wives of soldiers: thus, not only would India itself be a gainer, but the army would benefit directly as well as indirectly to an extent that cannot well be limited.

In order however, that such an arrangement may be fully carried out, it is essential that extensive accommodation be provided for these classes at particular depôts; to these, not only soldiers' wives and children might be sent when ill or falling out of health, but also as an indulgence on account of good behaviour on the part of soldiers. In times of war they would be much better cared for at regularly established depôts than they can be under the present system, which leaves them without much, if any care or supercision under such circumstances; nor does there appear any reason why a certain number should not always remain in the hills; the husband or father being so long as he deserves indulgence, permitted to pass the hot season there also.

At such places children might be well educated and trained to various handicrafts, and those of the women who chose to be industrious, be employed in various ways: thus some would make their own and their children's dresses, some knit stockings for the soldiers at regimental head-quarters, or for private individuals, others be employed in domestic service, a few as washer-women, and all made more or less useful.

Concluding remark.—Only one more remark seems necessary in bringing this somewhat long chapter to an end. The whole subject of hill stations in India is at present but in its infancy: much valuable information does indeed exist in regard to the few and inconsiderable stations of this nature that have already been occupied, but that the plan has yet to be tried upon a large and comprehensive scale, is apparent to all who have given it consideration.

When too the fact is borne in mind, that the question involves a probable expenditure of a sum of public money to be reckoned not by thousands, but by millions sterling, and that whereas the benefits would be shared, appropriated by the army generally, whether at home or in India, the cost of the arrangements would fall upon the revenues of the latter, it is easy to understand that difference of opinion regarding details should exist, and that unless the question be further discussed and brought forward, delays in the execution of the scheme may still be looked for. The question as already observed is not only one of mere sanitation, but one of national importance. From both these points of view therefore, it demands most serious consideration.

CHAPTER XXIV.

BARRACKS.

As they formerly were—Partial improvement—Dr. Jackson's opinions—Causes of unhealthiness—For West Indies—East Indies—Opinions of authorities—Verandahs—Material for walls—For floors—Arrangement of beds—General arrangement—Barracks for families—Remarks on a plan for barracks.

Until very recently, barracks for soldiers would seem to have been erected and accommodation in them arranged, without consideration to the health or personal comfort of their inhabitants.

It is true that many medical officers have, in buildings of this nature long recognised a powerful cause of disease among our troops, and raised their voice in condemnation; it is no less true however, that warnings so often uttered, continued to be disregarded until within a few years back; when the public having demanded inquiry into the various causes of the sickness and mortality that prevailed in our army, the subject of barrack construction for the first time received a portion of that attention which years before it demanded.

Even yet however, buildings of this nature have only to a small extent undergone that improvement in construction that is necessary, so that they themselves be no longer a source of disease to their occupants.

In the United Kingdom, these principles are now attended to fully: but not so in all foreign stations. In India, not only do some barracks that many years ago were condemned as not proper places to be occupied still continue to be used: but when military necessities require that new buildings shall be erected, barracks continue in some instances at least to be built upon the model, and in the manner of those that date back to a period prior to that when the

prevention of disease was much thought of, except by professional men.

The army medical officer may be called upon to give an opinion in regard to the construction of barracks about to be erected, or to alterations in existing ones; it is well therefore in a work such as the present that the more important opinions of authorities on these subjects be brought together in a manner convenient for reference.

Dr. Jackson, writing in 1804, expressed himself strongly on the subject of barracks,—"If," said he, "health suffer and life be lost from the operation of causes which arise from the bad position or faulty construction of the soldiers, dwelling; the military department is responsible to the country for a sacrifice of life without necessity." Strong language this for an army medical officer to make use of; but after an interval of half a century its truth has been acknowledged, and the subject to which it referred for the first time submitted to a systematic consideration.

But before this systematic investigation took place, more than one medical writer in India expressed themselves strongly on the evident faults of our barracks in that country. Dr. Chevers more especially urged this point, observing as he did, that badly constructed or ill-placed barracks may for years be the cause of a high rate of mortality in stations which are in themselves naturally healthy.

We shall presently see in the quotations about to be made, various examples of unhealthy barracks from one or other of these circumstances; but in the meantime, give the following as the principal causes of unhealthiness according to the authority of Dr. Parkes, namely:—

1. Improper site, as malarious, damp and disturbed ground, church-yards, exposure to unhealthy winds.

2. Bad arrangements of the buildings themselves as regards light and air.

3. Basements being badly arranged, confining masses of stagnant air, fungi, organic matter from cesspools or badly arranged sewers.

4. Improper administration as regards uncleanness, impure air, foul walls, soiled bedding (this must be so in India to an immense extent, so long as soldiers are permitted to have their own bedding: and it consists of materials which from their nature cannot be washed), insufficient or bad supply of water, or defective ventilation. Ophthalmia is said to be frequently occasioned by the latter defect.

Barracks.—For the West Indies, barracks,—so wrote Dr. Jackson, should be raised from the ground on brick pillars to a height of three feet, and thoroughly ventilated beneath. They should consist of only one story, and have a roof lofty and double: a piazza ten or twelve feet in breadth, furnished with jalousies painted green, should extend along their front and rear. The barrack-room should contain 12 men, and there should be a room for a non-commissioned officer at the end of the rear balcony. This arrangement, he says, is the most eligible for the health and comfort of the troops. If however, twenty-four men are lodged under the same roof, an apartment should be left at either end for non-commissioned officers.

Here we have the precise principles indicated, which sixty years after they were first enunciated, have been brought forward as altogether new by "sanitarians." It is right however, that the army medical officer who first propounded them, should have the credit due to him.

It may be well to observe that as in India, not only has most to be done in order to give our troops suitable accommodation, but that there, the question of barrack construction for so large a number is one of great financial aswell as sanitary importance, so this chapter is composed with more especial reference thereto, in the hope that while urging the necessity for buildings of this description, which is apparent

to all who have occasion to pay attention to the subject, the rules according to which improvements ought to be effected, may be made readily available for reference.

There is a remarkable uniformity of opinion, not only among medical, but also among other authorities as to the propriety of barracks having considerable elevation from the ground: and the propriety of the principle has been fully adopted by the various Sanitary Commississions that have of late considered the subject.

In India and all tropical and sub-tropical countries, it is indubitable that habitations are healthy in proportion to their height from the surface of the ground. Miasm is more powerful in its effects during the night than during the day; hence the propriety of barracks in India having upper rooms for dormitories. In the lower ones may be libraries, dining-rooms, and places of amusement: store-rooms and kitchen however, ought not to be on the ground floor of such buildings, but separate and apart from them.

In illustration of the great unhealthiness of lower stories of barracks as compared with higher, there are many examples in India:—thus, in Fort William at Calcutta, so distinctly was this the case prior to the erection of the present range there, that the ordinary custom was to move the soldiers at short intervals from the one to the other, in order that all should have their share of risk.

Among the numerous witnesses examined by the Royal Sanitary Commission, Mr. Jeffrys is of opinion that in India much unhealthiness is produced by barracks being too near the ground; that they should be elevated therefrom, fifteen or twenty feet.

Sir Ranald Martin says, that barracks and hospitals situated on the hot and pestilential plains of all hot climates, ought to be raised on arches.

Even the Government of Bengal acknowledges a similar principle; for in a letter to the Sanitary

Commission on this subject, it is allowed that "in Calcutta,"—"it is positively unhealthy to sleep on a ground floor, especially in the rains," and that "no soldier should be allowed to sleep at a lower level than 20 feet from the ground."

Dr. Sutherland says, "another obvious objection to the present construction is that barracks (in India), are not raised sufficiently above the ground, and in very few instances indeed, are they raised at all. Where they are raised, the plinth is generally filled in with earth paved over, and there is no free perflation of air between the floor and the ground. The consequence is that ground malaria enters both barrack-rooms and sick wards." He adds that in one instance of this, the ward was pervaded by a very noxious effluvium, and when one of the flags was taken up, the odour that came out was so unbearable that every body fled. This was at Bangalore.

Entire isolation of the floors from the soil is essential to health in tropical climates. In India, it is not safe for men to sleep within the sphere of night malaria proceeding from the ground within the limits of night fogs.

The floors of barracks and hospitals should be raised several feet above the soil, on arches,—the height varying with the nature of the locality. In low flat localities, troops as well as the sick should always sleep in upper stories.

Sanitary Commissioner's Report, vol. 1, page 313, qeustion 5493.—There is no perflation of air under the ward floors (in hospitals in India generally) and the sick are exposed to ground malaria in consequence."

Minutes of proceedings of Sanitary Commission for Bengal, page 64.—"We believe," says the Commission with Sir Robert Napier, that there is no part of the plains of India in which it would not be beneficial to the health of the men (writing of barracks), that they should sleep in upper stories,—and that it

should be a rule never to let them sleep on the ground floor if it can be avoided."

"We recommend that all new barracks be built upon a basement of 4 feet, with the air circulating under the floors:—that they consist of two stories, and that the men sleep in the upper only in Bengal Proper."

DITTO PARA 4, PAGE 65.—"In Bengal and in provinces, with a similar climate, the floors of the sleeping rooms must be raised at least 12 feet above the ground."

It seems almost unnecessary to state that in the views of the authorities just quoted, the Commission of which the writer of this chapter is a member, most fully concurs: indeed, so pressing did the necessity for raised barracks appear to be, that the first recommendation submitted by that Commission, was to the effect that all future buildings of this nature in India, as well as hospitals shall be erected on raised basements with the air circulating under the floors.

No less strongly did the same body urge that in low, flat, and damp districts, each building shall consist of two floors: the upper being used only as a sleeping room, the lower as a covered place for exercise and amusement; and that in such situations, the basement shall be of not less than three or four feet in thickness, the lower story being fifteen or more feet high to the floor of the upper.

According to the Royal Commission, the ordinary width of a barrack-room should be 20 to 24 feet; and under no circumstances whatever should more than two rows of beds be placed between opposite doors.

Dr. Jackson whose works have already been so often quoted, considers as above stated, that a barrack-room calculated for twelve or fourteen soldiers with a small apartment for non-commissioned officers, is the size best adapted for preserving health and maintaining discipline. It is not only curious, but extremely interesting to find that this view, expressed at the

beginning of the century, is that now adopted in the plans of half company barracks recently approved.

Formerly it was considered that in all hot countries, broad verandahs round each barrack were necessary: and in India, the perfection of barrack construction was looked upon as consisting of double ones; namely, an inner, which was in most instances occupied by soldiers, precisely in the same manner as the barrack-room itself, and an outer which was open. Verandahs thus constructed however, are found to impede ventilation and light, they are therefore now condemned by the great majority of present writers.

The material to be used in the erection of barracks becomes a matter of great importance; the walls should consist of thin stone or brick masonry: if thick, they absorb much heat during the day, and radiate a corresponding amount at night. Mortar and not mud should be used as cement, and it may be mentioned, new bricks, if this description of material is the one selected, should be used for the greater part of the building.

There is perhaps no objection to the partial use of bricks that are not very old, and that in the former building from which they have been taken, occupied a place well above ground:—those from foundations however, or that have been saturated with organic matters must on no account be used, neither should any but well-baked bricks be employed.

As an illustration of the great porosity of hard and well-baked bricks, Dr. Roscoe states that in a closed space, the air of which contained 16 per cent. of carbonic acid gas, 3·25 per cent. escaped in two hours through them. This is a very important statement: if true, and there seems no good reason to doubt its correctness, it indicates one manner in which a certain degree of ventilation takes place and explains how readily this kind of building material may become impregnated with morbific or decomposing matters.

Walls of Barracks.—The War Office Commission has recommended that walls of barracks should be hollow, so as to have an air space; that this space be ventilated above and below with air bricks. It does not appear however, why such an arrangement should really be required in hot countries, where the outer piazza or verandah gives sufficient protection from the heat of the sun. In temperate climates it is not needed.

All inner walls should be plastered. Instead of being coated with white paint, as is usually the case, they should be painted of an amber, pink, or light grey color. Either of these is a relief to the eye, while on the other hand, white fatigues it.

The best material for floors of barracks, more especially in India, is stone. Bricks soon become worn, and they, and terrace work crumble into dust which penetrates every thing; very much more care than is at present bestowed upon the construction of floors in that country, is required however; the flags should be square, their upper surface not left in the rough unfinished state they at present are; and their points of contact with each other should be secured by means of good cement. In the absence of it, the water used in washing barracks obtains access through the crevices.

It may doubtless surprise some readers of these pages to be informed, that it was at no distant time customary in India to have the floors and even walls of barracks and hospitals smeared over with cowdung as a means of keeping them *clean*: and still more may they be surprised to learn that the practice is at the present day advocated by some medical officers who have resided many years in that country. It is almost needless to observe that such a practice is most filthy as it is pernicious: and ought not to be longer followed.

Bedsteads.—In former days, bedsteads in barrack-rooms were arranged in double tiers, after the manner still observable in cabins of many passenger ships:

and indeed, as is still adopted in the case of women and children in troop vessels. If we are to believe accounts of the description of accommodation then afforded, two men or at times even more were placed in one bed: nor did the fact of one of them being ill from typhus fever seem to strike the military officers as sufficient cause why his bed fellow should be removed:—as for medical opinion, it was but little consulted.

Dr. Jackson in his work says, "a double tier of bedsteads, or a double tier of platforms marks an extreme ignorance of the nature of things. The contrivance contaminates the air by artificial condensation, favors the generation of the causes of contagious fever, and thereby tacitly and indirectly annihilates the army, or renders it ineffective through disease artificially produced."

So lately as 1860, platforms such as are mentioned by Dr. Jackson, except that they formed only one tier were erected in the building in Canton selected by the French authorities for reception of their troops during the joint occupation of that city. They had for many years prior to that date ceased to be used in barracks occupied by soldiers of the British army; and it is in some respects consolatory to think, that however tardy may have been the progress of sanitation with us, there do exist armies in which it has been still more so.

When it becomes necessary to erect a number of separate buildings in close proximity to each other, for the accommodation of troops, as for example, in India,—it may be well to bear in mind that individual buildings ought to be so planned, as that one shall not interfere with the thorough perflation of the other: and that the distance between different buildings that lie in the line of prevailing winds, ought not to be less than equal to double their height.

According to the Sanitary Commission for Bengal, the individual buildings should never be more than

two deep from front to rear, except only on the flanks where they may be three deep.

The out-houses should be arranged in streets between and on the flanks of the barracks; the plunge baths and ball courts should be on the exterior of the area covered.

Quarters for Married Soldiers.—The following are briefly the points which, according to the Home Commission, should be attended to in constructing quarters for non-commissioned officers and married soldiers, *viz.*—

To erect all separate quarters on basements ventilated beneath; the height varying according to circumstances, but the higher as a rule, the better. Each married soldier in the tropics to have two rooms, and an additional room to higher grades.

The general principles of construction to be the same as for barracks.

Drainage to be carefully attended to.

Latrine and bath accommodation for men and for women to be separate.

One kitchen may be sufficient for each group of buildings.

If in India, the barracks for married soldiers should be placed to the rear, and not in the midst of those for single men.

Remarks on a plan for barracks.—It is considered that no breach of official etiquette is committed, in submitting the accompanying plan of arrangement of various buildings for a regiment of infantry in India, as proposed by the Sanitary Commission for Bengal. According to that plan, the front occupies a line of 1,260 yards, the depth, one of 631 yards. As will be observed, roads may conveniently be made so as to afford free means of communication between the different buildings: the intermediate spaces admit of free perflation: no one building is covered by any other, except at such a distance as to render stagnation of the air from this cause impossible: the quarters

intended for married families are placed at the flanks and in rear of those for single men; and all out buildings have positions allotted them, by which the maximum of convenience is obtainable, and the minimum of inconvenience ensured.

The subject of barrack and hospital construction in India has already assumed a tangible shape. The re-arrangement of stations to be henceforward occupied by troops of the line has been in a great measure decided upon; and while these pages are being corrected, the Budget estimate for 1866-7 contains a grant of £1,800,000, the first instalment of a sum of £10,000,000, to be devoted within the next ten years to the erection of suitable barracks and hospitals for the men by whom this great empire is held.

Of the great importance in a sanitary point of view of these two measures upon our soldiers it is impossible to form an adequate idea. The vastness of the measures themselves is a fitting celebration of the transfer of the rule over that country to the Imperial Government.

CHAPTER XXV.

CLOTHING.

Variety necessary—Cotton—Serge—Flannel—Head dress—Protection for the eyes—The beard—Protection for the Loins—Socks.

In considering the subject of clothing, it only appears necessary in this place to offer a few general observations on the subject; among the works bearing upon army hygiene that have lately appeared, full details occur regarding individual articles, as well of it, as of the soldiers' equipment in detail. When we take into account the vast extent of the world over which the services of the British soldier extend, and the range of climate to which in it he is subject; the difficulty becomes great, considering the nature of his duties, and the restriction thereby put upon the amount of outfit to be carried with him, to provide a supply of clothing sufficient to meet sanitary requirements under the varying circumstances of climate and season. All that the medical officer can hope to effect, is that the stock in possession of the soldier may be turned to the best advantage.

Under special circumstances, as for example, in times of war, or in climates where the extremes of temperature are great, as in China, whatever description of clothing may by the responsible medical authority be considered necessary for the troops, even over and above those authorised by the general regulations of the army, may always be issued to them on proper representation being made as to the necessity of the measure: to this end therefore, the subject should always command the serious attention of those charged with sanitary administration of a force.

With reference to India, we find that during the cold period of the year, that is, during the months from October to March inclusive, English clothing is sufficiently well adapted for troops quartered in the more northerly stations ; at the extreme northern ones in that country however, as for example Peshawur, additional covering becomes necessary, while at those south of Benares, the temperature is at no time so low as to render the wear of this clothing otherwise than unpleasant.

Clothing.–Too heavy clothing may become not only a source of great inconvenience and injury to troops themselves, but actually be the cause of failure of an expedition. A melancholy instance of this did happen during the mutiny in India : a detachment of soldiers was in the month of July sent out dressed in thick tunics and cloth trowsers, as if they were proceeding in heavy marching order at home. Numbers were prostrated by heat apoplexy, the others weak and exhausted were unable to cope against their enemy, and a terrible disaster was the result. This happened in the Arrah district. Similar results are noted in America by some writers on military hygiene in that country at the commencement of the present century.

Cotton clothing conducts to the body external heat more slowly than does linen ; but is warmer when the temperature of the air falls below that of the body ; both these results arising from its non-conducting property.

In tropical countries, the lighter and looser the dress, the better it is for health as well as for comfort. The ordinary cotton dress at present worn under such circumstances, entirely answers both these purposes so long as the climate is dry : on the clothes becoming wet or sodden, whether by rain or perspiration, it is rendered unpleasant to the wearer, and even unhealthy on account of the liability thus induced to the person receiving a chill from any sudden draught of air to which he may be exposed.

These drawbacks are much increased during the rainy season: and the want of sufficient stock to enable a man to change his clothing so often as for sanitary purposes would be necessary, undoubtedly gives rise to a certain liability to fever and bowel diseases.

On the line of march in India, it is customary for men to wear loosely made coats of red serge, and these are very well adapted for the purpose. Trowsers of blue serge are also tolerably well adapted for the purpose, but are of hard and somewhat rough material: these, in men who do not wear drawers, are likely to chafe.

During the prevalence of the rainy season, especially on night duty, this dress would in many respects be preferable to white cotton. At the changes between the hot and the cold seasons, the serge clothing is generally taken into wear, but the artillery branch of the service, strangely enough, is not provided with a suit of this kind, although found so useful in the cavalry and infantry: hence, they have nothing intermediate between the thick material of English winter clothing and the light material of cotton drill.

On occasions when men are liable to be exposed to alternations of temperature or sudden changes from dryness to wet, they ought always to be clothed in woollen, as this material is not only a less perfect conductor of caloric than cotton, but absorbs in its texture far more of the secretions from the surface of the person.

For this reason it is that persons in private life almost all wear light woollen clothes, when residing in parts where sudden alternations are of frequent occurrence, as at Calcutta, Hong-Kong, and West coast of Africa during the rainy season at each of these places.

Flannel.—The flannel waist belt supplied in a soldier's kit in India, is a most valuable article of clothing. The fact ought to be borne in mind, that diseases implicating some one or other of the organs

within the body are those by which the great mass of the entire mortality in India is occasioned : and the best care should ever be directed to the measures most calculated to protect the soldier against the attack of these. One of the most available means consists in the men wearing a belt of this description when on night duty, or liable to be exposed to variations from wet to dry, or from heat to cold.

Of the sanitary value of flannel to the soldier in India, there can be no doubt, preventing as it does much of the danger arising from sudden alternations of temperature.

We learn that the Roman soldiers wore flannel next their skins, and Dr. Rush, writing in 1777, observes,—"During the last war in America, General Gage obliged the soldiers to wear flannel shirts from an accidental want of linen : and it was remarkable, he adds, not a single soldier belonging to that regiment was ever seen in any of the military hospitals. Dr. Rush observes moreover, that he has known instances where the yearly visits of intermittent fever have been checked in Pennsylvania by nothing else but the use of flannel.

The opinion of Dr. Jackson in regard to the question of this material as clothing, as in all matters bearing upon military hygiene, is of the greatest possible value.

He observes that there are many, even physicians of eminence, who maintain that flannel worn next the skin is preservative of health, both in hot and cold climates ; others contend that it increases the susceptibility to impression, and consequently favors the action of the causes of disease by receiving more readily, and retaining contagion more closely than hair or cotton ; and so seems to propagate sickness in armies.

He moreover says, the truth of this is strongly supported by what happened in the British army in the early part of the war of 1793. The soldiers were then enveloped in flannel. Yet their sickness

was great, and mortality unexampled. Flannel on this occasion, it is added, was not the primary cause, it was obviously a contingent one; and the balance of Dr. Jackson's opinion, after comparing the relative advantages and disadvantages of this material, is in favor of its use by soldiers.

An objection often urged against its use in India, is the difficulty always experienced in that country in getting it properly washed. This could be easily obviated by having proper washing machines taken into use in every regiment, and having all the washing thus performed, as is done in the 2nd Battalion of the 10th foot, at the very time these notes are being written. It may be useful to observe however, that in India "basin" that is the flour of lentils, is used as a cheap and convenient material for cleaning flannel, when used with water.

Head dress.—This is one of the subjects bearing upon the hygiene of troops, regarding which immense diversity of opinion exists. One class of authorities exert their ingenuity to discover by what means apparently, they can procure for the soldier the largest and most fantastic looking covering for the head. Another set of authorities consider that any such special contrivances are altogether unnecessary.

Unfortunately in selecting the style of head dress to be worn by the soldier, the opinion of medical officers is seldom asked; or if asked, acted upon. In a regiment in India however, much may be arranged which will conduce to the comfort to the men in this as in other respects, provided a good understanding exists between the commanding officer and the surgeon, and the opinion of the latter commands respect. As a rule, the head dress worn ought to combine lightness with durablity of material; and perhaps upon the whole, none combines these qualities so well as the ordinary forage cap, whether worn without a covering as at home, or with one of white cotton as in hot countries now.

Protection for the eyes.—During the hot weather campaign of 1857 and 1858 in India, officers derived very great comfort from wearing shaded spectacles, or ordinary eyeshades, such as are in common wear at home by railway travellers: and strange as it may appear, the protection thus afforded, actually tended to give a feeling of coolness as they rode onwards under the burning sun, and in the hot winds of the Central Provinces. Doubtless, the idea of a whole regiment or division of soldiers under such circumstances turning out with the probability of having to engage the enemy,—their eyes protected by green spectacles or goggles is absurd: but there would be no such absurdity in each man being provided with a piece of violet or green silk gauze upon his cap, in such a manner that he could when necessary, let it fall over the upper part of the face.

Stocks.—At the present day we cannot read without surprise that the practice of drawing the old leather stock tight around the neck, was formerly the practice in some services to make the men have a ruddy appearance, that is in fact, to prevent the return of the blood from the head to a degree sufficient to produce congestion. It is well, indeed, that such a custom, and the stock itself are now among the things of the past.

The beard.—It may not perhaps be considered altogether appropriate to the present subject to introduce in this place an observation regarding the custom now so general among our soldiers on foreign service of wearing beards; upon the whole however, this is perhaps the best and most convenient place to do so.

Soldiers and officers who are themselves gifted with large development of the beard, are eloquent in support of this appendage being maintained. The great majority of soldiers in a regiment however, are too young in years to have attained in this respect, their maturity: and of the remainder, but few are capable of what is called "sporting a good one."

For the sake of tidiness and uniformty therefore, the writer would advocate shaven chins, except while men are on service: but when they are, would allow them in this respect to please themselves. As to the supposed benefits from wearing beards, and the supposed disadvantages on the score of health of shaving them off, his own impression is that the one and the other is equally imaginary.

Covering for the loins.—There are many medical officers who with the author believe, that on the march or during great exposure to the sun, more danger exists of heat apoplexy occurring in conseqence of direct solar heat upon the loins, giving rise to spinal congestion, than from their effect upon the head. During the mutiny in India, not a few officers suffered so much in this respect, while sitting in their saddle during a day's march in an Westerly direction, that of their own accord they had recourse to a cummerbund, or girdle of thick folds of cloth: and with good results.

This may account perhaps for the native Indian habit of wearing large masses of cloth around the loins. It may however be observed, that in the cases of horses in India much exposed to the sun, their native keepers while leaving the heads of the animals uncovered, invariably place carefully upon their loins several folds of the horse cloth, which they usually carry with them, as if for the purpose.

Socks.—Considering the circumstances of the soldier, woollen is the material best adapted for socks: those of this description however, soon become so soaked with perspiration: unless care be taken that the men are supplied with socks of good quality, fretting and chafing of the feet occur on long marches, from the hard coarse description they often get; and they moreover speedily wear. It is not at all times easy to mend them even in England; in India this almost amounts to impossibility; hence, they have to be at times worn in so dilapidated a condition, that this of itself produces blisters and sores.

Cotton socks, if of good material and often changed, are far more comfortable to wear than woollen; but in this, as in many other respects, considerations of a purely hygienic nature have to give way to the circumstances of a soldier's daily life. All that a medical officer can do is to see that consistently with these, every practicable measure be taken to preserve health and personal comfort.

CHAPTER XXVI.

BOOTS.

How supplied in India—Men how fitted—Present mode of supply—Effects of badly fitting boots—Suggestions.—

The time is not far distant, when boots were issued to soldiers with very little if any attention to the size or form of the foot; nor does the subject yet, it is much to be feared, receive all that attention which its importance demands.

The few observations that follow in regard to the supply of these articles of outfit, are selected from a memorandum submitted by the writer of this volume to the Sanitary Commission for Bengal; and although having reference chiefly to the requirements in this respect of troops in that country, are in a great measure applicable to soldiers elsewhere, whether at home or in the colonies.

How supplied in India.—It would appear that prior to 1862, each soldier in India was allowed by Government one pair of boots per annum, and that a requisition for the whole number required by each regiment, at this rate, was sent to the Director General of stores in London. The boots received in this manner, were sized from No. 1 to 12; No. 3 being the smallest description required for issue in a regiment.

Men how fitted.—Individual men fitted themselves by going, usually a company at a time, to the Quarter Master's store, and there trying on one pair after another until they found one that suited them. It does not appear that any superintendence was exercised over them; nor that any rule was enforced as to the allowance necessary to be made in the size of the boot for the expansion of the foot while walking.

Pecuniary allowance.—A personal allowance equal to 8 shillings per annum was made, to enable those who wished to do so to obtain a second pair of boots. This they usually did by purchasing in the native bazaars a pair of country-made ones, the leather of which being only imperfectly tanned, and the workmanship bad, they were speedily rendered useless by wear, and had the additional great disadvantage of causing foot soreness whenever the men attempted to wear them on a march.

Present mode of supply.—Government of India's General Order, No. 152, of 1864, sanctions 2 pairs of boots annually to the dismounted services. The mounted branches get 2 pairs with their full-dress, one with their undress. Compensation was sanctioned, G. O., C. C., 25th March, 1864, for "the additional articles" in which the second pair of boots was included. In consequence of these articles not having been issued in kind since 1862-3, compensation was also sanctioned for the additional articles, for 1864-5, as per Adjutant General's circular 104 E, of 25th August, 1864.

Instead now, of the supply of boots being obtained from the Director General of stores in London, they are so from the superintendent of clothing at Calcutta. In other respects however, the routine in regard to them seems to be much as already described. The manner of fitting soldiers is as noted in a preceding paragaph.

Effect of badly fitting boots.—Dr. O'Nial, Surgeon of the 51st Light Infantry, remarks on the subject of boots as at present issued to the men, that "excoriation is produced either by direct pressure when the boots are too tight, or by friction when they are too loose. If the boot be too short, the toes being forced into the point of the boot, become excoriated. If the boot be too large, so as not to fit the instep and body of the foot with moderate tightness, the toes are at each step, and especially if the heel be high or the march down-hill, driven

forward into the boot, and the skin upon the upper surface excoriated."

"Excoriation on the heel is caused by the boot being too tight in that position, by roughness of leather there, or by pegs projecting upwards. It is also caused by the upper edge of the piece of leather called the stiffening being so tight, as to press upon the hollow immediately above the heel."

Dr. Parkes in his work on "Practical Hygiene" (p. 362.), gives illustrations of the high value placed upon perfectly fitting boots for the use of soldiers by commanders. He states that in walking, the foot expands one-tenth or more in length, and in breadth the degree of expansion is even greater: he gives some illustration of the defects at present most apparent in boots, and offers his views as to the best means of remedying these defects.

From a consideration of the foregoing points, the following suggestions are offered in regard to the method that would be best calculated to ensure the soldier being supplied with good boots.

Suggestions.—That two descriptions of boots be issued to soldiers in India, namely, one very stout, as at present, for use during the cold season or on the march; the other of lighter material, for use during the hot season. These could be respectively distinguished as cold-weather boots and hot weather boots; requisitions being prepared accordingly.

That as far as practicable, the supply be sent from the clothing stores to regiments un-made-up; the uppers and soles, according to sizes, being sent separate. Thus, the boots could be made in regimental workshops, so as to suit the peculiarities of shape of individual men's feet.

With regard to the boots themselves, it is recommended that they be made to fit more carefully than has hitherto been the case over the upper part of the instep; for which purpose there ought to be a lacing up the front as in ordinary shooting boots.

The heel ought to be broad ; the part at the *stiffening*, as it is called, so arranged as that its upper edge shall not, as is often the case now, press in upon the concavity immediately above the wearer's heel.

As far as possible, the part where two portions of leather meet and over-lap, should be so smoothed as to prevent "fretting" of the foot.

The sole as at present made is so stiff, that a soldier speedily becomes fatigued when wearing new boots. Various contrivances have been recommended to the War Office, with a view to remedy this defect ; as for example, that by Mr. Dowie, of introducing a piece of elastic into it, and that by Colonel Carter of introducing a slit.

Neither of these seem to have been systematically adopted in the army, yet it would seem advisable in India to institute a series of well conducted experiments regarding the description of boots that is really adapted for troops in that country. That such is yet a desideratum is unquestionable.

It seems very essential that soldiers when fitting themselves with boots, or having boots altered to suit peculiarities of their foot, should be under the superintendence of an officer. It is a dangerous thing to trust to the mere personal opinion of the men, as at present seems to be the case in regard to what shaped and sized boot they shall take.

It seems also desirable that in the store of every regimental Quarter Master, there should be printed instructions as to the sizes of boots, with reference to the men's feet; and as to the allowance that ought to be made in regard to the expansion of the foot on a march.

In addition to these recommendations, which have special reference to India, it is well to remark that in issuing boots to soldiers when about to proceed upon active service, or sending from England a supply to them while so engaged, it would be well to consider in their selection, the nature of the country,

and of the climate in which the men are operating; and to send such boots as are specially suited for these circumstances: thus, for example, we have elsewhere had occasion to comment upon the necessity in New Zealand of hob-nailed boots,—a description that in India would be totally inapplicable.

CHAPTER XXVII.

CONSTRUCTION AND ARRANGEMENT OF ARMY HOSPITALS.

Varieties of hospitals—Proportion for which necessary—Proper size—Requirements—Dr. Hennen's views—Of the Sanitary Commission for Bengal—Of Dr. Parkes—Sites—Basement—Verandahs—Wards—Wall space—Space between beds—Floors—Light—Temperature—Bedsteads—Bedding—Hospitals for officers.

It is necessary to observe that the remarks which have been embodied in the present chapter, ought more properly to have followed those already made on the subject of army hospitals. This, indeed, was the original intention of the writer; but he having sustained a severe attack of illness before the notes that are now to follow were arranged, he was under the necessity of introducing them in their present shape after the greater portion of the manuscript was in the hands of the printer.

With this explanation then, let us pass on to the consideration of the subject in hand.

We have already seen that for the purposes of an army in times of war, various descriptions of hospitals are required; the following include those that have been employed of late years, namely:—

1. The general hospital as contemplated by the medical regulations.
2. The consolidated hospital.
3. The depôt hospital.
4. The regimental hospital.
5. The general field hospital, and
6. The regimental field hospital.

Each of these may from time to time have to be established in times of war, and the first three are also equally applicable to these and to times of peace.

The first is established in accordance with medical regulations page 40. The great type of it in England is intended partly for the reception of invalid soldiers, whether arriving from abroad or sent to it from stations at home. It is also a most valuable training school not only for intending medical officers, but also for persons for the more subordinate positions connected with military hospitals. It must be observed however, that in these respects no great degree of difference exists between the organization required for it, and that necessary for a hospital and medical school intended for civilians.

Various modifications of this kind of hospital exist at different places, as for example, Woolwich, Dublin, Portsmouth, Chatham, &c., and also as a rule at the principal ports of some of our colonies; these fulfil an important purpose, but are in their nature of a stationary character.

The second combines the systems of the general and regimental; particular wards are appropriated to the sick of individual regiments; the sick are treated by the medical officers of their own regiments, and in so far as particular wards are concerned, regimental discipline is observed. The administration of the whole however, is that of a general hospital; the responsibility as regards professional details rests with the senior medical officer; there is one dispensary, one store, and one kitchen for the use of the whole establishment.

Medical officers almost without exception are loud in praise of the system followed in this description. It is convenient not only for them individually; but facilitates much the medical administration of regiments or of a garrison generally; it is therefore matter of great regret that a desire has lately become manifest to have all consolidated hospitals placed upon the footing of general ones.

The third is in its constitution as it exists in the United Kingdom, very different from that under the same name in India. At home, its footing is that of a regimental hospital. In the latter country however, there are three varieties,—thus, there is the invalid depôt hospital at the capital, that of a depôt specially set apart for the temporary reception of men newly arrived from the United Kingdom; and lastly, there is the hospital of the convalescent depôts at hill sanataria.

The fourth is the regimental hospital; and these establishments, let it be observed, have in all campaigns of recent as well as of old date, been the chief sources of succour in times of war; all other kinds of hospitals have broken down, and some have in fact become sources of injury or inconvenience to an army; the regimental hospital however, so long as it was conducted upon regimental principles, has ever maintained its superiority.

The fifth combines the purposes of a hospital for the reception and further disposal of sick and wounded with those of a reserve store for medicines, comforts, supplies of all kinds,—as well as for a reserve of medical officers and subordinate attendants.

The sixth form of establishment had often to be called into existence during the military operations connected with the sepoy mutiny; it then occasionally happened that regiments had to be detached from particular forces, so as to form an independent column; or accommodation for sick and wounded had suddenly to be provided after a succession of rapid movements: under such circumstances, a portion of the hospital establishment from each regiment or detachment was detailed; the whole united, and thus a convenient form of hospital for field service readily established.

For what proportion.—Whether the one form or the other be that established however, matters not in so far as mere accommodation for a certain proportion of sick and wounded is concerned: and it becomes a

matter of great importance to know the proportion for which provision of this nature is usually made.

Thus, on home service, hospital accommodation is provided for ten per cent. of strength,—a proportion which under ordinary circumstances is deemed amply sufficient: but as suggested by Major General Maunsell, K.H., in his evidence before the Royal Commission, there should be in addition a ward for ophthalmia, a ward for small pox, and a convalescent ward; all these being without reference to this proportion of ten per cent.

In India, recent orders direct that troops proceed into camp at a greater or less distance from wherever they may happen to be stationed, on the occurrence of an epidemic. This naturally lessens the necessity in some measure of providing a much larger amount of hospital accommodation than is likely to be required for the ordinary rate of sickness. It must be borne in mind however, that as all military establishments are arranged with reference to the requirements of a state of war, so also should be the hospitals, especially those at stations in or near parts of the country where hostilities are most likely to occur.

A number of large hospitals at these stations, which could be converted during times of war into such establishments as are usual at the base of military operations, would obviate much of the present necessity of impeding the operations of an army in the field with the amount of equipment, that under existing circumstances is absolutely unavoidable: and hence, in places such as these, it is considered that hospital accommodation for not less than twenty-five per cent. of the troops should be available.

Much of the space that could in time of war be appropriated for the reception of sick and wounded, would in times of peace be occupied as stores for medical, surgical, and camp equipment,—and thus, these would at all times be held in immediate readiness to meet any emergency that might arise.

Proper size.—As regards the proper size of military hospitals, Baron Larrey considered that no one should contain more than 800 beds. Dr Parkes gives 500 as the limit, and very properly remarks, that many small and widely separated hospitals are more advantageous to the sick, although they necessitate increased labor and expense to maintain them.

Not more than 50 to 80 patients should be under one roof, and where the buildings consist of two stories, the cases should be so distributed, as that patients to whom injury would arise from the exertion of going up and down stairs, shall be able readily to get into the open air. In the event of there being a balcony to the upper story, this difficulty of course ceases.

Separation of cases.—Wherever, says Dr. Millengen, speaking of general hospitals, wherever large masses of sick are accumulated, sickness will spread its ravages with additional concentration and activity. Therefore these several divisions (*viz.* for sick, for wounded, and for convalescents), should be formed in different buildings.

Convalescent wards.—The same author strongly advocated the separation of convalescents from the sick. Where circumstances of locality permit, said he, it would be desirable that in every hospital, separate wards were appropriated to the reception of patients recovered from their illness or their wounds.

Wards for special cases.—He observes however, that as buildings are seldom sufficiently large to be thus divided, other establishments for the purpose must be formed. He further remarks that in large hospitals, and indeed, in small ones, wards for special cases, more specially for those of an infectious nature, should be completely separated from the other wards. Those of the latter description also require special attention in regard to their ventilation.

Hospital requirements.—Dr. Hennen in 1818, thus expressed himself in regard to the requirements of

a hospital. The best building for one, should according to him be high, dry, and detached ; have sufficient doors and windows, admitting of cross ventilation, with open fire places, secure roofs and walls : the rooms of easy access, lofty and of moderate size.

Wards, he observed, should be capable of accommodating 12 to 16 beds. Long suites of small rooms communicating with each other by a common entrance are very objectionable : ground floors should be avoided : elevated parts of buildings should be chosen, and beds raised from the floors by boards and trestles Are not these the very requirements of hospitals recently adduced by so called sanitary reformers as something altogether new, and as if never thought of by medical men prior to their time ? But even prior to the time we speak of, army medical officers had strenuously protested against the kind of buildings into which sick soldiers were huddled ; their voice however was for the most part unheeded.

For a battalion 500 or 600 strong, the hospital as remarked by Miss. Nightingale, formerly consisted of eight or ten little bedrooms miscalled wards,—a little kitchen,—every thing in fact on a little scale like a collapsed hospital. That this was so, is undeniable: but it was in opposition to the oft repeated representations of army surgeons. The state of matters here described, is therefore one which has existed, not by the sanction of army medical officers, but in direct opposition to their oft repeated condemnations of it : and it may safely be asserted, that had the opinions and recommendations of our older officers been adopted, the necessity would have years ago ceased for many of the improvements that have very properly been introduced since the Crimean War. It is but right and fair to army medical officers that some of their recommendations be quoted. Let us therefore notice a few.

Arrangements.—Many of the rules laid down by Dr. Hennen in regard to the arrangements in an hospital, for the inmates, are deemed quite as excellent

now in 1866, as they were when first published by him in 1818.

Thus, according to him, each bedstead should be completely isolated from walls, pillars, or other beds. It should be so placed as to admit as much air as possible, above, below, and around it; but not so as to expose the patient in it to a direct draught. It should admit of easy removal, so as to allow the place beneath to be cleared. The bedding should be removed and allowed to remain in the open air: or be folded up, so as to allow the air to freely perflate it, while it lies unoccupied on the bedstead.

He recommends with a view to adapt buildings for the purposes of a hospital, that some windows be cut down to the level of the floor; others raised to the ceiling —ensuring the steady and perfect entrance of cool fresh air, and the exit of that which is hot, foul and stagnant: and that, instancing a church at Dijon, where sick accommodated in it were rendered very unhealthy by reason of its having been used as a place of interment, he observes, "places of this description should be cautiously avoided."

He thus further expresses himself on the same subject,—"a room," he observes, "10 feet high, 16 long, and 10 broad, would accommodate two extremely well." This would in fact, allow 800 cubic feet and 80 superficial to each.

"Whatever," said he, "be the height or cubic contents of a room, each bed should have a space of 6 feet by six, or 36 superficial feet. In rooms with low ceilings, 8 by 8, or 64 feet; and as *much more as possible.*" In the latter part of the sentence which has here been italicised lies the gist of the whole. It is evident from it, that the value of ample space was fully recognised by this military medical officer many years ago.

At the time he wrote, however, the fashion had not arisen of taking civil hospitals as a standard of comparison for military: the comparison was then all

the other way: for instance, so wrote Dr. Hennen, "the beds should never touch each other or be distributed in pairs, *as is sometimes to be seen in civil hospitals.*"

Superficial space.—Some of the recommendations by the older writers now look strange when read,—"two, three, or more patients," writes Dr. Cutbush, "should not be placed in the same bunk" and he adds in a foot note, that he has seen three miserable objects ill of fever in one bed. He does not appear however, to have had any extended ideas of the amount of superficial space that was absolutely necessary, for he remarks,—"six feet by seven or eight should at least be allowed each man according to the height of the ceiling,"—an amount not much more than half what is now deemed essential,—yet it is apparent the value of superficial space was well known in his day.

Hospital construction according to the Sanitary Commission for Bengal.—The following may be considered to embrace the principles laid down by the Sanitary Commission for Bengal, according to which hospitals for troops in India should be constructed, namely:—

That the rate of sick for which hospital provision has to be made, may be taken at 12 per cent., except at certain stations where 15 is considered not too great for the requirements of the men.

This unit has not been arrived at by a mere consideration of the average rates per cent. of sick during a stated time, for it must be obvious that such a method of calculation would be fallacious. It has therefore been obtained by a reference to returns, showing the maximum number of sick out of a force of known strength that has been in hospital during ordinary seasons; for when an epidemic occurs in India, special arrangements must always be made to meet its requirements, and one of these would probably be the temporary withdrawal of the troops from the infected locality,—thus removing the necessity of great

increase of hospital accommodation at the station to meet such an emergency.

Hospital units.—The units therefore for which it is considered that hospital accommodation should be provided in India for each arm of the service are :—

For a regiment of infantry ...	110	men	20	women.
,, ,, Cavalry ...	62	,,	14	,,
Light field battery ...	20	,,	4	,,
Garrison ,, ...	10	,,	4	,,

Number of stories.—All hospitals should be of two stories, the whole of the wards for the sick being upon the upper. In the hills however, it may be necessary to have a third story : but even there, the wards should be confined to the two upper.

Pavilions.—Detached pavilions connected by an alcove or covered way, are best adapted for hospitals in India : or in the words of the Barrack and Hospital Commissioners, those that consist of " two separate parts under two roofs." These pavilions or parts should be joined end to end, with a wide, light, well-ventilated staircase between the ends.

Sick under one roof, and number of buildings.—There should not be more than 100 sick, and their attendants under one roof, even in a cool climate ; but in India not more than 60 or 70. At this rate, there would be for a regiment of infantry, 2 buildings for men, and 1 for women and children; for a regiment of cavalry, one for the men, and another for the women and children. For one or two batteries of artillery, one building for both men and women : for three, or four batteries, two buildings, and so on ; the rule being that one building shall serve for two batteries.

Convalescent ward.—It is considered that in a regimental hospital, there should be one ward for convalescents, capable of accommodating 24 patients ; the average number of convalescents to patients being about 25 per cent. of the latter.

Ophthalmia ward.—There should be an ophthalmia ward for about ten men, with separate lavatory, so

that each patient shall have his own basin and towel.

Wards for special cases.—For special cases there should be two wards of four beds each, and one ward of two beds. Thus the accommodation would be distributed as follows, *viz.*—

1 Convalescent ward ...	... 24 men.
1 Ophthalmic „ ...	... 10
3 Special case wards, 2 of 4 Beds each, and one of two	... 10
Total	... 44

Leaving 66 beds to be provided for in a regiment of infantry.

Infectious diseases.—For cases of infectious disease there should be a detached ward; this should be in a separate two-storied building, away from the regimental hospital: the size of it equal to one half per cent. of the strength of troops.

Arrangement of beds.—The best number of beds in a large ward, calculated to meet the requirements of the sick themselves, and for convenience and economy of administration, is considered by the Commission to be 28. The beds should be arranged at opposite sides of the ward between the doors, with their heads to the wall: one bed between each pair of doors, or what is still better, between a door and a window.

Size of pier.—Each pier should afford a wall space of six running feet: each doorway or window be 4 feet, thus giving each bed ten feet.

Divisions of wards and space per patient.—The width of the large wards should be 26 feet, but for those intended for only 2 beds, a width of 20 feet will suffice. The height to the wall plate should be 18 feet for the lower ward; but 21 feet for the upper: thus, each patient should have 130 square feet, and 2,730 cubic.

Ward accessories.—Connected with each ward there should be an attendant's room: a ward scullery or extra kitchen, a ward lavatory, and the privy. In the latter there should be a urinal; close stools in the proportion of three to each ward should be allowed, and the dry system of conservancy carried out.

Quarters for medical subordinates.—In India, it is necessary to have quarters for the medical subordinates.

For Hospital Sergeant and Orderlies.—There should be separate quarters for the Hospital Sergeant, and for orderlies; the latter should have separate sleeping and day rooms, as well as separate lavatories and privies.

Store-rooms.—There should be separate store-rooms for bedding and clothing; for packs, utensils, provisions, and medical comforts. These should all be properly furnished.

Foul linen store.—Foul linen should be removed out of the hospital. It might be kept in a room connected with the laundry.

The Surgery.—Care should be taken that the "surgery and receiving room," are properly fitted up with all appliances: that water be laid on, sinks and means of disposing of waste water supplied; and that they have sufficient tables, shelves, drawers, and other conveniences.

Kitchen for sick.—The kitchen should be constructed so that it have two compartments; one as pantry, is intended for all the food being prepared for cooking: the other to be set apart entirely for cooking purposes, with ranges, ovens, boilers, sinks, &c.

For attendants.—Separate arrangements from those for the sick, should be made for cooking the food of the orderlies, apprentices, &c.

Out-door lavatory.—The out-door lavatory should be divided into two compartments, one for the orderlies, the other for the patients.

Out-door privy.—The out-door privy should be similarly divided.

Guard-room.—The guard-room should, as a rule, be in a separate building at the entrance to the hospital enclosure.

Servants' houses.—A range of houses for native attendants and servants is essentially necessary, and it should be within the hospital enclosure.

Laundry.—One portion should be fitted up with all requisites for a laundry, and the foul linen store should be near it.

Washing.—Washing and drying should in India, take place at a distance from the hospital.

Ambulance shed.—A shed should exist near each hospital for the ambulance and its cattle : and for the hearse. Here also should be accommodation for the conveyances and horses of medical officers during inclement weather, as well as stabling for the horses of the medical subordinates.

Dead house.—The dead house should, if practicable, be divided into two compartments ; one for the reception of the dead bodies preparatory to interment, the other for post mortem examinations. As recommended by the English Barrack and Hospital Commissioners, it should have a convenient table, water tap, sink and proper drainage ; it should be well ventilated, and far enough from the hospital to admit of free circulation of air between the two.

Enclosure railing.—The hospital enclosure should be protected by a railing: not by a high wall.

It may doubtless seem strange that so many measures are deemed necessary in order that Indian hospitals may be placed on a footing at all approaching to that which modern science and due consideration for the sick alike demand: that the urgent necessity for these changes exists however, is a very lamentable fact.

According to Dr. Parkes, the wants of a military hospital are the following :—

Wards, large and small.
Day rooms.
Attendants' rooms.
Scullery.
Bath and ablution rooms.
Small store-rooms.
Urinal.
Closet (one seat to every eight men).
Operating room.
Dead house.
Administration.
Surgeon's room.
Case-book and instrument-room.
Offices.
Officers' rooms.
Dispensary or pharmacy.
Store-room.
Dispenser's room.
Cooking store room.
Wine and beer room.
Larder and meat room.
Kitchen.
Room for arranging diets.
Scullery.
Cook's room.
A wash house.
Dirty linen store.
Fumigating room.
Cleaning room for matrasses.

Steward's department.

Offices.
Furniture store.
Linen store.
Utensil store.
Pack store.
Rooms for arranging diets.
Provision store.
Foul linen store.

Sites for hospitals.—In selecting a site for, and arranging the plan of a hospital, the necessity of full exposure to air and light should be held as paramount. The fundamental idea of all hospitals should be to have fresh air in every part of the building.

The windows should be so placed, that no part of the ward shall be dark. Other essential points to be borne in mind in constructing a hospital, or adapting to the purpose a building already existing, are that there shall be available a constant supply of pure filtered water; that ablution and bath accommodation be readily accessible from the wards; that there be sufficient water closets, and a sufficient supply of water to keep them thoroughly clean.

Basement.—In former days, not only the houses of officers in the provincial parts of India, but all those

for soldiers' barracks, as well as hospitals, were scarcely raised above the level of the ground. In some parts of the world, for example China, so great an amount of disease and death was directly traced to a similar circumstance, that what was there called the Indian bungalow plan of building, had to be abandoned. Now, the houses there consist of several stories; the ground floor being occupied only as offices or store rooms. Even in India, the objections to the original system are becoming so universally recognised, that wherever new buildings are about to be erected, it is deemed essential that a basement of considerable thickness separate them from the ground.

Not only should the foundation of every hospital be laid on dry ground, but it should be covered by concrete, and have an arched basement, so as to admit of free circulation of air underneath the ward floors. The best authorities consider that no Indian hospital should be erected upon a solid plinth; either the plinth should be thoroughly flued, or the building should be erected upon pillars.

Undoubtedly, of the two descriptions of basement, that having large open arches is the preferable: inasmuch that where flues exist, small animals, reptiles and insects gain admission, die, and finally block the openings up with decomposing matter. Large wide arches admit of the admission of a person who can clean them out from time to time.

According to the Commissioners, the sick in dry localities in India, should be not less than 4 or 5 feet from the gound; in malarious parts of the country, they should always be placed on upper floors.

Verandahs.—The Royal Commissioners think that it should be an invariable rule that no barracks or hospitals be in future constructed with double verandahs. Some medical and other officers of reputation have, it is true, expressed a different opinion; but the Commissioners are distinctly opposed to having more than one verandah to the side of a hospital: and

with few exceptions, British army medical officers agree with them.

Among the many objections to double verandahs, are the facts that the circulation of air and the free admission of light to the sick are alike prevented: hence, although hospitals in India that are thus constructed are probably cooler than those with single verandahs, they are objectionable as regards these important points.

In them, not only are the wards extremely cheerless and dark, and the lower part of the walls constantly damp during the rainy season; but the recovery of the sick is slow, and the liability to being attacked in hospital by disease great.

Wards.—It is not deemed advisable to have the wards of any hospital of a greater breadth than 30 feet: and in India, the Sanitary Commission for Bengal has expressed an opinion, that the best breadth for those about to be erected in that country, is 26 feet.

Space per patient.—The Royal Commission has recorded its opinion that the cubic space per man in the wards of a hospital should be 1,500 to 2,000 feet, and the superficial 120 to 130, according to locality. Sick who have undergone operations, should have not less than 2,000 to 2,500 cubic feet of air each.

It must be borne in mind that the general size of a hospital bed is 3 feet six inches wide, six feet three inches long: and that the head is usually about nine inches removed from the wall, thus occupying a superficial space of 21 to 24 feet. It is therefore necessary in calculating space to have at least 80 feet over and above this amount.

It is considered that wards of a smaller size than those for 20 patients are objectionable, inasmuch as they are with difficulty ventilated by natural means; and that the best size for wards for ensuring the conditions of health and discipline, is from 20 to 30 sick. This size is also considered best for the purposes of administration by many authorities. The Royal

Commission however, considers that a ward capable of accommodating 20 to 24 sick, is the most convenient for all purposes.

Wall space.—In India, the wall space per patient should not be less than eight feet under any circumstances. The Sanitary Commission for Bengal considers that ten feet should be the wall space, and that not more than one bed should be placed against each pier.

In the United Kingdom it is considered that there should be one window to each two beds; each window 4 feet 8 inches wide, reaching to within two or three feet of the floor, so as to enable the patients to see out: and to within one foot of the ceiling. The proper proportions for a ward for 20 patients are considered to be a length of 80 feet, breadth of 25, and height of 16. There should be 13 feet between the feet of the beds on one side of the ward, and of those on the other. There should be 16 running feet allowed to each pair of beds, thus giving in a ward of the above dimensions, 1,600 cubic feet to each patient. There should be a space of 3 feet between the two beds forming each pair. The best materials for floors are oak, fine composition or tiles.

Floors.—In many of the temporary huts in India that are used as hospitals, the floors consist of mud, and it, for the sake of appearance, is daily wetted and smoothed down; nor was it lately by any means rare to see this operation performed with a mixture of cow dung and clay. Other materials used as floors of hospitals in India, are bricks, and these from imperfect baking, readily crumble into powder; leaving excavations which collect dirt of various kinds, and are moreover inconvenient on account of the dust that arises from them. Flags of sandstone are used in others.

Light.—Light is essential to the recovery of the wounded and sick. The evil results from defects in this respect are well known to all professional men; it is expressly stated that in some hospitals at St.

Petersburgh, there were rooms without direct light, and that the sick and wounded treated in these yielded only a fourth part of the recoveries when compared with patients treated in light rooms.

With reference to means of warming the wards of a hospital, it may be noted that in India the difficulty comes to be how to keep down the temperature to what is a proper standard. In England this is noted at 55° *F.* to 60° *F.*, a point which under present conditions cannot in the former country be obtained within 25° to 30°, in the most favorable circumstances while the hot season lasts; the temperature then ranging from 90° *F.* to 100° *F.* In the lower parts of the country the temperature here noted as a standard, is below the natural one of the atmosphere during the cold season. In the more northerly portions however, and in the hills, artificial means of warming are required in the same manner as they are at home.

Bedsteads in Hospitals.—It may at first sight seem unnecessary to mention that sick or wounded should be provided in hospital with bedsteads. It is difficult to conceive any circumstances even during active military operations, which render this impracticable; for in the event of litters or doolies not being sufficient for the requirements of the whole, some contrivance could be extemporised: and during a siege, ample time is afforded to enable the responsible officers to procure any kind of bedstead that may be deemed necessary.

The fact however, that so recently as at the siege of Lucknow, many wounded who were accommodated in a general hospital established in a large and commodious building at a little distance from that city, were unprovided with bedsteads shows that the remark is not wholly superfluous. These men, in many instances suffering from severe compound fractures and flesh wounds, had no other means of separation between them and the hard floor of stucco, than a thin Indian-made matrass of tow, or what is called a "resai":

that is, two layers of coarse cotton cloth, with cotton wadding placed between them.

The sufferings of men so situated were terrible: soldiers implored to be taken to their own regimental hospitals: and yet, at a distance from this very hospital of less than a mile, were several score of bedsteads that had belonged to sepoys from whom the position had been wrested, and only required to be brought to the wards.

These facts are mentioned to show what might under similar circumstances be done; for it is almost impossible to conceive the great agony to which the men on this occasion were put: merely perhaps because there was no special "department," whose duty it was to forage about and procure every possible means of comfort for them.

Hospital bedding.—Hospital bedding may however, become a cause of insalubrity of hospitals. A large quantity of air passes into the pores and spaces: organic matter and water are largely absorbed by blankets, woollen coverlets and feathers; and, in a less degree, by cotton, linen, and straw. It therefore becomes necessary, that great care be bestowed in the selection of such articles as are not likely to induce such a result: as for example when an army is on active or foreign service, and the medical officer so thrown upon his own resources, that he is glad to avail himself of such articles of this description, as he may become possessed of during an advance through an enemy's country.

Officers' Hospitals.—One of the great desiderata even in the United Kingdom, but more especially in our foreign possessions, including India, is the want at individual military stations, of hospital accommodation for officers. During active service, an institution of this nature is found to be indispensable. At some places, as for example Hong-Kong, sick officers may, under certain circumstances be taken into the hospital intended for the reception of soldiers. At

Calcutta, a separate establishment for the purpose was opened during the mutinies, and still in a manner exists; but for the reception of officers sick with their regiments in India, there is absolutely no provision made.

Sir George Ballingall states that more than 40 years before (he was writing in 1852), Sir Arthur Broke Faulkner ably advocated the formation of such institutions after the disastrous expedition to Walcheren. In the present Code of Regulations, some allowance is made for them, but the interests of the service as well as those of individuals require that hospitals of this nature be established at each station.

As Dr. Millengen observes, in large towns the inconvenience arising from sick and wounded officers being scattered in different and distant quarters is incredible. Another serious evil also attributed to this system, is the dissipation which generally prevails in capitals and large towns, proving a seduction to young officers, retarding their recovery, and bringing on relapses or other diseases.

Dr. Millingen is in favor of the medical officer in charge of the officers' hospitals, living among his patients. This would he says, tend to produce a relative degree of friendship between them. The correctness of this was confirmed at Calcutta, where, in the establishment of this nature the various medical officers successively in charge, *viz.*—Assistant Surgeons Ligertwood—Longhurst and Carter lived among and took their meals with their patients: and there are probably many readers of these pages who yet entertain a grateful sense of the great boon this institution was to them, when, sick or wounded: some desperately ill, without friends in Calcutta, and in many instances it is to be feared without much surplus means—they here found all requirements ready supplied, instead of having to take their chance in some hotel, as otherwise would have been the case.

CHAPTER XXVIII.

HOSPITAL DIETARY.

Want of suitable kitchens and cooks—Want of delf dishes—Diets how supplied—Indian scale—War Office scale—Remarks on these—On diets generally—Chemistry against experience—Suggestions regarding India—Remarks.

It may be well to observe at the outset of the proposed remarks on this matter, that although certain modifications have lately been made in the diets of sick in India, no improvement has been made in the manner of cooking these ; in the utensils in which they are prepared, or in those in which they are served up.

WANT OF SUITABLE KITCHENS AND COOKS.—At this moment, there is not, with one or two exceptions, a cooking range in any regimental hospital in the presidency of Bengal. The cook-rooms, as a rule are close ill-ventilated apartments ; the fire-places merely the native "chulas" upon the ground ; the cooking utensils, only a few copper vessels, tinned inside, a frying-pan and gridiron. No arrangements of a suitable nature exist for preparing such articles of delicacy as the sick soldier requires. There is for example no means of cooking a pudding, except the very primitive one of placing the pudding dish upon some live embers, and heaping a quantity over a similar vessel, which for the time being is made to do duty for a cover.

The cooks are untrained for their special work. But this is not all ; they obtain as a rule, less pay than the same class of servants employed for the barracks, because while the former only receive their regular pay, the latter receive various perquisites from the

men; indeed, so few are the inducements held out under existing orders for good cooks to continue in hospital, that we find these men often quitting the service as soon as they have obtained a very moderate knowledge of their business: and as was personally seen on one occasion by the writer of this chapter, a man who was a ward cooley one day, was the following installed as cook, *vice* the previous functionary absconded.

An example will serve to give an idea of the proficiency of hospital cooks such as are provided to regiments in India. The head cook of a regiment, on one occasion, showed the author the process of preparing a rice pudding. The rice having been boiled, was placed in a pudding dish and well pressed down; the sugar sprinkled over it. Two eggs were then broken over the mass, as if to be poached. The spices were then sprinkled over all, and the so called "pudding" placed as already described, among live cinders to be baked.

Want of delf dishes.—As an experiment, delf dishes were some years ago sanctioned to a few stationary hospitals, but with these exceptions, tinpots and plates still constitute the furniture of this nature allowed in regimental hospitals; so that a patient may have to partake of his medicine, tea, wine, or beer, all out of the same vessel,—and it a coarse metal one. Soda-water or lemonade when ordered, must also be drunk out of this tin cup.

The Diets how furnished.—In India, the diets of the sick are provided as heretofore by the Commissariat department. No Purveyor's department as yet exists in that country. The medical subordinate, called a steward, keeps the accounts and superintends the expenditure of stores of all kinds, dieting among the rest; but the entire responsibility in connection with them rests with the medical officer, whose time and attention are thus to a very important extent withdrawn from his professional duties, not to speak of

the risk he runs of having deductions made from his pay on account of errors or omissions in accounts, with which he ought in reality to have nothing to do.

Indian scale of Diets.—In 1862, a scale of diets for sick in India was laid down experimentally, and in 1865, was ordered to be adopted permanently for hospitals in that country. This scale was in its nature very different from that laid down in the army medical regulations, and adopted in the United Kingdom as well as in the colonies. It is considered desirable to note in this place the ingredients of the different kinds of diet according to each of these, so that the reader may be the better able to compare them with each other.

The authority under which the Indian scale has been adopted, is to be found in General Orders by the Governor-General, No. 13 of 1865, page 7; the scale itself is as follows; the weights of each article being *avoirdupois*, namely :—

1.—Spoon.

Sago	2 oz.	Milk	6 oz.
Tea	½ oz.	Rice 2 oz. }	For conjie
Sugar	2¼ oz.	Salt 2 drs. }	water.

2.—Tea.

Bread	8 oz.	Milk	9 oz.
Tea	¾ oz.	Rice 2 oz. }	For conjie
Sugar	3 oz.	Salt 2 drs. }	water.
	Arrow-root ...	4 oz.	

3.—Beef Tea.

Bread	1 lb.	Milk	6 oz.
Tea	½ oz.	Beef	12 oz.
Sugar	1½ oz.	Salt	6 drs.

The quantity of meat is to be exclusive of bone, when bone is taken with the meat, one-fourth more in weight to be allowed.

4.—Low Milk.

Arrow-root	3 oz.	Sago may be used in lieu of arrow-root, in the proportion of 2 oz. sago to 1 of arrow-root.	
Milk	1½ pts. with 6 oz. for tea.		
Sugar	3 oz. including ¾ oz. for tea.	Chicken	8 oz.
Tea	½ oz.	Bread	4 oz.
Salt	6 drs.		

5.—Milk.

Bread	12 oz.	Butter	½ oz.
Rice	3 oz. including 1 oz. for conjie water.	Sugar	2¼ oz. including ¾ oz. for tea.
Milk	2 pts. and 6 oz. for tea.	Tea	½ oz.
		Salt	2 drs.

Soojee 4 oz. in lieu of rice, at the discretion of the medical officer.

6.—Chicken.

Fowl made into soup or broiled	8 oz.	Salt	6 drs.
Bread	12 oz.	Barley	½ oz.
Tea	½ oz.	Flour	½ oz.
Sugar	1½ oz.	Onions	1 oz.
Milk	6 oz.	Milk	1 pt.
Butter	1 oz.	Sugar	1 oz.
		Eggs	2 For

custard pudding or "chickens broiled." The same as above, with the addition of butter 1 oz., and the omission of the barley, flour, and onions.

7.—Low with Pudding.

Mutton in broth	8 oz.	Barley	½ oz.
Bread	12 oz.	Flour	½ oz.
Tea	½ oz.	Salt	6 drs.
Sugar	1½ oz.	Rice	2 oz.
Milk	6 oz.	Milk	¾ pt.
Butter	½ oz.	Sugar	¾ oz.
Onions	1 oz.	Eggs 2 for rice pudding.	

8.—Low.

Mutton in broth	8 oz.	Butter	1 oz.
Bread	1 lb.	Onions	1 oz.
Tea	½ oz.	Barley ...	½ oz.
Sugar	1½ oz.	Flour	½ oz.
Milk	6 oz.	Salt	6 drs.

9.—Half.

Mutton... ...	10 oz.	Milk	6 oz.
Bread	1 lb.	Butter	1 oz.
Potatoes ...	8 oz.	Onions	1 oz.
Tea	½ oz.	Barley	½ oz.
Sugar	1½ oz.	Flour	½ oz.
	Salt ...	... 6 drs.	

Or half grilled or fried. The same as above, with the addition of 1 oz. in lieu of barley, flour, and onions.

10.—Fish.

Fish	8 oz.	Sugar	1½ oz.
Bread	1 lb.	Milk	6 oz.
Potatoes ...	8 oz.	Butter	2 oz.
Tea	½ oz.	Salt	6 drs.

The quantity of fish is to be exclusive of the head and back bone, when the latter is taken, 1 oz. more in weight to be allowed.

11.—Full.

Meat either beef		Sugar	1½ oz.
or mutton ...	12 oz.	Milk	6 oz.
See note in beef tea.		Butter	1 oz.
Bread	1 lb.	Onions	1 oz.
Potatoes ...	12 oz.	Barley	½ oz.
Tea	½ oz.	Flour	½ oz.
	Salt ...	... 6 drs.	

N. B.—In this diet, the meat may be roasted, fried, or grilled, in place of being boiled, in such cases the diet to be marked "full varied," and butter or ghee, 1 oz. to be allowed in lieu of flour, barley, and onions.

War Office scale of Diets.—The diet scale according to the War Office Medical Regulations is as follows, *avoirdupois* weight being used as in the preceding, namely:—

1.—Tea.

Bread ...	8 oz.	Sugar ...	2½ oz.
Tea ...	½ oz.	Milk ...	6 oz.

2.—Spoon.

Bread ...	8 oz.	Also arrow-root	2 oz.
Tea ...	½ oz.	Sugar ...	1 oz.
Sugar ...	1½ oz.	Or oatmeal ...	4 oz.
Milk ...	6 oz.	Milk ...	8 oz.

3.—Beef Tea.

Bread ...	12 oz.	Milk ...	6 oz.
Tea ...	½ oz.	Beef ...	8 oz.
Sugar ...	1½ oz.	Salt ...	½ oz.

4.—Milk.

Bread ...	14 oz.	Milk ...	3 pts.
Rice ...	2 oz.	Sugar ...	1 oz.

5.—Low.

Meat ...	8 oz.	Milk ...	6 oz.
Bread ...	14 oz.	Butter ...	1 oz.
Salt ...	½ oz.	Rice ...	2 oz.
Tea ...	¼ oz.	Milk ...	¾ pt.
Sugar ...	1½ oz.	Sugar ...	½ oz.

Egg 1.—For pudding flavored with cinnamon, lemon, &c.

6.—Chicken.

Fowl ...	8 oz.	Tea ...	¼ oz.
Bread ...	18 oz.	Sugar ...	1½ oz.
Salt ...	½ oz.	Milk ...	6 oz.
		Butter ...	1 oz.

7.—Half.

Meat ...	... 8 oz.	Tea	$\frac{1}{4}$ oz.
Bread ...	... 16 oz.	Sugar	$1\frac{1}{2}$ oz.
Potatoes	... 8 oz.	Milk	6 oz.
Barley ...	... $1\frac{1}{2}$ oz.	Vegetables ...	4 oz.
Salt ...	... $\frac{3}{4}$ oz.	Butter	1 oz.
	Flour	$\frac{1}{4}$ oz.	

8.—Fish.

White fish	... 8 oz.	Tea	$\frac{1}{4}$ oz.
Bread ...	... 18 oz.	Sugar	$1\frac{1}{2}$ oz.
Potatoes	... 3 oz.	Milk	6 oz.
Salt ...	... $\frac{3}{4}$ oz.	Butter	2 oz.

9.—Roast half.

Roast meat, chop, or steak.

Meat ...	... 8 oz.	Tea	$\frac{1}{4}$ oz.
Bread ...	... 18 oz.	Sugar	$1\frac{1}{2}$ os.
Potatoes	... 8 oz.	Milk	6 oz.
Salt ...	... $\frac{3}{4}$ oz.	Vegetables ...	4 oz.
	Butter	1 oz.	

10.—Entire.

Meat ...	... 12 oz.	Tea	$\frac{1}{4}$ oz.
Bread ...	... 16 oz.	Sugar	$1\frac{1}{2}$ oz.
Potatoes	... 16 oz.	Milk	6 oz.
Barley ...	... $1\frac{1}{2}$ oz.	Vegetables ...	4 oz.
Salt ...	... $\frac{3}{4}$ oz.	Butter ...	1 oz.
	Flour	$\frac{1}{4}$ oz.	

When meat,—roasted, baked, or stewed,—bread 18 oz. (being 2 oz. extra), in lieu of barley and flour.

To be marked "varied" on roll.

Remarks on these Scales.—On comparing these two scales of diet, we observe that in no respect does the scale laid down by Indian Regulations assimilate to that by the War Office, over which it possesses no apparent advantage.

In either case, the multiplicity of diets is considered to render the use of many extras unnecessary; and hence, the use of articles as such, is restricted to malt liquors, wines, or spirits : except under very special circumstances, which must be detailed in the book record of the case of the patient receiving them : and indeed, whatever articles are given as extras have to be recorded in the " Case Book."

But while the Indian scale possesses as already mentioned, no advantage over that authorised by the War Office, there are several respects in which it possesses great disadvantages as compared to the latter : the following are some of these :—

1.—As affecting the medical officer, the list of diets is so extensive ; the ingredients and quantities contained in them so numerous and complicated that no medical officer having upon him the stress of work, which constitutes the normal condition of matters in India, can carry them all in his memory : consequently, he cannot make more than a distant approximation in the diet ordered to those articles which according to theory, the particular patient may require.

2.—As the preparation of so many different diets demands a very considerable degree of proficiency on the part of the cook, and as under present circumstances, this proficiency does not exist among the class of men employed as such in our regimental hospitals, the advantages that might under more favorable circumstances be expected to accrue from multiplicity of diets are impaired, if not wholly lost, by want of knowledge as to their preparation.

But 3.—It is with reference to the sick themselves that the disadvantages of the present scale of hospital diet is principally felt. To make this more clear, it is to be remarked that this scale, extensive although it be, does not pretend to meet the dietetic requirements of every case : and therefore, in order to obtain for a patient any one article for which he may have a craving or desire, it becomes necessary that the other

articles in the particular diet containing it be more or less completely wasted.

On Diets generally.—As well expressed by a medical officer who has reported on this subject, "it is difficult to understand why a man on chicken diet should be allowed only custard pudding, although he might prefer rice pudding; or why a man on chicken diet with pudding, should be allowed rice pudding only, although custard pudding might be considered more suitable for him."

These are but examples of disadvantages connected with the scales of diet now in use. In practice however, medical officers confine the diets ordered to three or four, so that with the restrictions now enforced in regard to extras, sick soldiers virtually obtain less variety in their diet than they did before the so-called improvements were introduced.

Nor must it be forgotten that the appetites and desires of sick men, capricious as they everywhere are, are especially so in India: and that an article which, as an item of ordinary diet, prescribed nearly thirty hours before the patient can obtain it, often gives rise to distaste or loathing when served up at the end of that time; whereas it would have been relished and enjoyed by him, had it been given him as an ordinary extra, and soon after the passing desire for it may have arisen.

Chemistry against experience.—That it has of late become the custom to determine supposed capabilities of imparting nourishment possessed by each particular diet, according to the proportions of its chemical constituents, the writer is well aware: he is no less aware however, that in actual practice it is found that chemistry is sadly at fault when we trust to it alone, if indeed we ever do so, to decide what particular ingredient will supply nutriment in a given case,—what other ingredient will fail to do so.

Thus, to borrow a sentence from the Medical Times and Gazette of 17th June, 1865,—"it is not carbon or

nitrogen which the animal body wants, but certain yet unknown and complicated compounds of these"—"we have yet to learn the laws through which a feeble irritable frame with stomach to match, shall demand variety amongst things which are all alike to the mere chemist; shall reject ordinary and *wholesome* food, and shall create, as it were, an instinctive longing for what is popularly thought *indigestible*, unwholesome, and noxious." "The art of keeping feeble people alive, is the art of suggesting and administering under the guidance of instinct and experience, food in such variety as to supply the living material with what it will take to itself in one shape, if it will not in another."

In these few lines lies what seems to be gist of the entire subject of dieting sick men: according to their teaching we should administer as food, not such substances as theory would lead us to prescribe, but those for which the patient manifests an evident desire, or that on trial are found best to suit his particular condition and constitution. Thus we are naturally led to suggest as mere diet, formularies in themselves of the simplest possible nature; but if we desire to minister to the tastes and necessities of the sick, we must have the means of prescribing for them articles of comfort, nay, perhaps even luxury as the desire for these may occur. In other words our diets should be simple, but our list of what are called "extras," liberal and extensive; it being understood that a due check be maintained upon inexperienced or indiscreet medical officers, so as to maintain their administration within proper bounds, and to proper cases.

Suggestions regarding India.—In order that diets of sick in India may be put upon the footing, that the necessities of our troops demand; the following are the principal points that must undergo improvement,—as well as the improvements that have been suggested·

1.—That kitchens of a suitable description for hospital purposes be erected, and that they be provided with all necessary appliances.

2.—That trained Europeans be employed as cooks, the natives employed in the kitchens being merely as assistants to them. The particular manner of supplying the former will form the subject of remark in a subsequent chapter of this volume.

3.—That all hospitals be supplied with suitable earthen-ware table utensils. This might be done as at other foreign stations, as well as on home service, by having individual hospitals provided with these articles,—the articles being left there under the charge of a responsible officer on the departure of the regiment either to another station or on service.

4.—It is very desirable that, with advertence to the requirement of sick soldiers, medical officers be permitted to exercise more discretion in ordering extras then they have at present. This would render even the long list of diets laid down in War Office Regulations unnecessary, as a rule: but inasmuch as the scale that has been specially authorized for India, while possessing numerous disadvantages, has in it nothing to recommend it in substitution for that in use throughout the rest of the British dominions, it appears desirable that it be assimilated to that in use in the army generally, and the orders on the subject of extras revised.

5.—It is very desirable that the sick, whether in India or elsewhere, have dining rooms set apart for their use; this improvement has been strongly urged by Commissions as well as by individual medical officers, and will it is hoped, be adopted in all hospitals hereafter to be erected.

The increased comfort that would arise from men who are able to dine at table, sitting down to one covered with a neat cloth, and nicely arranged, would be very great: instead of what they experience with

the present slovenly, untidy, and comfortless plan in force in India.

There can be no difficulty in obtaining in every regiment a soldier who understands cooking, to an extent at all events equal to the knowledge possessed by the natives hitherto employed; and such a man would willingly take the situation for a small sum monthly, added to the privilege so much envied by a soldier, of having every night in bed. He would speedily learn whatever might be at first wanting: but in order that he might have full advantage, it is most essential that the apparatus provided in cook-houses be of a kind and scale, such as that an European can make use of them.

Remarks.—At page 146 of this volume, some remarks occur on the present subject, and to these the reader is referred. Had it not been for the illness of the author already alluded to, the entire subject of hospitals and of hospital diets, would have been discussed in two consecutive chapters; the cause which led to the present arrangement being known however, it is hoped that allowance will be made accordingly.

In concluding the present remarks, it is well to observe that whereas in India, the scale of diet laid down for that country is used in all hospitals and under every circumstance, whether of peace or war, the War Office Medical Regulations provide that in regimental field hospitals during war, and in the event of the articles named on the diet tables not being obtainable, the usual ration shall be drawn from the Commissariat, and cooked according to the manner the medical officer thinks best.

Under such circumstances however, great latitude is in effect allowed to medical officers, whereas in India, no similar relaxation of rules takes place under such circumstances. In that country there is an official whose designation is examiner of medical accounts. A very important part of his duty is simply to see that the expenditure of "extras" is kept down

to " regulation" quantity, or the prescribing medical officer called upon to pay for whatever is expended beyond this quantity; no allowance whatever being made on account of the nature of the cases of patients, or of the circumstances under which they are placed. Suffice it that a certain quantity of a small variety of " extras" is permitted by regulation to be expended monthly for a certain number of sick, it matters not whether these " sick" suffer from the most trifling ailments, or from the most severe: whether they are comfortably accommodated in their regimental hospital at a military station, or torn by cannon shot on the field of battle: under all circumstances, numbers, not the nature of cases, is alone considered.

If the reader turn to the autobiography of Sir James McGrigor, he will there perceive that a similar system to that above mentioned formerly existed in the British army. So long ago however, as 1814, it was found that among other evils, it necessitated that medical officers should pay undue attention to matters involving expenditure, as compared to those of a professional nature: and that as a consequence, the sick suffered in proportion. Sir James was not long in office as Director General, before this monstrous system was in a great measure swept away: and although in India it still is enforced towards our troops who hold that country, it is to be hoped that the time is not far distant, when a similar change of system as regards " extras" to sick soldiers to that introduced in the army generally more than half a century ago, may be included among the other measures by which ere long, those serving in this part of our dominions may be placed upon an equally advantageous footing with those in all others of the British empire.

CHAPTER XXIX.

HOSPITAL ATTENDANTS IN INDIA.

Preliminary remarks—Their description—Personal experience—Apathy of the Indian—Trained attendants—Improvements how to be effected—Proposed school at Calcutta—Consolidated Hospitals.

Preliminary Remarks.—Considering how much has been done for the comfort and well-being of the soldier in India, and how much it is still in contemplation to effect, it is marvellous that improvements directed towards those who are sick have certainly not kept pace with those for effectives.

It is not the object of this work to discuss probable causes towhich existing conditions are to be traced: the objects aimed at are to describe these conditions as they do exist; to suggest to the army medical officer, how he may best take advantage of them, and effect improvements. It is obvious however, that in order that some of the improvements suggested be carried intoe ffect, customs and rules now in force must first be completely abrogated; and hence, that other authorities than medical must see the necessity for the changes proposed.

No doubt, it is at all times difficult to demonstrate to persons immediately concerned, the imperfections or fallacy of systems that have existed for more than a century; and hence, perhaps it is, that in several respects, more especially as regards hospital accommodation, bedding, cooking, and attendants, our troops are at this moment at a great disadvantage in India, compared to what they are in any other portion of our empire, whether that be at home or abroad.

If therefore the remarks that follow have the effect of drawing attention to the latter circumstance, with a view to the proper remedy being applied, the object of the writer will be attained.

Their description.—"As to the attendants on sick soldiers in India," says Miss Nightingale, "they are just the same as would be supplied to idle healthy men." "In serious cases, a waiting man is supplied from the battalion, who is relieved daily; that is, he goes on guard for 24 hours; as in the guard-room, so in the sick-room. It appears that mounting guard in the sick-room, is disliked, and the guard sometimes neglects his patient."

It is desirable still further to quote from the same report, as the statements therein contained, illustrate in a terse manner the disadvantages under which the sick soldier in India labors, as compared with his comrades throughout our other dominions.

Thus then, as there stated, the Hospital sergeant is for discipline; under him are 79 coolies and bheesties in cold weather, 240 in hot. Native attendants are in some sense kind, but as a rule very inattentive. Where there is any pressure of sick, they are lazy and apathetic: and the sick, it need hardly be said, neglected, and averse to be attended by them.

The writer of the present remarks would beg from his personal experience in India, to add his full concurrence in the truthfulness of the illustration here given. He would go further, however, and assert that no more melancholy picture can be seen than that presented by a ward of an Indian regimental hospital during a period of great sickness.

It is true that in almost every regiment, there are one or two steady old soldiers employed as hospital orderlies. There is no actual authority for the measure, but the advantages of it commend themselves to all medical, and the great majority of commanding officers. The men so employed have,

in almost every instance, an aptitude for the particular duties required of them. They are selected as being of good character. They usually receive a trifle from the Canteen fund as remuneration, and are excused from the performance of military duties, save those that are indispensable.

One of them usually takes charge of the sick of a wing of the regiment. He looks after individual patients, and superintends the ward coolies, keeping the latter up to their work, as far as that is possible.

From practice, these standing orderlies, as they are called, acquire a tact in attending sick and ministering to their wants, that it is to be feared they do not always obtain due credit for. As must be evident however, even in those regiments in which their employment is tacitly permitted, they can do no more than give a very general attention to the numbers of men under their charge ; while in regiments where they are not employed, the condition of the sick is sad indeed.

The number of ordinary ward coolies employed in the wards, depends not on the nature or degree of severity of cases to be treated, but upon the number of patients in hospital. Men for this employment are obtained, by requisition or " indent," as it is called, from the Commissariat Department. They are selected from among the cooly class, have no special training for the work they are about to undertake, and so soon as the numbers of sick in hospital diminish, a proportion of the coolies are discharged. The men thrown out of employment, seek for whatever occupation may happen to be at the time available. They become tillers of the ground, or carriers of loads.

By such men therefore, are our sick soldiers attended. Particular patients are provided with the services of a waiting man, as described before the Royal Commission. This man may be kind, attentive, and humane ; for these sentiments exist among soldiers

to a greater extent, than some writers would apparently wish to believe: but as observed before the Commission, something more than kindness is required in order to make a good nurse. It may readily be conceived therefore, not only of how little use, but of what absolute injury to a sick man is the presence of a rough comrade, destitute of tact and perhaps destitute of sympathy or natural kindness.

Personal experience.—The writer has in his experience, seen the sick in a large and crowded hospital, have no better attendance during severe illness, than such as is here described. He has seen waiting men neglect their charges, and be found in a distant part of the building, amusing themselves with their comrades, while the man over whom they were meant to be, was writhing with pain,—unable to raise his voice sufficiently to make known his wants, or having done so, been unable to obtain the services of any of the so-called attendants: and he has seen a man so circumstanced, give himself up in actual despair, looking upon himself as uncared for and lost.

Apathy of the Indian.—The innate apathy of a native Indian is such, that whatever be the sufferings he may witness, the desire to relieve them never seems to enter into his conception. Between themselves this apathy and indifference to suffering exists to a degree that perfectly astounds an European. When however, the latter is the sufferer, it attains a degree which betokens that if the moral sentiments be present at all in the native, they have attained merely the faintest glimmer of existence.

But the native attendants are not only apathetic, they are physically weak. They are thus absolutely incapable of giving sick men assistance in those respects that tend most to comfort during illness. They are unable, were they inclined, to raise the head from an uncomfortable to a comfortable position, far less to raise or turn the patient; and when required to perform some of the most important duties of a nurse,

caste prejudices forbid them to minister to the requirements of the sick. Moreover, there is no mincing the fact, that to the great majority of Englishmen, the cold reptile-like touch of a native's hand is absolutely repulsive.

Such is the state of matters during the day; but at night, they are far worse. The natives are then sound asleep, either strewn about on the floor of the wards, or in verandahs. If a patient be strong enough to call aloud, the cooly whose duty it is to attend him, groans, looks up, and sleeps again; if unable to call aloud, the cooly sleeps on till morning gun-fire; nor does it by any means seldom happen that when he then goes to his patient's bed, he finds there a corpse.

Now, sad as this picture is, it absolutely contains not an illustration, except what the writer of it has actually himself beheld in India.

On trained attendants.—The Royal Commission had before it, sufficient evidence of the defects in the present system of the hospital attendants in India, to lead to its 27th recommendation, that trained hospital attendants be introduced into all hospitals. What has now been stated however, will, it is hoped, serve to indicate the absolute and pressing necessity which exists, that the recommendation thus made be carried into effect without avoidable delay.

It therefore becomes necessary that a few remarks be made, upon the means by which this end is to be attained: and in so doing, an expression of surprise may be permitted, that although upwards of twelve years ago, a corps was raised principally with the view of providing trained attendants for soldiers in all other of Her Majesty's dominions, no actual step has up to the present time been taken to extend similar advantages to the troops in India.

The army hospital corps is recruited from regiments of the line, the men being liable to be remanded to their corps in the event of misconduct. While

they continue in the former however, they perform no military duty whatever: they are to all intents and purposes hospital servants.

On home service, and in temperate climates, no further attendants than these are required in hospitals; the appliances of the hospitals being all in a complete condition. In tropical countries however, natives are employed to perform the more menial duties, and as assistants to the trained attendants. Thus, in China, it was found necessary to employ one orderly for every eight sick in hospital, instead of one for ten, as laid down by regulations. But in addition to these, such number of natives were employed in the wards, as the requirements of the sick from time to time demanded.

There was however, this difference between the duties of the coolies employed in China and in India, that whereas in the former, the necessities of the sick were attended to by men of their own race more or less trained for the particular purpose, the coolies merely being employed in very subordinate offices,—there is in the latter, little, if any provision made for supplying sick soldiers with other attendance than such as we have just seen, the ward coolies afford.

Improvement how to be effected.—In order then, that the sick in that country may obtain the advantages contemplated by the Royal Commission, two courses are open, neither of which presents any special difficulty as to execution.

The first is, that trained orderlies of the army hospital corps be sent to India from England, in the proportion in which regiments are provided with them at home: with one man in addition per regiment to supply the requirements and probable casualties there. That regiments embarking for India bring their trained orderlies with them, as they do when embarking for any other foreign station; and that a proportion of these, be sent out from time to

time to supply the places of casualties. These men, although not absolutely belonging to regiments, could readily be paid by regimental paymasters, or by officers commanding depôts, precisely as non-commissioned officers of the corps of armorers now are. They would be under regimental discipline, and surgeons held responsible, as elsewhere, that they are kept up in efficiency in accordance with instructions published on the subject under authority of the War Office.

The second plan to be proposed is, that a corps of the description alluded to, be raised for service in India itself. It would be recruited in part by men who are already soldiers, partly by men of known good character, who might desire, and be found fit to enlist into it; the one proviso in regard to them being that they shall be natives of England, Ireland, or Scotland.

It would, as a matter of course be right that liberal terms be given to them; that every inducement for good behaviour and faithful service be held out; but that neglect of duty, or indifference in its performance be severely punished.

The organization of the corps and payment of the men until attached to regiments, ought to be in the hands of an officer specially selected for these duties: and it would be his duty to see that records of the men's services be kept in a complete state, in a similar manner to documents of the same kind, of soldiers.

These men would have in the first instance, to be regularly trained for their duties, and being so, would be sent to regiments throughout the country; medical officers being held responsible that they be regularly practised in their particular duties while serving under them.

Proposed school at Calcutta.—With regard to the original training of these men, it is necessary to observe, that it is taken for granted, the Government of India will carry out the proposal which has, indeed,

been so far sanctioned,—that the building at Calcutta hitherto occupied by the Law Courts, shall be given over for the purpose of conversion into a general military hospital.

This measure being carried into effect, there appears no good reason why the establishment to be formed, should not serve for the Presidency of Bengal, if not for all India, some of the purposes that Netley does for the service generally ; one of the respects in which it does so, being as a school, where men shall receive sufficient training to render them fit for attending upon our sick soldiers. Not only orderlies, but all other classes of hospital attendants would there be taught their respective duties ; and having undergone their course of probation, would be drafted to regiments requiring their services.

Consolidated Hospitals.—It is to be hoped that at stations where two or more British regiments are quartered, that modification of the general hospital system, known as consolidated hospitals, will ere long be introduced. By it, as already discussed at length, while the actual discipline and administration of the sick in wards occupied by men of each particular regiment are left solely to that regiment, the administration of the whole is under one head.

Among other advantages that would arise from the establishment of hospitals according to this plan, would be the readiness with which orderlies could undergo training for their duties ; becoming initiated into the routine of duty required when troops are massed together. Men too, could be readily taken on probation, and their probable efficiency tested before admitting them to the corps, of which it is proposed that they shall form a part.

CHAPTER XXX.

WATER.

Requirements—Potable water—Rain water—Air in water—Impurities—Hard water—How rendered soft—Internally—Externally—Effects of impure water—From organic matters—Wells near cesspols—From inorganic matters—As a deodorant—Regulated allowances—Water supply—How measured—Search for—How purified—Filtration—Other measures—Raising water—Conduits—Troughs—Reservoirs and tanks—Loss by evaporation—Rules regarding supply—Transformation of organic matter—Qualitative examination.

REQUIREMENT BY THE SOLDIER.—Water is required by the soldier. 1. For internal consumption, as in food and drink. 2. For external use. And 3. For purposes of ablution. Under the varying circumstances of military life, he may not only be on the march, where special arrangements are needed to procure and carry with him this necessary of life; but he is often on board ship, where he must be restricted to a very small quantity: he may moreover be at stations on shore, where on account of scarcity of water, a regulated allowance is doled out with as great nicety as if he were at sea. He may be on service in a territory where search for water has to be made in order to meet his wants, or he may be besieged in a fortress, where the rate of supply must be strictly measured, and the expenditure most carefully registered.

POTABLE WATER.—The first essential in regard to water, is that it be sufficiently pure and soft to be fit for use in drinking and cooking. The characters by which this is ascertained, are that it is limpid, and remains so on the addition of lime water, chloride of barium, nitric acid, oxalate of ammonia, or hydrochloric acid. The degree of softness is indicated by

the readiness with which beans or peas may be boiled in it, and soap dissolved.

Rain water.—Absolutely pure water however, were it attainable on a large scale,—and it is not—could not be used. Rain water is not absolutely pure, and when first collected is not agreeable to the palate, partly no doubt from being deficient in saline materials, and partly from not containing the proportion of atmospheric air which is essential to its "freshness."

Air in water.—The normal amount of air in water is about 2 cubic inches per 100. To maintain this, the water must be in motion; hence, that of rivers is better ærated than that of tanks: and what has been boiled or condensed after evaporation is altogether deficient in this respect. Thus, it is vapid and insipid, and requires free agitation and exposure to the air before it can be used.

Impurities.—It is generally allowed that water containing suspended matters, should not in that state be issued to troops, and that the presence of any other free gas than carbonic acid renders it unfit for issue; but opinions differ in regard to other constituents and their proportions, which are held to be causes of rejection, except as regards animal matter; and all authorities agree that good water should contain no appreciable quantity of it.

Some assert that if it contain no more than one or two grains per gallon of vegetable matter, it may be deemed fit for use; others would even allow a larger quantity in potable water, even 20 grains per gallon.

So in regard to saline matters, the statements are various. Some authors consider that water should contain no more than 2 or 3 grains of saline matters which are themselves not injurious. Others think good potable water may contain 6 to 20 grains of solids per gallon.

Salts per gallon.—Certain waters which contain far above either of these quantities, however are used without any evil results. For instance, that of Trafalgar

square contains 68 grains of saline matter per gallon, of which 25 grains are chloride of sodium, and in many parts of India, where much saline impregnation of the soil exists, these amounts are far exceeded.

Hard water.—It often happens that water which is unfit for internal is perfectly adapted for external use, and it is by no means rare to find that by a simple proceeding, water which is in its natural state unfit for such a purpose, is rendered perfectly so. Some of these processes will be mentioned further on, but here it is convenient to allude to that rendered "hard" by the presence of lime, or free carbonic acid.

Water of this nature is the product of lime stone formation, new red sandstone, oolites, chalk, and some of the tertiary rocks. Its characters when employed for boiling, or with soap, are the reverse of those alluded to as distinguishing soft. Soap is not dissolved in it, because the alkali of it unites with the acid from the salt of lime,—the earth itself being suspended as flakes or curdy masses.

Rendering hard water soft.—The means used to obtain softness in such a water, are boiling, Clerk's process, and soda. By boiling, the carbonic acid from the lime is dissipated, and the lime precipitated. The process known as *Clerk's*, consists of adding to the water an amount of solution of lime, sufficient to form carbonate of lime with the free carbonic acid: the carbonate of lime so formed, is precipitated. By the addition of soda, the lime salts are got rid of, the carbonate of the alkali becomes a bi-carbonate. If the water be "hard" from the presence of sulphates or of carbonates, it is in that state not only unfit for internal use, but for external surgical use also, such for example, as dressing ulcers.

For internal use.—The precise quantity of water required for internal use necessarily varies according to the circumstances in which a man may be placed; it varies also according to natural constitution, some persons requiring more than others. During exertion,

more is needed than in rest; in hot, more than in cold weather; and in dry states of the atmosphere than in moist. For purposes of comparison however, it is roughly estimated that under ordinary circumstances, a man requires daily a quantity internally, not less than equal to six-tenths of an ounce per pound weight of his body: of this, about 20 ounces are taken in with the solid articles of his food; about 80 with fluids.

WATER EXTERNALLY.—Water externally has other effects than merely serving the purposes of ablution; it renders the surface that has been parched by exposure to heat or dust, flexible: it communicates oxygen to the blood in the capillaries, and thus serves one of the purposes of respiration: it moderates intense thirst by the simple operation of endosmose, and under certain circumstances it acts as a powerful nervous tonic or excitant.

Under other conditions however, and always by long continued application, it acts as a powerful depressant. In such circumstances, the pulse may be reduced 50 beats per minute, as for example, by a *douche* bath at the rate of 30 to 40 gallons per minute, and a temperature 64° to 68° F. A shower bath of 8 gallons per minute at 47° F., reduces the volume of the pulse, but does not affect its frequency: at 74° F. to 100° F., no perceptible effect is produced.

In certain conditions of health, the use of a shower bath cannot be borne, as for instance, in some states of alcoholismus; in persons who have recently recovered from severe fevers; in those liable to attacks of intermittents, or who labor under internal diseases. It has often been stated that in the West Indies, confirmed drunkards cannot bear the douche. In the East Indies, old soldiers of long service in the country, not infrequently suffer from attacks of fever, or have paroxysms of shivering after using the plunge bath or a shower bath; hence, medical officers find it necessary to exercise some discrimination as to

the general applicability in a regiment, of prescribed bathing parades.

Even in the United Kingdom, there are persons who absolutely suffer in health from the use of a bath of cold water. These require that the water used shall be warm, and that they do no more than sponge themselves with it; similar peculiarities exist among soldiers, and the medical officer will do well to bear them in mind. Such cases however, are the rare exceptions. As a rule, not only is the bath indispensible to personal comfort, but it is so to health. If, said Dr. Rush, soldiers grew as speedily and spontaneously as blades of grass, the want of personal cleanliness would reduce them in two or three campaigns to a handful of men. The cold bath was part of the discipline of the Roman soldiers, and contributed much to preserve their health.

Effects produced by impure water.—Impure water used for any considerable length of time, produces various diseases, the nature of which depends upon the character of the impurity: whether however, it exists suspended or dissolved in the water; is gaseous, organic, or mineral in its nature, certain distinct trains of symptoms follow the use of water thus impregnated.

From organic matters.—Organic matters,—and of these, matters of animal origin unquestionably produce the most serious and fatal diseases; for instance:—

Cholera.—Cholera as is now well known, spreads rapidly by contamination of water by foul matter. Dr. Budd has pointed out that in this manner the discharges from cholera patients may become sources of great danger; and hence, the Cholera Commision in India, and the various Sanitary Commissions, strongly urge the necessity of carefully burying all such, so as to avoid the risk of their becoming mixed with the drinking water.

Of this, we have frequent demonstration in India, in the occurrence of the disease in persons or com-

munities who make use of water of streams or tanks that have been rendered impure by the filthy habits of the natives. Dr. Stewart Clark is of opinion however, that the extent to which this occurs has been exaggerated : but that much of this form of disease is thus propagated in India, has been clearly shown to be the case by Drs. Chevers, Macpherson, and other well known medical writers in that country.

Miss Nightingale in alluding to the absence under certain circumstances of physical characters to distinguish impure water, remarks that water drawn from wells supplied by filtration through old grave-yards, is often clear, bright, and sparkling, from being charged with carbonic acid derived from human remains in the soil : and she mentions the well known fact that during epidemics of cholera, water from such a source is poisonous.

We have elsewhere in this volume given a few striking instances of similar results ; in some of which the specific effects manifested themselves in an extremely short time after the poisonous water had been imbibed. In India, the traveller inland may see near almost every village inhabited by Mahomedans, the grave-yard in which for generations their dead have been interred. In one corner of this cemetery, will be found almost invariably a well, from which the villagers and casual travellers draw water for drinking : now it is impossible that water from such a source can be otherwise than poisonous, from being tainted with the products of decomposition : and thus, we may reasonably presume, is cholera at times produced and disseminated.

Fevers.—Fevers of a typhoid nature also may owe their origin to water containing animal matter : dysentery and diarrhœa are similarly produced, whether the organic matter be simply suspended in the water, or having decomposed, has given rise to poisonous gases. The two latter diseases spread rapidly by means of evacuations of patients suffering from them getting

disseminated by water. Fevers of intermittent and remittent types are produced by water, which contains vegetable matters; hence, troops marching through or near jungly districts, should not use water unless filtered, and for this purpose should be provided under such circumstances with patent filters.

Boils.—Boils and acne occur from the use of water contaminated by organic matter: and there is every reason to believe that the use, as drink of such, predisposes the person to a number of zymotic diseases, should other circumstances combine to light them into existence.

Parasitic diseases.—In addition to the above-named diseases, which more or less directly owe their origin to organic matter in a dead condition, there are some of a parasitic nature, that are directly introduced into the system by means of water: of these the best known are *lumbrici*, *filiaria*, and the *bothriocephalus latus*; until recently, it was believed that tœnia was also propogated in this manner, but late investigations would seem to indicate that it must be received into the system as the *cysticercus* of meat.

Leeches.—Much personal inconvenience, and even actual danger is at times incurred by the introduction into the nostrils, fauces or œsophagus of small leeches by persons drinking carelessly in districts or countries where these annelides abound.

Wells near cesspools, &c.—There at times occur circumstances in connection with the propriety or otherwise of drawing water for the use of soldiers from wells in the vicinity of sources of organic contamination, that naturally lead us to consider at what distance from a place of this description, as for example a cesspool, a well may be looked upon as beyond the risk of being thus rendered noxious. It is usual to consider that at and beyond a hundred yards from a cesspool, water is innocuous; much will doubtless depend upon the degree of porosity of the soil, but perhaps, as a general rule, this distance may be considered as that beyond which risk ceases.

Inorganic matters.—Various diseases owe their occurrence more or less directly to the presence in water of inorganic matter, thus:—

Dyspepsia.—Dyspepsia is occasioned sooner or later by the use of water containing sulphate of lime, chloride of lime, and magnesian salts.

Printing materials.—Poisoning from the use of water tainted with the materials of printing, such as lead, arsenic, &c., is at times observed in the civil residents of towns: but there is no reason why this should happen among troops. The supply for barracks and military hospitals need never be exposed to the risk of being thus contaminated.

Lead poisoning.—Paralysis from lead however, is by no means very rare; and colic from the same impregnation has happened among a body of soldiers to a great and alarming extent, as at Newera Ellia in Ceylon a few years ago.

The quantity of lead in water necessary to produce evil effects is variously stated; thus, an American author considers that one-hundredth part of a grain per gallon will poison; others give $\frac{1}{57}$th, $\frac{1}{40}$th, and $\frac{1}{10}$th of a grain respectively as the quantity required.

Sheffield water which contained $\frac{3}{10}$ths to $\frac{4}{10}$ths of a grain per gallon, caused much poisoning, and in Manchester, $\frac{5}{10}$ths to $\frac{7}{10}$ths of a grain per gallon affected 38 per cent. of those who used it.

From lime.—Several diseases are believed to owe their origin more or less directly to the continued use of calcareous water; the principal of these being exostosis, phosphatic calculi, and goitre.

From salts.—In several parts of India, as for instance, at Mooltan, in Scinde generally: at Delhi, Agra, and Lahore, the presence of alkaline salts in the water, super-added to the dearth of cruciferous vegetables during a considerable part of the year, is looked upon as a powerful exciting cause of the scorbutic diathesis so common among our troops there. So at Aden, the want of fresh water, and the

brackish nature of what has to be used, combine to bring about a similar condition of body among the troops who garrison that fortress.

Deodorizing power of water.—That water exerts a powerful influence as a deodorant, is demonstrated by the enormous quantities of sewage and other offensive materials that are in the instances of large towns thus more or less completely rendered innocuous to the smell. Many persons even in our own country, looking upon it as the universal cleanser, as well as solvent, forget that although water into which such substances have been admitted, is not to be distinguished from that which has continued pure, it has nevertheless been rendered poisonous by the intermixture. This circumstance has been casually mentioned in a preceding paragraph; but is of sufficient importance to be specially noted as it now is.

Regulated allowance in United Kingdom.—The quantity of water allowed for use, is in the United Kingdom, about 7 gallons per head per day; and this includes the requirements for washing purposes, as well as for consumption. For cleansing alone, about 4 gallons a day are allowed, but to have this done effectually, sixteen gallons at least would be required: and for washing, about a gallon more is needed. For cleansing sewers, it is calculated that about 25 gallons per man are required: and for flushing the drains connected with a house, it is calculated that there should be at the rate of seven cubic feet of water, that is, 43·671 gallons per day for each inmate.

In hot countries.—In hot countries, a much larger quantity of water for daily use is of course required than there is at home; thus, in the scheme under contemplation, when these notes are being written, for supplying Calcutta with water, the calculation is made to allow at the rate of 30 gallons per day for all purposes to each European resident, and 15 to each native.

For the purposes of bathing, an average quantity of six to eight gallons is allowed, but this is too

small; a common bath ought by rights to have 60 to 70 gallons.

In hospitals.—In hospitals, according to the Sanitary Commission, the allowance of water per head per day should be 25 gallons, including sick and attendants. Dr. Parkes however, is of opinion, that this is much too small: according to him, the allowance should be 40 gallons.

Urinals.—For urinals consisting of a basin and stand, such as are described by the Sanitary Commission, the quantity required is about 20 gallons each per night.

At sea.—During sea voyages, the quantity allowed for all purposes, is six pints per man while out of the tropics:—in the tropics, eight pints are allowed. For each horse embarked, the allowance is six gallons per day; further remarks however, on this part of the general subject of hygiene will be found in the chapter specially devoted to ships.

During sieges.—It may become necessary during a siege to consider the sufficiency of the water supply. Under such circumstances, a man is deemed to require per day a minimum of 2 gallons. A horse requires for use 8 gallons, and for cleaning 8 gallons more=16; a cow or bullock 5 to 8 gallons; a sheep $\frac{1}{2}$ to 1 gallon; and a pig a somewhat smaller quantity.

At some of our foreign stations, the means of preserving water are so imperfect; at others, the amount of rainfall so scanty, that troops are restricted to an allowance of fresh water, with as much care, as if they were on board ship, thus:—

Cape Coast Castle.—At Cape Coast Castle for example, where water has to be carefully stored, the allowance is one gallon per day for washing, cooking, and drinking. Sometimes this is reduced to one quart, as became necessary to be done in 1863. Sea water is used for bathing; the body being afterwards sponged with fresh water. At some of the stations

on that part of the coast of Africa, water is even more scarce: thus, at Winnebah, so great is the difficulty in obtaining a supply, that we are informed by Staff Assistant Surgeon W. A. Gardiner, in his Report, published in the Departmental Blue Book for 1863, that the water required for ten men, had to be obtained at an expense of £3 per month.

Aden.—At Aden three gallons of fresh water are allowed per man per day; but in times of scarcity, this is reduced to two gallons. Two more gallons of brackish water are given. The introduction of a distilling apparatus to this station however, will doubtless enable the troops to obtain a more liberal supply.

Water supply.—The following points should obtain especial attention in regard to the supply of water to troops, namely:—1. Its source. 2. The means of filtering or otherwise purifying it. 3. Its conveyance. 4. Its stowage.

Rainfall.—At many foreign stations, the periodical rainfall is the only source of water supply. It has then to be collected, either upon gathering grounds, or upon the roofs of buildings. In such a case, the following rules by Dr. Parkes for ascertaining the quantity and permanence of supply may be useful. Having ascertained the average rainfall for many years, note the minimum: then find the area of the receiving surface, as for example, a roof. The square feet $\times$ 144 = square inches, which $\times$ by rainfall = the amount of rain for a given time, and of the given surface in cubic inches: then $\div$ the cubic inches by 277·274; the number of cubic inches in a gallon = number of gallons which are to be calculated in order to ascertain their sufficiency for a particular number of men.

The other most frequent sources of supply are rivers, wells, and springs.

In United Kingdom.—In the United Kingdom, the barrack supply is generally, if indeed not always a part of the general supply for the town. In forts and

redoubts however, it is necessary that there should be the means of supply altogether independent of external resources, and so wells more or less deep are excavated.

In India.—In India, the sources of supply are various: thus, in Lower Bengal, there are the rivers, filthy and contaminated as they are: tanks, only a little less contaminated, and wells which are for the most part good. In the North-West and Central Provinces of that continent, there are wells, the water of which is in many instances much impregnated with salts: and in the hills, there are springs and mountain streams.

To measure a stream or spring.—Circumstances may occur during a campaign in an imperfectly known country, where it may be necessary to consider the amount of water in a particular stream or spring, in view to ascertain how far it is adequate to meet the wants of the troops. In such a case proceed as follows. Select a spot where the stream is straightest, and the banks even; mark two points in the river; get the mean depth between these; float down a light object from one point to the other, and note the velocity of the surface thus indicated. Four-fifths of it is generally the mean velocity of the stream. Then multiply the length, breadth, and depth, the result represents the yield in a specified time. If a small spring, the shortest way is to receive the water in a vessel, and then measure the quantity given in a certain time.

Search for water.—It may so happen that the army medical officer may find a few brief rules useful as a guide in regard to the steps to be taken by him in searching for water, thus:—

1. If on a plain near the sea, and hills not far distant, water may be found near the shore at no great depth from the surface.

2. If soil be light and dry, impregnation by sea water will extend a considerable distance inland. If no hills be visible, the precise distance is uncertain.

3. Survey a plain and try at points where it is lowest, and where there is verdure present, or where mists hang at sunrise, or where flights of insects collect. In such places dig as deep as possible in the search.

4. Springs may be found at the foot of hills, or at the junction of two strata, the lower of which is impermeable.

5. In Affghanistan, the natives search for water on the side of a hill down which the *dip* of stratified rocks extends. They form an adit horizontally through the strata, until water can be collected from the crevices thus exposed.

6. If water be not found, sink a well at the lowest part of the foot of the highest hill, or at the point where a valley opens on a plain, observe that the *dip* of the strata be towards you, observe also the nature of the soil : for instance, if it consists of clay, it will be useless to dig ; the water will have run off it.

From primitive rocks.—As a rule, it may be stated that the purest of all waters is that obtained from primitive rocks and mountainous districts, where its source is the rain percolating through these.

Coal measures.—The coal measures for the most part produce water, yet not invariably. That obtained from this formation is often contaminated by iron and sulphur. It often holds lime in solution.

Similar causes of contamination often affect the water found in the oolites, lias shales, and salt rock in the new sandstone series.

In alluvial soil.—In alluvial districts, as for example, India, the water of tanks and of wells in many places is loaded with impurities of various kinds, organic and inorganic. That from rivers also in that country, soon becomes tainted from decomposition occurring in it when kept ; and it may be taken as a rule that the smaller the amount of saline matters in such water, the more rapid is the decomposition.

Purification of water.—Various methods are recommended for the purification of water which contains organic matter, without subjecting it to the process of filtration. A few of these may be enumerated.

(*a*).—*Expose water* of this nature in small streams passing over wooden plates. These will attract the organic matter, and sulphuretted hydrogen.

(*b*).—*Boil the water* to drive off the sulphuretted hydrogen, and precipitate the carbonate of lime and iron salts. The organic matter will be at the same time decomposed.

(*c*).—*Add six or seven* grains of alum per gallon. This clears it of clay, marble, and organic matters of vegetable origin. The alum combines with the vegetable extractive for which it has strong affinity : thus, precipitation is the result, the alum falling as a subsalt, while its sulphate of potass remains in solution.

(*d*).—*Condy's Solution*, or permanganate of potass, this should be added, and the whole well agitated : this is especially useful on board ship.

(*e*).—*Tea*—In China, water prior to use for consumption has a small quantity of tea added to it and boiled : the weak infusion is then drank. The purifying property of this herb doubtless depends upon the presence of tannin, which decomposes the organic matter by combining with its albumen.

Kino and other vegetable astringents have a smaller action.

(f) .—*The nut of Strychnos potatorum.*—This nut, which is commonly used in India, acts according to Dr. Pereira by virtue of the presence in it of albumen, and caseine. Precipitation of the organic impurities is thus brought about.

(g).—*Charcoal*—This acts by attracting oxygen from the organic matter, and thus inducing its decomposition.

We have already seen how alum acts : and from the readiness with which charcoal is procurable, and the

portability of alum, the use of both these substances in combination should be inculcated among troops on the march, especially in India and other low lying countries where pure water is scarce.

Filtration.—Filtration is the method most commonly employed for purifying water. This may be performed at the source of supply, as through sand and gravel by ascent, or descent, or both. Some kinds of trap and of sandstone rocks make excellent natural filters.

Good animal charcoal purifies 600 to 700 times its own weight of water, and vegetable charcoal 498 to 504 times. The former will remove 88 per cent. of organic matter, and 28 or 30 per cent. of mineral matter, as chloride of sodium, sulphate of lime, or carbonate of lime. The power of both animal and vegetable charcoal filters is readily restored by exposure after long use to the sun, or to slight heat; but it is necessary that the charcoal be pressed into the hardest and most compact mass possible, as for instance in those known under the name of silicated iron filters.

Other descriptions of filters have been used, but all inferior in efficacy to those of charcoal. The kinds most frequently met with, are composed of magnetic oxide of iron, peroxide of iron, and salts of manganese.

A small pocket filter such as are now procurable in any of the outfitting shops, is of the greatest use on the march, or service. The silicated carbon Filter Company, manufacture excellent filters. Torbane hill mineral is also good for the purpose. Magnetic iron ore has been suggested, but it does not appear equal to charcoal.

Cheapest filter.—The cheapest and best form of nlter for extended use, is readily made with gravel, sand, and charcoal; artificial magnetic oxide added to these will be beneficial where much organic matter is present. This increases the oxidizing power of all filters, and renders them more effective for destroying organic matter.

Spencer's filter.—By Spencer's filters, organic matter in water can be decreased from 3·15 grains per gallon to 1.75 grains, *i. e.* 33 to 44 per cent.; the gallon being 70,000 grains. This was proved by experiment with the water of the Hooghly at Calcutta. The particular substances employed in this filter consist only of magnetic oxide of iron and sand: thus it is simple and cheap.

Lind's filter.—Dr. Lind's plan for purifying water is very simple. It consists of taking a large cask with the head out, in which he fixes another cask, longer and narrower than the former, but with both ends out. Half of the inner cask is to be filled with clean sand, and the space between the casks also filled with sand to one-third of its height. The water to be filtered is then placed in the inner cask, and as it rises in the space between the two, should be fit for use. This method would certainly appear simpler and more likely to be effective for barrack use than the earthen vessels in ordinary use at stations in India.

A simple and effectual kind of filter is described by Dr. Cutbush. It consists of a trough, six or eight feet long, two broad, and two and a half high. This is divided into four compartments. Into the second, alternate layers of gravel, charcoal, and clean sand are put, until it is about two-thirds full. Place similar materials in the fourth compartment, so as to half fill it. Some holes having been made in the first partition near the bottom, some near the top of the second, and the bottom of the third; water placed in the first, undergoes filtration by ascent and descent, and can be taken for use from the last compartment.

Rate of filtration.—When filtration is performed upon a large scale, as is necessary for towns, a calculation as to the rate at which it proceeds is usually made, by assuming that 600 gallons of water per day passes through each square yard of filtering apparatus.

Removal of other impurities.—It is practicable to remove certain gaseous and mineral matters from water ; a few of these may be enumerated, *viz.*—

A.—Gases such as sulphuretted hydrogen and organic vapours may be removed by boiling.

B.—Mineral substances.

Carbonate of lime.—*a. Carbonate of lime.*—Boil, and add lime water.

Chloride of sodium.—*b. Chloride of sodium.*—Filter through much gravel and sand, or charcoal. Make a large syphon ; fill its long leg with charcoal, and allow the water to run through ; this is said to purify even sea water.

A condenser.—It appears however, that there are no means of getting rid of sulphate of lime, sulphate of magnesia, and chloride of lime, except by evaporation : whenever water is brackish, and always in board ship, there should be a *condenser* for distilling it.

Raising water.—A gallon of water weighs lbs. 10. One horse power is equivalent to raising 3,300 gallons, or 33,000 lbs. of water, one foot high per minute.

A pump for water supply, if the lift be more than 30 feet, must be double action : that is, lift and force. Steam is the cheapest means to employ, but where it cannot be used, animal power, as bullocks may be so.

Conduits.—The fall of a conduit should not be less than one in 1000, nor greater than one in 300, unless the tubes be of cast iron.

For station service, cast iron should be used for all pipes above 2 inches in diameter. These should be coated inside and out with black varnish. If not placed near gas pipes, they should last about ten years.

The joints of tubes of this kind should be by insertion into sockets : a certain amount of contraction takes place of necessity in these if exposed to the air or changes of temperature, and thus some leakage occurs. They are however the best that have yet been found. Lead as solder for joints, should never be used, chiefly

because it and iron expand in different ratios. Lead for pipes and cisterns should not be used under any circumstances.

Wrought iron pipes from $\frac{3}{8}$ths up to $\frac{1}{2}$ inch, may be used for service in houses and buildings ; cast iron pipes from 3 inches up to 3 feet diameter for *mains* in towns.

Conduits should be at such a depth in the soil as to prevent the water from becoming heated by the rays of the sun.

Troughs.—In cavalry regiments, each trough for supplying horses with water should have independent means of being filled. The one should not be supplied from the other.

Reservoirs and tanks.—Brick and masonry tanks if arched, should be covered in with sand or fine earth to a depth of 18 inches. This will preserve the water cool. They should however have means of free ventilation. Those under ground keep the water coolest.

It is usually considered that in India the deeper the tank, the fuller of aquatic plants it is, the more exposed to the wind,—the fresher and better is its water. The presence of trees, or vegetation of a dense nature in its immediate vicinity is objectionable, partly because these prevent free perflation, and partly because leaves and branches falling into the tank contaminate the water. Great mistakes have however been committed by clearing away from the bottom and sides, plants which had found in these a congenial site. Clear and wholesome water has thus been converted into that which was foul, offensive, and unfit for use.

The depth should be fifteen to twenty feet. If less, expenditure of the water, and the great amount of evaporation which takes place in the dry season, may, by emptying them completely, render the bottom so foul as to impregnate the water of the succeeding year to a degree sufficient to make the tank unfit for use.

It is almost unnecessary to observe that these tanks should, if the water from them be intended for consumption, be preserved carefully not only from contamination by sewage, but from use for purposes of ablution.

Loss by evaporation.—It may be necessary under certain circumstances in calculating the probable supply of water that a given tank in India will yield, to take into account the rate of loss which that tank sustains by evaporation. At Calcutta, for example, this amounts to a quantity far beyond what might at first sight be imagined, being at the rate of two inches and a half per day: while, in addition, some of the tanks in that city lose six inches by percolation into the surrounding porous soil.

Rules regarding supply.—In laying on water for barracks, it should be borne in mind that means of escape for the whole amount should be provided. All barracks and out-houses requiring it should have the supply available day and night.

If the supply of pure water be limited: that is, where the rainfall affords the only pure water for cooking and drinking, this part of the supply should be filtered, tanked, and distributed by itself. This is done at the military hospital at Devonport. The ordinary supply there, is obtained from the "leet" or conduit from Dartmoor; the pure water from rainfall collected as described, on the roof.

Transformation of organic matter.—In reference to the subject of water rendered impure by animal matters, the following remarks extracted from the Report of the Royal Commission on the sanitary state of the army in India, will be found useful to the military medical officer.

"Shallow wells," according to the evidence of Dr. R. D. Thomson, page 257 of the octavo edition, "become impure from organic matter on the surface and that procolating from the sewers, which gradually changes from the first condition into ammonia,

and the carbon or charcoal of the original water changes into carbonic acid, and dissolves the lime (the well water of London is that which is here referred to). This ammonia gradually passing through porous soil, is changed into nitric acid. The best tests are the presence of ammonia and nitric acid."

QUALITATIVE EXAMINATION.—In conducting the chemical inquiry regarding the quality of water, the degree of hardness by Clerk's (soap) test should be ascertained; next the quantities of organic and inorganic constituents per gallon, their precise nature and the amount of each.

ORGANIC SUBSTANCES.—For the detection of these, the Commission, at page 254 of its Report, recommends that every medical officer be supplied with a solution of permanganate of potass for testing water. If it is necessary to use half a dozen drops of that solution (to render the color permanent), it is a sign that the water contains a good deal of organic matter. It is right to mention however, that a doubt has by Dr. Woods been thrown upon the infallibility of this test.

Another simple method of ascertaining the presence of organic matter is to introduce a little nitrate of silver in the water, and to expose the solution to the light. If organic matter be present, it will be blackened.

Another plan is by the application of a solution of gold. If a few drops of chloride of gold be added to the water, and the water allowed to stand in the light for about an hour and a half, the organic matter becomes apparent. If boiled for 15 or 20 minutes, a violet tinge appears; its deepness being in proportion to the organic impurity present.

The following is a summary of the means recommended by the Commission to be adopted, in order to ascertain the amount of organic and other impurities contained in a gallon of water, namely:—

Place the water in a scrupulously clean glass bottle, set it aside for six or eight hours, collect the sedimentary matters (a minute portion of which may now be examined by the microscope). If the sediment be very small in quantity, pour off all the water except about half a pint; transfer the remainder to a conical glass of suitable size; after three or four hours, decant all but two or three drachms of this, which, place in a smaller glass for subsidence.

Evaporate an imperial pint of the water to dryness; transfer the residue to a small porcelain or platinum dish of known weight; cleanse the dish with distilled water, the rinsings being added to the contents of the capsule; evaporate to complete dryness. The difference between the weight of the capsule and contents, and that of the empty capsule, gives the amount of solid contents, organic and inorganic: this $\times 8$ = amount per gallon. Burn off the organic matter; weigh the capsule again; what remains will approximately represent the inorganic matter. If the amount of organic and inorganic matter exceed 30 grains, the water may, as a rule, be considered impure,—see page 260 of the Report. If during the process of drying the residue of the evaporated water,—this residue does not turn brown or black, but remains white or brownish only, then the quantity of organic matter in the water is but small; if however it does turn deep brown or black, and if especially, it chars and burns, giving out a disagreeable smell, the amount is considerable.

It is not deemed necessary in this place to enter in detail upon the qualitative examination of water with reference to inorganic impurities contained in it. Dr. Parkes has done this in his work, and full directions in regard to the subject exist in the various manuals on chemistry.

CHAPTER. XXXI.

AIR.

Importance of the subject—Temperature—Inspiration—Blood to be oxygenated—Mobility of chest—Reserve air—Expired air—Results—Causes of impure air—Septic condition—Impure gases—Movement of air—Ozone.

NATURAL CONDITIONS.—The natural conditions of the atmosphere exert an all-important influence upon the phenomena of health and of disease: thus, heat and cold, dryness or moisture, and the ever varying electrical conditions produce their respective effects upon the human system.

CLIMATE.—These conditions constitute what is called climate, and their consideration becomes of material consequence to the medical officer, whose duty it is to propose sanitary arrangements for our troops, moving as they do, through nearly every variety of it.

TEMPERATURE.—Great caution however is necessary in arguing in regard to these phenomena, from specialities to generalities. Let this be illustrated in regard to temperature. It is customary to state that temperature decreases at the rate of 1° F. for every three hundred feet of elevation above the sea level. This is actually the case, when the observations have reference to a hill, but the scale becomes fallacious in the instance of widely extending plains; thus, in Central India and the Punjab, the temperature at an elevation of more than a thousand feet above the sea level, is far beyond what the thermometer indicates in the maritime districts.

INDIVIDUAL CONDITIONS.—Physical formation of the continent has in this instance, deranged the application of the arbitrarily formed rule; so will physical geography be found to interfere with rules similarly formed in

regard to the other characters mentioned; and hence, the necessity of studying separately and individually the different localities and their characters under which our troops may be serving, or are about serve.

Rate of inspirations.—A full grown man is generally considered to take sixteen to twenty inspirations per minute, inhaling at each of these twenty to thirty cubic inches of air: let it be assumed that $16 \times 30 = 480$ cubic inches be taken as the quantity inhaled per minute, while the person is at rest and sitting; if he were to stand, the amount of inspiration would increase in the proportion of 1·33: if walking, at the rate of three miles per hour, 3·22. If in addition to this he carried a weight equal to lbs 34, to 3·50; of lbs 62, to 3·84; if of lbs 118, to 4·75. Presuming that without such weight he were to walk at the rate of four miles per hour, the increase would be 5, and at six miles per hour, 7; thus, therefore, a man walking at the rate of four miles per hour, and carrying such a weight would inhale $480 \times 5 = 2{,}400$ cubic inches of air.

In tropical countries however, the number of respirations is fewer than in cold; it therefore not only happens that less exertion can be made, but that air under such circumstances contains less oxygen in proportion to its volume, on account of the rarefaction caused by the increased temperature; to these circumstances, some authorities would attribute the prevalence in such climates of phthisis, tubercle, and fatty degeneration of the heart.

Blood to be oxygenated.—The quantity of blood to be oxygenated by respiration, may be estimated at lbs. 32. We assume that at each systole, the left ventricle projects an ounce and a half, and that the heart contracts seventy-four times per minute; at this rate the whole of the blood would undergo circulation in 314 pulsations, or in 4 minutes and 36 seconds.

Mobility of chest.—The degree of mobility of a healthy chest is three inches; this cannot be much if

at all exceeded by natural effects; it may be so to some extent by the employment of force, but under no circumstances can the lungs be completely emptied of air. The circumstance may be here mentioned also as somewhat noteworthy, that obese people are in a degree exceptional, inasmuch as they have chests and lungs of inferior capacity as compared with men of ordinary size, and that they have therefore less breathing power.

Reserve air.—That portion of air which remains in the lungs after ordinary respiration, but which may be thrown out at will, is said to range from 77 to 170 cubic inches, and has obtained the name of reserve air. The numbers here given are those noted by Pickford, but it is confessed their extent of range is remarkable.

Residual air.—Residual air is that which remains in the lungs after the strongest expiration. It is estimated by Davy at 41 cubic inches, by Goodwyn at 109, and by Menzies at 179.

Beyond control.—Whatever air remains in the lungs beyond the amount described as "reserve," is not under the control of the individual.

Expired air.—Expired air being assumed to contain 4 per cent. of carbonic acid; a person would at this rate evolve 16 cubic inches of this gas per minute, 960 per hour, or 23,040 per day=7 ounces, 2 drachms, and 49 grains of carbon.

According to the observations of Lavoisier, the quantity of oxygen consumed during muscular exertion as compared to that during rest, is as 32 to 14.

Amount of air inspired.—If we assume with Dr. Parkes and some other authorities, that a man breathes 16 times per minute, and at each inspiration takes in 30 cubic inches of air $\therefore 16 \times 30 = 480$ per minute $\times 60 = 28{,}800$ cubic inches per hour $\div 1{,}728 = 16$ cubic feet $\times 24 = 394$ per day.

Carbonic acid in expired air.—According to the above authority, (page 71) inspired air contains 0·4 vols. of carbonic acid per 1,000, or 4 per 10,000: expired

air contains in addition to 4 per cent. of carbonic acid, and watery vapour, a certain amount of organic matter. To dilute the 40 per 1,000 of carbonic acid in expired air to 4 per 1,000 of unrespired air, 100 times the original volume of air must be added. $\therefore 16{\cdot}66 \times 100 = 1{,}666$ cubic feet of air per man per hour are required to reduce the proportion of carbonic acid to 0·4 per 100 during that time (page 65).

According to Mr. L. Beale, if the quantity of oxygen imbibed in respiration be taken at 100, the quantity of it exhaled in the carbonic acid gas will be only 74. The other 26 parts go to oxidize other substances, as hydrogen, sulphur, and phosphorus.

Sir Humphrey Davy many years ago considered that for the purpose of respiration during twenty-four hours, 45·504 cubic inches of oxygen were required; these weighed 15·751 grains, and produced during the process 31·680 cubic inches of carbonic acid, weighing 17,811 grains, and containing 4,853 grains of carbon. According to this authority also, the average quantity of carbon evolved from the lungs amounts to 130 grains per hour, that is 3120 grains, or a little over 7 ounces per day. From these facts therefore, we readily perceive why it is that various dangerous or fatal results arise from crowding persons together, or from placing them in imperfectly ventilated apartments.

Causes of impure air.—Among the more common causes of impurity of air in and around barracks are oil lamps and candles: one pound of oil if burnt, gives out 10 cubic feet of gas according to some writers on hygiene; this quantity requiring 18,000 cubic feet of ordinary air in order that the latter may be rendered pure again.

Candles give out 5 cubic feet of gas per pound, thus contaminating 9,000 cubic feet of ordinary air. It is also stated that a common oil lamp burns 160 grains of oil per hour, and thus sets free carbonic oxide which acts upon the red particles of the blood: and

sulphurous acid, which is no less pernicious. It is therefore apparent that in view to reduce to their minimum, the probable injurious results that may arise from these causes, a constant change of atmosphere becomes necessary in rooms lighted in the manner mentioned.

The impurities suspended in the atmosphere may consist of dust from the soil, and contain silica, iron, or chalk; they may be of sea spray, and of course contain all its constituents. Others may consist of animal debris and germs, or contain similar remains of vegetables and fungi. In cities, the atmosphere usually contains in greater or less proportion particles of carbon, starch cells, cotton fibres, hair, wool, steel, stone, iron. It may also contain small quantities of the acids, more especially carbonic, sulphuric, nitric, and hydrochloric.

Organic impurities.—But in addition to these, or independent of them, the atmosphere may contain epithelial cells, themselves in a state of decomposition, or laden with germs of disease. It may contain the poison of fevers, eruptive and continued; it may be laden with the influences by which epidemics are propogated; or it may be laden with pus cells, ready in their turn to set up ophthalmia, purperal fever, hospital gangrene, or pyemia.

Emanations from sewers.—One of the most common sources of contamination of the atmosphere is the emanations from sewers. This is especially so at military stations in the United Kingdom and Europe generally. It is so also to some, although a less extent at our foreign stations where the system of having sewers is in force.

To illustrate this it may be noted that one gallon of sewage yields from one to 12 grains of gas per hour. The gaseous results of sewage are very various at different places,—so much so, that the particular character of odours that prevail in certain places is proverbial, and not to be mistaken by travellers who have visited them.

Sewage gas.—Asphyxia is caused by exposure to the influence of the gaseous emanations from sewers; these contain sulphuretted hydrogen, carbonic acid, and various organic emanations in addition. Workers among sewers are said to suffer from ophthalmia, lumbago, and sciatica, and to have syphilitic diseases in an aggravated form. They often suffer from phlyctonous and pustular eruptions; bilious, typhoid, and cerebral fevers; colic and diarrhœa. These emanations are rendered less noxious by heavy rainfall, but when concentrated, they generate diarrhœa, the exanthemata, hospital gangene, and erysipelas.

Church-yards.—Air of church-yards contains 0·6 to 0·8 volumes of carbonic acid per 1,000; as also ammonia and carbonate of ammonia. In addition to these, it is laden with putrid vapours. The effect of exposure to these emanations manifests itself in the production of typhus or bilious fevers, small-pox, and cholera. Instances have occurred in the United Kingdom, where outbreaks of these diseases have been directly traced to the proximity of grave-yards. In hot countries however, the effects are at times disastrous; for instance, at Sukkur in Scinde, our troops were soon after the capture of that country cantoned upon what had been a grave-yard, with the deplorable result of almost total annihilation. So also at Rajghât near Benares, notoriously the most deadly station in India, the soldiers occupied what until recently had been a grave-yard.

Brick kilns.—The air from brick kilns contains carbonic oxide, carbonic acid, and sulphuretted hydrogen. It is poisonous at a distance of 20 to 30 yards from its source.

Air from marshes.—The air from marshes contains an excess of carbonic acid, 0·6 to 0·8 per 1,000 volumes; also sulphuretted hydrogen. If in the vicinity of the sea, it moreover contains chloride of sodium. In marsh gas, there is also a small proportion of hydrogen, a little ammonia and phosphuretted hydrogen. To

these is added organic matter, to which marsh fevers are considered to be due: and finally it contains some fungi, imfusoriæ, and small crustaceans.

Septic condition of the air.—The so-called septic condition of the atmosphere, or that condition in which fermentation takes place in vegetable matters, is now known to be induced by the presence in it of living organisms; thus, saccharine fermentation is induced by the presence of a *torula*: the acetic by a *microderm*, and the butyric by *vibrio*. Nor are the operations of organisms confined to the vegetable kingdom. Sheep are said to suffer from braxy or spleen apoplexy in consequence of the presence in the blood of *bactaria*; and it is only necessary to allude to the numerous diseases of the human race, now recognised as resulting from the presence in the atmosphere of organisms of animal as well as vegetable matter.

Fœcal emanations.—It is true that fœcal matter may accumulate in the atmosphere to a certain extent, and that indeed a very great one, and no injury to health be the result. This may be seen in China, yet undoubtedly in such localities, when typhoid fever, cholera, or any other zymotic disease has once been set up, the degree of mortality becomes great in proportion to the extent of filthy accumulations. In India, this has frequently been distinctly observed, and even so late as the terrible outbreak of cholera in 1861, it was observed that men situated nearest to the privies, were in many instances the first attacked.

It may be observed that it is only during the process of decomposition, that fœces become pernicious; hence, any circumstance which retards decomposition, prevents the occurrence of evil effects.

Standing camps become unhealthy, chiefly from accumulation in their vicinity of decomposing matters giving rise to emanations of this nature; and hence, the necessity under such circumstances, of exercising vigilance to remove to a distance to leeward if possible, and bury such sources of disease.

Emanations from slaughter houses.—Recent emanations from slaughter houses, if these places have been kept clean, are not necessarily injurious in a temperate climate : butchers are for the most part a robust and healthy set of men. In tropical countries however, where decomposition takes place with great rapidity, the effects of such gases upon man are similar to those from grave-yards and other receptacles of decomposing animal matters. Similar results arise from exposure to emanations from manufactories of articles from animal substances : and in India, from places of cremation.

Carbonic acid.—An atmosphere containing 50 vols. of carbonic acid per 1,000 is speedily fatal, and by habitually breathing air which contains 1 to $1\frac{1}{2}$ vol. per 1,000, a tendency to phthisis is produced.

Carbonic oxide.—Carbonic oxide is even more dangerous than carbonic acid. Less than 5 vols. of it per 1,000 is fatal, and this is the cause of many deaths in mines. Its *modus operandi* is by displacing the oxygen of the blood ; asphyxia is immediately the result.

Sulphuretted hydrogen.—Sulphuretted hydrogen in a proportion of 1·25 vol. per 1,000, affects dogs : in 4 per 1,000, horses. Men have however breathed without injury air containing 30 vols. per 1,000. The effects of protracted exposure to the influence of this gas are loss of muscular power and weight : dyspepsia, and anœmia.

Sulphurous acid.—Exposure to the fumes of sulphurous acid causes bronchitis, emphysema, and anœmia.

Chlorine.—Chlorine induces bronchitis.

Respired air.—The effects upon men of breathing air that has already been respired, are nausea, headache, heaviness and feverish symptoms ; when breathed continuously, as in a barrack-room, it produces paleness, loss of apetite, muscular debility, and phthisis.

Motion of the atmosphere.—In the motion of the atmosphere, we have the best and most extended

means of its purification, in the same way that similar actions maintain the purity of water. It may be said with truth that these movements are altogether beyond our control. So they are in one respect, but not in another. Science has given us in a measure the mastery: thus it is in our power so to regulate the action of the winds as to conduce to ventilation of our dwelling places.

Ozone.—Another natural means of restoring the purity of the atmosphere is contained within itself; being evolved by the operation of its ever varying electric condition. This is ozone, which is said by Schoenbein to be so hostile to organic miasmata, and so incompatible with them, that its presence enables us to affirm the absence of these, and the healthiness of the locality in which it is found.

Doubtless, there is room for question here, both as to the constitution of the so-called ozone, as well as to the wonderful effects ascribed to it, but such are the statements in regard to it made by one of its earliest investigators. The subject of ozone is yet in its infancy however, and deserves to be investigated with every degree of care.

Not only is a knowledge of the various phenomena connected with the climate of individual stations of great importance to army medical officers in respect to the prevalence of epidemics and ordinary diseases, but it becomes indispensable to those who are charged with the duties of suggesting the description of bedding, clothing, and equipment of troops destined for service in certain localities. At home and in the colonies, there already exist at the more important stations, the necessary means for making the required observations, but in India these means still are things of the future: although in no other part of Britain's empire is there greater, if indeed, so great a necessity for their establishment.

CHAPTER XXXII.

VENTILATION.

Effects of imperfect ventilation—Views of Dr. Cutbush—Dr. Jackson's statement—In recent wars—Necessity for ventilation—Vitiation of air—Dr. Hennen's views—Miasm—Dr. Fergusson's views—Movement of air—Essentials of ventilation—Ventilating space—Outlet openings—Outlet—Inlet and outlet—Other means of ventilation—Ventilation of barracks in India—Cooling them.

Effects of imperfect ventilation.—In the chapters on air and on overcrowding, some remarks have incidentally been made, that bear more or less directly upon the subject of the present, and to these therefore the reader is referred. Various evil effects that owe their origin to one or other of, or all the circumstances there and in this place alluded to, have already been mentioned. There are others however, that arise from want of ventilation,—more especially if thereto be superadded the accumulation in a confined space of large numbers of persons. According to Dr. Toynbee, defects in this respect are prolific causes of all diseases of the joints, scrofula, and deafness: to all of which, as is well known, soldiers and other classes of persons in India are particularly liable; these affections being very probably indirectly induced by continuous residence in rooms shut up and darkened, as is the custom in that country during the hottest months of the year.

To endeavour still further to demonstrate the pernicious effects that arise from this cause, may seem superfluous. So indeed it would be, were it not that in quoting opinions in regard to this point, we discover that the necessary principles according to which improvements in it have been effected, were

enumerated many years ago by army medical officers, and by other members of the medical profession. For example, Professor Daniell proved that in a badly ventilated room, the moisture from the breath of the inmates, and from the combustion of lamps and candles accumulates nearly to the point of saturation.

Views of Dr. Cutbush.—"In crowded hospitals," so wrote Dr. Cutbush, "the exhalations from the lungs and bodies of men in fever, the emanations from gangrenous parts and carious bones, besides the vapours arising from beds and other sources, show the necessity for frequent renewal of fresh air. We see ulcers which wore a healthy aspect, become spongy and gleety; amputated stumps deluged with matter; and fevers assuming all the symptoms of typhus gravior."

As to the best means of obtaining this ventilation, he says, the smoke from the lamps should be conveyed out of the wards by means of a tin conductor. Holes may be bored in the walls, especially in the angles of the wards and corresponding walls from the floor to the ceiling, which cause a current of air, and remove the stagnant air. In short, he propounds the very principles of ventilation that have of late been suggested as if new, by some writers on sanitation.

Dr. Jackson's statements.—Dr. Robert Jackson also, alluding to the Peninsular War, makes this remark. "It has often happened," said he, "that in the history of the late war, more human life was destroyed by accumulating sick men in low ill-ventilated apartments, than in leaving them exposed in severe and inclement weather at the side of a hedge or common dyke."

In recent wars.—The correctness of this assertion by the eminent army surgeon, has over and over again been fully demonstrated by experience gained on actual service; thus, during the campaign of 1859 in Italy, we are informed that the experience both upon the French and Austrian sides, clearly showed that the

sick and wounded were not injured by judicious transport, because the pure air thus ensured to them was more than sufficient to counterbalance the evil effects of a crowded hospital. So also during the civil war in America, examples were of frequent occurrence in the pages of medical periodicals of the day, indicating that a wounded soldier had more chance of recovery if treated in vans or on the road side, than in some crowded hospitals.

Ventilation—necessity for.—The following particulars illustrative of the necessity for free ventilation of buildings in which large numbers of persons are accumulated, are extracted from Dr. Pickford's work on hygiene.

Exhalation from lungs.—He reiterates the fact elsewhere noted by him, that the amount of carbonic acid gas daily evolved from the lungs in the process of respiration, is 23,040 cubic inches,—that being equivalent to 7 ounces, 2 drachms, and 49 grains of carbon as already mentioned.

From skin.—In addition to this, there is, he observes, exhaled from the skin per day, 576 cubic inches of carbonic acid gas: that is, one-fourth of an ounce of carbon.

Transpiration.—The amount of insensible cutaneous perspiration including pulmonary transpiration, has been estimated at a mean of 18 grains per minute: or lbs 4, 6 ounces per day.

Perspiration.—The perspiration is composed of a large quantity of water, a small proportion of free acetous acid, muriate of ammonia, soda and potash; an atom of phosphate of lime and oxide of ammonia, and an inappreciable amount of animal matter, closely resembling gelatine; the relative proportion of solid matter to that of water being 0·5 to 1·25 per cent.

Fustiness of ill aired rooms.—He quotes the Report by Dr. Letheby, where the latter gentleman states, that on visiting some of the haunts of filth and

misery in London, he found the atmosphere close and unwholesome, infested with that peculiarly fusty and sickening smell, so characteristic of the filthy haunts of poverty. He found the air in these localities deficient in due proportion of oxygen, but containing three times the usual amount of carbonic acid, besides a quantity of aqueous vapour charged with alkaline matter that stank abominably.

Condensed air of a crowded room.—Dr. Pickford further relates, that Dr. Smith of Manchester has demonstrated, that the condensed air of a crowded room yields a deposit of a thick glutinous mass, having a strong ammoniacal odour. This deposit becomes in a few days converted into a vegetable growth, followed by the production of multitudes of animalcules.

Vitiation of air.—According to Dr. Arnot, each individual vitiates per minute by respiration 400 cubic inches; and by pulmonary and cutaneous transpiration, 3 cubic feet. Mr. Tredgold calculates that in a properly heated and lighted room, the fires and lamps vitiate at the rate of one-fourth of a cubic foot of air per minute for each individual. Dr. Rind taking these matters into account, is of opinion, that the quantity of air required under such circumstances should not be less than ten feet per head per minute.

Children smothered.—In West Middlesex alone, Mr. Wakely has asserted that 150 children annually lose their lives from inhaling under the bed clothes, the carbonic acid gas exhaled from their lungs and skin during sleep; the blood becoming poisoned for want of pure air. Here then is an example of what occurs when free access of air is prevented. The evil result is in these instances comparatively rapid, and the children are said to be smothered. The results are slower, when a number of persons are confined together in ill-ventilated apartments, but are in the long run none the less certain.

Dr. Hennen's views.—It may be profitable in this place to epitomize the views expressed by Dr. Hennen

on the subject of ventilation. According to him, in order to permit the exit of foul air, and the entrance of fresh, there should be judicious openings at the top and bottom of a ward. To prevent violent currents, the mouths of these should be protected by slips of board at the distance (from them) of a few inches. These sources of ventilation should as opportunity admits, be opened in all the walls of each ward. They should be furnished with sliding shutters or turn-caps to admit of being opened or shut at will; the lower openings being on the windward side, the upper on the leeward. If this cannot be done, the aspect of the ventilators should not be towards courts, crowded streets, burial grounds, manufactories, hospital offices, necessaries, &c., or any source of vitiated air.

Dr. Jackson considered that lateral ventilation would be best secured by windows extending down to the floor, the lower part being of wood, so as to open and shut independently of the upper; and no doubt, he was right. More recently it has been enunciated by authorities on the subject of ventilation, that ample provision should be made for the supply of fresh air, and the removal of that which has been vitiated, irrespective of the doors and windows of an apartment or building.

Miasm does not withstand ventilation.—No miasm can withstand copious and free ventilation; nor can epidemics, pestilential or otherwise, linger in buildings exposed to free perflation by air. A remarkable illustration of this is stated in the history of the plague in Edinburgh in the 17th century. The then Tolbooth was built so as to span the High street: and was so situated, as to have a thorough current of air pervading it, even when the theory of ventilation was not understood. The plague devastated the houses on either side, but no case occurred among the prisoners.

It is only in a calm, that such influences retain their great intensity, and it was remarked that for some time prior to the appearance of plague in London, a

calm had prevailed. In India and other tropical countries, a calm condition of the atmosphere is almost always the precursor of severe outbreaks of illness, either in the form of fever, cholera, heat apoplexy, or hepatitis.

Dr. Fergusson is of opinion that towns and districts of country, will be found *cæteris paribus* to be healthy or otherwise in proportion as they enjoy more or less perfect ventilation by powerful and regular winds: and every-day experience teaches us that the effects that arise from imperfect ventilation, whether natural or artificial, and from overcrowding, are identical. These effects are increased in degree, if to them is superadded high temperature; hence, the evident necessity of a large allowance of space and of ventilation in the case of troops stationed in tropical countries.

Movement of air.—Very careful experiments have of late years been performed with the object of ascertaining precisely, what are the phenomena attendant on movement of the atmosphere at different degrees of rapidity. From these we learn that air travelling at a less rate than 2 miles per hour, is imperceptible: at 3 feet per second, or $2\frac{1}{2}$ miles per hour, it becomes just perceptible: at $3\frac{1}{2}$ feet per second, a draught is formed, but at a rate of 5 or 6 feet per second, the current is so powerful, that a person could not stand against it.

Mode of testing the rate.—The most ready means of testing the rate of motion of air through a room, is by floating in it a light substance as a piece of cotton fibre, or a feather, and noting by the watch the rate at which it travels.

Essentials of ventilation.—To ensure good natural ventilation, the rate of motion in the air should be moderate, and every part of a room should be pervaded by it. If the movement be too small, ventilation is imperfectly performed, and if it be too strong, the air ploughs its way as it were through that

contained in the apartments, heaping it up in the corners, and thus preventing its change.

The air should come from an uncontaminated source. It should have free exit from the building upwards, as well as horizontally. It should pervade the entire room; and we must remember that air at one part may become contaminated by that from another, by the operation of the law of diffusion of gases.

In the United Kingdom, ventilation even in comparatively still states of the atmosphere, is materially aided by the difference in temperature of the air outside the barracks as compared to that within. In India however, and in the tropics generally, the difference in these respects is of immaterial consequence; and hence in that country, one of the most valuable adjuncts is wanting.

Ventilating space.—The subjects of ventilating space, and the relative proportions that inlet and outlet, openings of shafts for the purpose should bear to each other, have lately occupied much attention. With regard to the former of these, let us suppose for example, that a room contains 12 men; each man should have 24 inches of ventilating space, $12 \times 24 = 288$ square inches for the whole; and this should be the case whether it be afforded by one large opening or by several small ones.

In a large room, several small openings best ensure ventilation; but if the apartment be square, one large opening is most effectual, provided that the tube be not more than two feet, or less than one superficial foot in size. If it be more, a downward current is occasioned. These tubes should not, it is almost needless to observe, pass through the centre of the room above that for the ventilation of which they have been introduced.

In the new barracks at Gravesend, where ventilation seems to be very complete, in a room capable of accommodating 24 men, each has 6·22 square feet of ventilating space irrespective of doors and windows. In India, some of the asylums admit of each person

having as much as 20 feet: the same amount is obtainable in some barrack cells: and considering the nature of the climate of that country, this cannot be looked upon as an excessive quantity.

At Netley, in the nine patient rooms, the total area of inlet openings, irrespective of doors and windows, is 162 square inches, which÷9=18 square inches per man. In the fourteen men wards, the amount of ventilating space is 15½ square inches per man. The outlet openings are in the former 17 inches, in the latter 16.

Inlet openings.—As elsewhere observed, a man should have 1,200 cubic feet of air per hour. To secure this, it is stated that there should be inlet openings in the proportion of one superficial inch for every 120 cubic feet of room space; fresh air being moreover admitted from behind the grate. Thus, for a room containing twelve men, or containing 7,200 cubic feet of air, the sectional area of the inlets should be 50 square inches, and the total area of inlet space for air per man, should never be less than eleven inches.

In India, the inlet openings may be near the floor, with perhaps additional ones at a little height for admitting air during the cold months; a cowl is required outside in order to break the force of the air, and thus prevent partial draughts. The inner openings should be trumpet-shaped, and covered with perforated zinc.

Outlet openings.—Sir Joshua Jebb would allow for the outlet opening an area of 36 inches per man; these, in buildings consisting of more stories than one should be as follows, namely:—

On ground floor 1 sq. inch per 60 feet of space
„ 2nd „ „ „ „ 55 „ „
„ 3rd „ „ „ „ 50 „ „

or for a room constructed for the accommodation of 12 men on ground, first and second floors respectively: 12, 11, and 10 inches.

According to the Sanitary Commission, the outlet opening per man should be in high rooms, 10 to 12 inches; less in small rooms. Dr. Parkes on the other hand being of opinion, as he is, that each man should have 2,000 cubic feet of air per hour, considers that in order that this may be obtained, the outlet opening should be 24 square inches.

Inlet and outlet.—There is a rule with reference to the relative size of inlet and outlet openings for air, with a view to ensure the best ventilation practicable. In England, it is held that the inlet being equal to 9, the outlet should be equal to 10; some authorities however, think the respective diameters of these should be as 4 to 5 : and we have just seen a few paragraphs back what are the relative proportions in the wards of Netly hospital between these two openings.

Other means of ventilation.—Among other means of ventilating buildings that have been recommended, the two principal are what are called "air bricks" and fires. The former furnish a ready means of admitting ventilation, but are not much used for the purpose in temperate climates. The second are used for the double purpose of ensuring ventilation, and for the ordinary means of warming.

Fire places.—It is only necessary to remark in this place, that in a chimney with an area of one square foot, 5 feet of air will pass per second: thus, 5 × 3600=the number of feet of air that will thus escape per hour.

With regard to the subject of warming, it may here be observed that in the heat giving powers of various kind of fuel, we find great variety exists:—thus, 100 lbs. of good coal will melt lbs. 90 of ice; of coke, lbs. 84; of wood, lbs. 32; of wood charcoal, lbs. 95; and of peat, only lbs. 19.

Ventilation of barracks in India.—Up to the present time, ventilation of barracks in India has not been upon a very scientific principle, inasmuch as it

has involved exposure of the soldiers to the effects of direct currents of air,—heated as that is in the plains during several months in the year, to a temperature which in itself is injurious.

In that country as well as in tropical countries generally, experience has shown that exposure of men in barracks to such partial draughts of air as take place through open doors and windows of their sleeping apartments, is prolific of a variety of disorders : as for example, fever and rheumatism. If the abdomen be the part upon which these draughts impinge, diarrhœa or dysentery is often the result: if the chest, pneumonia, pleurisy, or pleurodynia: and if the head and face, neuralgia, otitis, or ophthalmia.

A plan has been proposed for ventilating, and at the same time cooling these buildings by means of the introduction into them of condensed air. There does not appear however to be much prospect of its being carried out.

Cooling by evaporation.—Another plan for attaining the same end, is the proposed one of introducing from below, air that has been cooled by passing over water under the floors, and thus by the process of evaporation having its temperature lowered. It is not likely to be extensively carried out; nor would it be a proceeding to be approved, to have a large amount of stagnant water underneath the floor occupied by the troops.

To illustrate the theory upon which this proposal is grounded, let it be borne in mind, that for every cubic foot of water evaporated, 967 cubic feet of air have their temperature lowered 1° F. Thus, the evaporation of a gallon of water would have the effect of reducing the temperature of 2,500 cubic feet of air from 80° F. to 60° F.

It has ever been found that considerable difficulty exists in ventilating satisfactorily one storied buildings, such as those in which our troops in India have hertofore been for the most part located, as well

as the lower stories of buildings that consist of several: and the circumstance furnishes an additional argument in favor of double-storied barracks as recently recommended, in which the upper floor only should be occupied.

In temperate climates, and with buildings consisting of but one story, it is considered that with a view to ensure the best practicable ventilation of the room, and at the same time avoid the risk of exposing the occupants to direct currents of air, there should be in the walls of the apartment five doors; the room itself being adapted for the accommodation of twenty-four men: that is, two doors at either side, and one at the end. Over each door there should be a window, carried up to within eighteen inches of the ceiling; the sills should be 2 feet or 2 feet 6 inches in height, and formed of two parts, the upper of which is capable of being raised or allowed to remain closed, as may be required: and with a view to prevent injury to the men by direct draughts from the doors, screens may be with benefit erected. In tropical climates, similar windows should be placed over each of the more numerous doors that we have described as necessary under such circumstances.

In addition to these means of ventilation, ridge openings along that part of the roof, such as are commonly now formed in Indian barracks, are most effectual in ensuring at all times a current of air through the barrack-rooms; and this end is still further attained by so constructing the roof, that the eaves should overlap the top of the side walls: and while leaving an interval of several inches between them at the point where the overlapping takes place, extend to some distance beyond it: thus, the introduction of rain, &c., is prevented.

Shafts.—In buildings of several stories, tubes should extend upwards along the sides of the rooms from the lower to the higher flats. These may consist of wood or metal, or be formed by the masonry in the

side walls themselves. In arranging these, it is necessary to bear in mind, that curves check the current less than angles. The tops of the tubes should be covered, and a downward draught prevented by a cowl which turns away from the wind, or by two louvres.

Punkahs and thermantodotes.—In India, punkahs and thermantodotes are used for the double purpose of producing ventilation and cooling the atmosphere of a room. The former of these contrivances have in reality little effect in producing any absolute change in the air, and only lower temperature by means of the agitation of atmosphere producing evaporation from the person's surface. The thermantodote is a much more effectual means of producing ventilation ; and also when the atmosphere is dry, of producing cold by the process of evaporation on the wet scented grass-roots through which it passes, ere being forced by machinery into the room.

Tatties.—"Tatties" furnish another means of ventilating as well as cooling rooms. They consist of frame work of split bamboo, over which the roots of a grass of the genus *Andropogon* is spread and secured. These screens are made to fit each of the door ways on the windward side of the barracks ; and are of inestimable service during the prevalence of hot winds, by permitting a free current of cool air to pervade the barrack-rooms. Of course, it is necessary that they be attended to and kept well watered. In their sanitary effects upon the troops however, they well repay the local Government for any expense incurred in reference to them. Many cases of ardent remittent fever, and of the disease known as heat apoplexy are averted by their use ; while in the cool climate thus temporarily afforded to the men, and the mere bodily comfort they experience, their general health in the mass is maintained.

CHAPTER XXXIII.

OVERCROWDING.

Natural tendency to huddle—Evils from the practice—In man—In lower animals—Black hole of Calcutta—Small cubic space—Overcrowding otherwise than in rooms—Early attention to the subject by medical officers—Regulations.

NATURAL TENDENCY TO HUDDLE.—It is remarkable that notwithstanding the evil to health, the inconvenience and even offensiveness to individuals which attend the practice of huddling numbers together, there is apparently a natural tendency among people of all countries, tropical as well as frigid, to follow the practice. In India, in Africa, and in our own country, we see this filthy practice prevail among the lower classes; in many instances, its pernicious results being farther increased by insufficient ventilation and diet. Need we therefore wonder that under such circumstances, small pox, cholera, and typhus should every now and then sweep along as epidemics; and that among children there should be a large proportion who are scrofulous, deformed, or idiotic?

OVERCROWDING OR OCHLESIS.—Captain Hall in his work on the Exquimaux, describes the horrible fetor that exists within the close ill-ventilated huts occupied by these people; and any person who has been in the Himalayahs, has no doubt experienced a feeling of nausea while passing the doors of the Hill men's huts from a similar cause. The accounts of the progress of the Indian plague, or mahamurree which devastated the hilly parts of India in 1851 and 1852, are replete with examples of the evils that occurred from the combined effects of overcrowding, want of ventilation, and inferior diet.

Evils from the practice.—The numerous evils that arise from crowding numbers of persons together in a limited space, are now so universally acknowledged, that only a few remarks on the subject are required in this place; perhaps there is no one circumstance that has had such a distinct effect in bringing about the diminished rates of sickness and mortality as compared with former times, as that of allowing them increased space and accommodation in barracks.

In some barracks that have in the recollection of the writer of this work been occupied by 1,000 or 1,200 men, not more than 400 are now placed; and the result has been a decrease in the rate of death in more than a corresponding proportion.

Ventilation.—No species of animals, so wrote Dr. Paris, "can congregate in ill-ventilated apartments with impunity. Under such circumstances, the horse becomes affected with glanders, fowls with pip, dogs with distemper; and sheep, if too thickly folded, with a disease peculiar to them. In the history of hospital gangrene, he observes, that we have the most satisfactory evidence of the influence of a pestilential atmosphere generated by the congregation of sick: and he quotes an instance at Turin in 1817—1820, where, according to Dr. Riberi, this disease varied with the relative impurity of the air; those patients who lay in the best ventilated parts of the sick wards having, instead of the severe sphacelation that elsewhere prevailed, an erysipelatous affection.

In man.—Among the more ordinary effects of overcrowding when long continued, the following may be enumerated namely, degeneration of the internal organs,—a source of many instances of sudden death met with in India: anœmia and cachexia, hepatitis, dysentery, remittent and typhus fever: ophthalmia, phthisis, and scrofula.

It is moreover well known that epidemics prevail more fatally in crowded localities than in others;

and that the type of a disease accidentally introduced, becomes speedily aggravated by the fact of masses living together under one roof.

In India, the disease commonly called sun stroke or heat apoplexy, occurs as is well known much more frequently among men in barracks, guard-rooms, or hospitals, than in those who are much in the open air, however high the temperature may be. On the line of march too, it is much more likely to attack men when marching in close column, or through a belt of brushwood where free circulation of air is prevented, then when proceeding along ordinary roads, or across country. This was specially observed to be the case during the campaign of 1857-58 in that country, and illustrates what has already been stated in regard to overcrowding being possible, with its attendant evil results, alike when it takes place in a given space, whether out of doors, or in a building.

Among lower animals.—It is not in the human race alone however, that overcrowding exerts an evil effect; the lower animals are equally affected by the same cause. It is even believed by some authorities, that in the instance of game, for example, the excessive strictness with which, under the operation of recent enactments for their preservation, this is carried out by some landlords, the occurrence among birds so protected, of fatal disease, has not only defeated the desired end, but vindicated the natural law in obedience to which, no more than a certain population of whatever description it be, can long live and thrive upon any given extent of territory.

Overcrowding.—Dr. Fordyce mentions instances where sheep and hogs were transported during the American War from England to America in the holds of ships, and many of them were confined in a small space; an infectious fever broke out among them, which destroyed great numbers of these animals: and there is reason to believe that the plague which now prevails among cattle in the United Kingdom, has in

some measure at least been attributable to the manner in which animals were crowded together in the sheds in which they were kept: on board steamers, and while being transported by railway.

Black Hole of Calcutta.—One of the most terrible illustrations of the effects of overcrowding in a heated atmosphere that history records, is furnished by the catastrophe which befel our countrymen who in 1756 fell into the power of Suraj-ood-Dowlah.

The *black hole* was the dungeon of the fort, a part of a low range of buildings facing the west. It was provided with only two small windows, both of which opened in that direction, and were sheltered by the verandah that ran along its front; a door entered it on the north side. A wooden platform raised three or four feet from the floor, open beneath and six feet broad, extended along the east side of the dungeon for persons to sleep upon. The windows were barred. The dimensions of this room were 18 feet × 14, and 18 feet high.

These measurements would give a total amount of space equal to 252 superficial and 4,536 cubic feet.

Into this terrible place, on 20th June, 1756, when the heat at Calcutta is at its greatest, 146 British were driven. Thus each had actually less than 2 feet of superficial space, and only 31 of cubic, while there was no thorough draught, and no escape for vitiated air. The results are graphically described by Orme. At the expiration of ten hours, only 23 remained alive: several of these were delirious: others were so weak as not to be able to stand: while the stench from the decomposing bodies of the dead was such when the doors were opened, as to render it a matter of difficulty to get natives to enter and remove the bodies to the ditch, in which a place had been excavated for their reception.

Small cubic space.—The small amount of space in which life may for some time be maintained, is perfectly marvellous. In Chinese cities for example,

beggars have been seen by the writer, huddled together in a room in which the proportion of space was only 35 cubic feet per man : and slaves have been known to have no more than 14 feet during a voyage of six weeks' duration. We all have read of the frightful mortality during what has been called the middle passage however : and with a degree of packing human beings such as this, we cease to wonder that such should be the case ; on the contrary, the natural surprise is that any should survive.

Overcrowding otherwise than in rooms.—It is not alone in apartments however, that overcrowding may take place, although it is to this condition that the condition is usually assigned. It may be brought about by having barracks erected in too close proximity to each other ; by having buildings erected with too many stories for occupation by troops ; and also from continuously keeping men massed together in the open air, as during drills. In fact, the results to health are very similar, whether the crowding take place in a room or upon a given space of ground.

This view of the subject received some of the consideration that is due to its great importance, by the Crimean Commission, especially in the bearing of the question upon encampments. In connection with this, Miss Nightingale in her remarks on mortality in the British army, very truly observes that "other things being equal, the sickness and mortality among given populations bear a certain ratio to their density. The most densely peopled towns and districts are generally the most unhealthy."

As a standard of comparison, the density of population in some of the most crowded towns in the United Kingdom, and in camps arranged according to the instructions by the Quarter Master General's Department, is represented in the rule quoted: thus, including built area and streets, there are in East London, 1,75,816 persons per square mile, and this degree of density is the greatest shown in the table

here alluded to, whereas according to the instructions for encampments, the density of population over the area of the tents and the intermediate streets, would be from 3,47,000 to 6,64,000 according to the plan adopted; and if that over the occupied area alone be considered, it would amount to 1,054,820.

In further illustration of the same point, a series of diagrams is given by the talented authoress. According to these, the space allowed to each person is 17·6 square yards; the average distance from person to person, 4·5 yards. In London generally, these are respectively 160 yards and 14·2 yards. According to the instructions of the Quarter Master General, if we include the occupied and the unoccupied area, the density of population would according to the plan for encampment selected, be from 4·7 to 8·9 square yards per person; the degree of proximity or distance from person to person, 2·3 to 3·2 yards: while, if we only take into account the area actually occupied, the space per person is 3 yards; the distance from person to person, 1·9 yards.

It is satisfactory to know that camps in India formed according to the local regulations, afford to each person an area of about 360 yards; that is, more than double the space enjoyed by the inhabitants of London as a body. Considering the nature of the climate, this is by no means too much: but in a country where so many sanitary defects exist, it is well to find that in this respect at least the arrangements are far more satisfactory than they are under Imperial usages.

Early attention to the subject by Medical Officers.—As in other so-called recent sanitary improvements however, so in those regarding the amount of space deemed necessary to the health of troops that have of late years been introduced, we claim for army medical officers the credit of having urged their necessity many years ago, and long before the subjects had attracted the attention of persons to

whom the title of sanitary *reformers* is now usually given. Thus, Dr. Rush in 1777, expressed himself to the following effect,—"Too many soldiers," he said, "should not be allowed on any pretence whatever to crowd into the same tent or quarter. Jail fever," he further observed, "is the offspring of perspiration and respiration of human bodies brought into a compass too narrow to be diluted and rendered inert by mixture with the atmosphere,"—and, in 1808, Dr. Cutbush, also of America, strongly urged that soldiers wherever quartered, ought never to be crowded together: because, as he observed, the emanations from their bodies and lungs, and the odours from the privies that are near, may produce disease.

Of late years, very definite and precise rules have been laid down relative to the amount of space to be allowed to soldiers in the different kinds of habitations they may have to occupy: and so minute have been the details in regard to this subject, that the deduction necessary on account of the space taken up by the man's body, has been defined. It is stated to be at home and in the colonies, 3 to 4 cubic feet: but for a soldier in hospital, including bedding, bedstead, and bedside tables, about 10 cubic feet. In Indian barracks, there is a deduction from the space in barracks to be made on account of the soldiers' boxes, according to the size of these, over and above what is here noted.

Regulations.—Thus we find it laid down by the Royal Commission, that in barracks, the cubic space per man should be 1,000 to 1,500 feet, and the superficial, 80 to 100; the additional rule being given that beds should not be less than three feet apart from each other.

It is generally now admitted that in barracks situated in temperate climates, the amount of space per man should not be less than 600 cubic feet; presuming that the air in the barrack-room is changed twice every hour, thus giving each man 1,200 cubic feet during that time. Some authorities consider even

this space insufficient, and that 2,000 cubic feet is the minimum amount that soldiers ought to have per hour.

In temporary barracks at home, it is not deemed advisable that troops have less than 600 cubic feet of space; in huts 400; in hospital 1,200. In the tropics, 1,500 cubic feet is the smallest quantity that is deemed sufficient: and in either case the amount should be changed twice an hour.

Other authorities are of opinion that a soldier in barracks should have 1,059 cubic feet, and at night 2,118. That persons employed in workshops should have 2,118; that a similar amount per man should be allowed in prisons and theatres. In schools, 1,059; in hospitals under ordinary circumstances, 2,825; in surgical wards 4,000; and that during an epidemic, the allowance per patient should be 5,600 cubic feet.

We ought to bear the facts in mind however, that neither superficial space by itself nor cubic space by itself, as indicated by mere figures, represent the suitability of an apartment for occupation by a particular number of troops; thus, we may have large cubic space with insufficient superficial area, or *vice versa:* and again, especially in prison cells, we may find in long narrow apartments of the kind, places that are totally unsuited for occupation, although mere arithmetical figures would lead to the impression that in both cubic and superficial measurements they were in every way satisfactory.

CHAPTER XXXIV.

DISINFECTANTS AND DEODORANTS.

Those formerly used—Objects—Fresh air—Heat—Purifying solids—Purifying liquids—Purifying gases—According to American Sanitary Commission—Other disinfectants—Fumigation of stables.

THOSE FORMERLY USED.—The means of purifying the air and destroying infection, commonly used prior to the present century, consisted in white-washing with lime; scouring the wood work with ley or potash and water, or with lime water: fumigation with vinegar, or with nitre or gun-powder; and the reader need scarcely be reminded that persons were formerly sponged with vinegar before being brought into court from jail.

BED CLOTHES.—All the old writers express themselves as fully aware of the dangers that may arise from accumulations of clothing that had been used by persons suffering from infectious disease. Lind, Trotter, and others recommend that it should be at once thrown into tubs containing potash ley, or that as heat is a powerful corrector of contagion, the clothing be exposed to it in ovens. We thus see that our forefathers were careful to apply the means at their disposal, and although these were few and limited compared to the list that has been made available for us, it would be unfair towards them to believe that this portion of hygiene had only recently been attended to.

OBJECT SOUGHT.—The object sought to be attained by the use of disinfectants and deodorants, is the purification of the atmosphere from noxious or morbific matters that may have been imparted to it.

Fresh air.—Undoubtedly the best disinfectant is fresh air; no miasm can withstand it.

Heat.—Among the artificial purifiers of the atmosphere, a very powerful one is heat. A temperature of 120° F. destroys the poison of some diseases, as for example plague: of 150° F. that of scarlatina and typhus: hence, by the simple process of subjecting wearing apparel to that degree of heat, all danger of infection being communicated by them is destroyed.

Purifying solids.—The solid substances which act as purifiers of the atmosphere, are charcoal, quicklime, and dried earth.

Charcoal.—Charcoal by its powerful affinity for oxygen and its capacity for absorbing gases, decomposes organic matters suspended in the atmosphere, and for this purpose should be employed when necessary, suspended in bags or in open trays. Besides expediting the oxidation of injurious matters by virtue of its porosity, it is capable of absorbing immense quantities of gaseous bodies: for both these purposes, vegetable charcoal is best adapted; and of it, that of beech wood, which according to Leibig is so porous that the surface presented by a cubic inch, is equal to that of 100 square feet.

Quick lime.—This absorbs carbonic acid and water, and in absorbing the latter takes up organic matter: it moreover unites with the phosphoric acid, the carbonic acid, and the sulphuretted hydrogen; thus it exerts its purifying effect upon the atmosphere of a room by the process of white-washing the walls. After a few days however, decomposition again takes place among these combinations themselves, and offensive odours are liberated.

Dry earth.—Dry earth is the simplest and most readily available. It has been used from the earliest ages as mentioned more at length under the head of "conservancy"—what for instance is sepulture of the dead but an application of the process? What the custom still in use in many smaller houses

at home, in public houses and tap rooms,—of besprinkling sand upon the floor, but a practical application of dry earth as a deodorant? The Chinese have, as elsewhere mentioned, employed earth for intermixture with human ordure for generations, although with them the process of strewing the preparation upon the fields, and thus exposing it to the elements, destroys the effects as a deodorant that it may have at first exerted.

Eremecausis.—Dry earth acts in a great measure like charcoal: that is, partly by condensing putrid vapours within its pores and on its surface, thus causing them to unite with oxygen forming slow combustion,—a process to which the name of eremecausis has been given. It is necessary however, that the substances so used be perfectly dry, and that air have free access to them.

Pernitrate and perchloride of iron.—By the action of pernitrate and perchloride of iron, a large amount of peroxide of the metal is thrown down, and this carries with it the suspended matters. Sulphuretted hydrogen is decomposed; sulphuret of iron being formed during the decomposition.

McDougal's powder.—McDougal's powder is stated to consist of a combination of sulphites of lime and of magnesia with carbolic acid. Its power of deodorizing matters arises from the property it possesses of preventing changes taking place in those of an organic nature to which it is applied.

Most common disinfectants.—Among the most convenient substances for use as disinfectants may be enumerated chlorides of sodium, of lime, of zinc: hypochlorites of potass or of soda,—the latter preparation known under the name of Labarraque's disinfecting fluid: sulphurous acid, the vapours of nitric acid, of muriatic acid, oxygen, creasote.

Others less common.—Among others that have been used, although less extensively, are superphosphate of magnesia: alum, sulphates of iron, and of copper.

Iodine.—Tincture of iodine is said to be one of the cheapest disinfectants: it possesses the double advantage of exerting its effect by the vapour it gives off, as well as by being applied in the liquid state to solid surfaces, or matters of an offensive nature.

Purifying liquids.—The following is a brief notice of the mode of action of some of the more generally used purifying liquids, *viz.*—

(a).—Condy's liquid.—It consists of permanganate of potass: oxidizes organic matter, but has no effect upon gases.

(b).—Nitrate of lead.—Affects chiefly the ammoniacal compounds, and sulphuretted hydrogen.

(c).—Chloride of zinc.—Like the above it also affects chiefly combinations of amnonia and of sulphur: contrary however to the general impression entertained in regard to it, it would appear to have comparatively little effect upon organic matter.

(d).—Chlorinated solution of soda.—This as a deodorant, acts by its strong affinity for hydrogen, decomposing all the compound gases into which it enters, especially that of amnonia which plays an important part in the process of putrescence of wounds and ulcer.

(e).—Perchloride of iron.—This has great effect upon sewage: it destroys sulphide of ammonia, and sulphuretted hydrogen.

Purifying gases.—Of the most effectual gaseous agents by which purification of the atmosphere is produced, the following are some of those most commonly used, *viz.*—

(a.)—Chlorine.—It decomposes instaneously sulphuretted hydrogen and sulphuret of ammonia, and destroys odours whether arising from organic or inorganic matters; hence, it is among the most effectual if not actually the most effectual of all deodorizers. It is effectual in checking the spread of typhus, and might be so also in dysentery occurring in crowded situations as on board a ship.

(b.)—Nitrous acid.—This compound is irritating, but effectually destroys organic matters, and the smell which adheres to dead-houses. It also decomposes sulphuretted hydrogen : is said to check the spread in buildings of cholera, and to be effectual in destroying the poison of typhus and of yellow fever.

(c.)—Nitric acid.—The action of this is said to be effected by its readily parting with one equivalent of oxygen to the substance to be deodorized, and which thus becomes oxidated. The nitric acid having thus become nitrous acid, speedily regains its original composition by taking back from the atmosphere the equivalent of oxygen : thus the process of decomposition goes on.

(d.)—Sulphurous acid.—This, like nitrous acid is very irritating ; it destroys ammoniacal compounds and sulphuretted hydrogen,—sulphates being produced.

(e.)—Ammonia.—The vapour neutralises organic matters, and in some measure destroys malaria ; hence, the every-day use of smelling salts is actually beneficial in warding off the effects of certain atmospheric poisons.

(f.)—Vinegar.—The vapour of vinegar is pleasant, but of inferior utility in destroying poisons suspended in the atmosphere : as has been remarked, its employment has no other effect than to conceal one odour by producing another.

In addition to all these, we find that fire, smoke of wood, and the fumes of sulphur are described by Dr. Rush as having a singular efficacy in restoring the purity of the air ; and in India, so recently as 1864, it was recommended by a medical officer of many years experience in that country, that green wood should be burnt as a preservative against cholera.

According to American Sanitary Commission.—The following is a *resumé* of the classification of disinfectants adopted by the American Sanitary Commission, *viz.*—

1.—Absorbents and retainers of noxious effluvia as charcoal, sulphite of lime, porous clay, and silicate of alumina.

2.—Chemical agents that act upon and re-combine some of the elements of noxious effluvia, such as quick lime, sulphuric acid, hydrochloric acid, nitric acid, nitrous acid.

(3.)—Soluble salts that arrest decomposition, as nitrate of lead, chloride of zinc, protochloride of iron, and protosulphate of iron.

4.—Antiseptics, active in destroying compound gases, as chloride gas, hydrochlorite of soda, (Labarraques' solution), chloride of lime.

5.—The most prompt and effective antiseptic known,—bromine.

6.—Antiseptic, as an oxidizer and available source of ozone,—permanganate of potass.

7. Antiseptic and deodorant (but precise mode of action not stated.) Carbolic acid and coal tar compounds.

8. Destructive,—Heat of 212°, and cold of 32° F.

Disinfectants.—The same Commission recommends one or other of the following disinfectants as being the most convenient, namely:—in hospital wards, barracks, transports, and contaminated quarters, chlorine and the alkaline chlorides, nitrous acid vapour, bromine vapour, permanganate of potass, nitrate of lead or iron, charcoal, gypsum, quick lime, or coal tar compounds.

For cleaning latrines, sinks, sewers, &c., coal tar and its compounds, chloride of lime, sulphate of iron, charcoal, gypsum : or dry earth, after proper cleansing and flushing.

Other recommendations.—The following is an epitome of the measures recommended by Dr. Jackson for the purification of barracks infected with contagious disease, namely, nitrous fumigations, white washing, a coating of hot varnish : washing the floor and walls with soap and hot water, or water and potash provided the walls be polished : dry rubbing daily in damp and

foggy weather: and "by the proper management of a volume of pure air entering at the level of the floor by doors and windows in fine weather."

Tar is now used in barracks in the United Kingdom for the purpose of deodorizing urinals: and in France a still more perfect arrangement, by which one of its perparations is simply dropped into the receptacle; a small quantity being sufficient for the purpose.

In India, a preparation called *dhoona*, is used for the same purpose, and is said to be tolerably successful.

Fumigation of stables.—The instructions for cleansing and fumigating stables, contained in the *Aide Memoire* for French artillery officers, direct that with a view to fumigate stables that require that operation, the entrance to the stable shall be well swept, the walls well washed with water, the mangers, stalls, pegs, and all wood work cleansed with soap and water: after which, these as well as the buckets and troughs are to be washed with a solution of one part of potash of commerce in 15 parts of water; the walls are to be then white-washed.

Fumigation will subsequently be effected with chlorine prepared by mixing 4 parts of sea salt, and 1 part of black oxide of manganese; to which is added 2 parts of sulphuric acid, diluted with 2 parts of water. The dish containing this mixture is placed upon live charcoal, the doors are shut, and the fumigation allowed to proceed during 12 hours; the doors are then opened, and thus the place is left till all odours disappear.

Fifty grains of the salt, with the other materials in proportion, form a sufficient quantity for fumigating a stable containing 15 to 20 horses; if the stable be larger, several dishes containing the materials should be placed at intervals.

In the absence of the above materials, nitrous acid fumes may be disengaged by adding sulphuric acid to nitre.

The fumes of vinegar and of aromatic plants are useless as disinfectants, they only serve to mask one smell by another.

Another means of disinfecting stables is to wash their various parts with a mixture of one part of chlorinated solution of soda to twelve of water; this being applied by means of a brush.

Of harness.—To disinfect harness, solution of chlorine, or of chloride of calcium is applied to the tainted portions. Having taken the harness to pieces, wash separately its different parts in this manner, then apply water freely: wash the metal portion with soap and water, and finally apply neat's foot oil to the leather portions.

All articles employed in grooming horses affected with infectious diseases, must be destroyed; and the clothes worn by the grooms must be washed with chlorine solution, as is the harness.

CHAPTER XXXV.

CONSERVANCY.

Drains and sewers—Principles of drainage—Size of pipes—Provision against floods—"Fall"—Flushing—Ventilation of sewers—Emanations—Cesspools—Trenches—Paving drains—Subsoil drainage—Evils from imperfect sewage—Sewers and drains in India—Latrines—Urinals—Acton's jets—Dry earth conservancy—Removal of ordure—Conservancy of "married" barracks.

Probably there is nothing in the principles about to be propounded in this chapter that is more applicable to the conditions of military life than to any others, where large bodies of persons are congregated together in buildings erected and specially arranged for them; it seems to the writer however, that in order to fulfil the objects of the present work, this purpose would be still incomplete, were some remarks not added in regard to the general subject of conservancy.

Drains and sewers.—It is almost unnecessary to observe that for the purpose of removing the refuse fluids of houses, barracks, hospitals, stations or towns, sewers and drains are made; it therefore becomes apparent, that in the construction of buildings of whatever nature, if in places where a regular system of drainage is practicable, plans for the latter are as essential as they are for the building itself; and that before its erection is commenced, the under-ground drainage should be laid down and properly arranged with regard to the final means of disposal or escape.

Principles of drainage.—According to the War Office Commission, the following principles should be held in view in connection with barrack drainage, namely:—

(*a.*) Abolish cesspits.

(*b.*) Conduct all drains away from the buildings.

(*c.*) For the main drain of each barrack, a 6 or 9-inch glazed earthen-ware pipe is sufficient.

(*d.*) This should receive the water from the ablution room and night urinal, and the roof water not tanked for use.

(*e.*) The drain should be trapped outside the building, and ventilated.

Whatever be the description of drainage adopted; that is, whether the conduits consist of pipes, open trenches, or under ground and masonry lined "mains," two points have to be considered in reference to their plan of construction: these are 1st, their proper size, and 2nd, the degree of "fall" they must have.

Size of pipes, &c.—Earthen-ware pipes of 4 inches in diameter, are sufficient for water closets and sinks; these may join drains of 6 inches; the 6 inches joining those of 9 inches, 12 inches, and 15 inches: these forming a tributary main, or passing to a main sewer.

For all purposes of drainage of barrack and hospital buildings, latrines, closets, urinals, lavatories, sinks and baths, glazed earthen-ware pipe drains of 9 or 12 inches diameter will be sufficient for 1,000 men. If however, we take the requirements of England as regards sewers as an example, we find that although this size is deemed sufficient to meet the actual necessities as here noted; still, in order that provision be at the same time made to carry off water which suddenly falls during rain storms, instead of the sewers having the above dimensions, the rule seems to be that for these necessities, the dimensions shall be 4 feet high by 3 feet wide.

This question may also be conveniently put in another shape, thus, in England, the difference in the volume of water to pass through drains and sewers varies, as may be illustrated by the states of the natural streams from a minimum in times of drought, to a maximum after excessive rain of 300 and even

500 to 1. In tropical countries, the difference is much more than even this.

Provision against floods.—It is also necessary to bear in mind, while laying down plans regarding the outlet, if that be towards the sea or a tidal river, to what height the flood usually rises; thus, for example, in Great Britain it rises from low water level to a height of 20 feet, and even upwards. In some parts of Europe, as Spain and Italy, there is no water present during dry seasons, where during the rainy, torrents sweep along. So also in the mountain districts of India.

It may not always be easy on cursory inspection of a locality, and especially during the dry season, to form a correct opinion as to the condition assumed by it during the rains; it is usually observed however, that in districts where violent floods take place, the steep ground, if any such exists, will be found to be furrowed; rocky ground will be bare; and water courses and valley lines will exhibit the violent effects of water floods.

"Fall."—Provided always that a main drain or sewer has a free outlet, a very small "fall" or "grade" is sufficient: or indeed, none at all, provided only that a proper arrangement of man holes and for flushing exist. Thus, in a sewer at West Ham, which has a length of three miles, there is only a "fall" of three feet per mile: and at some stations in India, there is scarcely a perceptible "grade"; the drain being regularly entered by men and thoroughly flushed by means of water engines and sweepers. Chinsurah is an example in point.

Flushing.—In India, drains are usually flushed with water brought for the purpose from an adjoining river, and forcibly discharged into them by a fire engine: in no other way could they be cleared out. In Britain however, and Europe, where a regular system of pipe sewage for houses exists, it is considered that if properly attended to, the water from latrines, urinals,

lavatories and baths, may be used for the purpose of flushing the drains.

By means of flushing, a velocity of one foot per second may easily be obtained throughout the extent of a sewer; this degree of velocity is sufficient to remove silt and coarse sand.

Ventilation of sewers.—All main sewers should have full means for ventilation at the upper or higher ends, through charcoal air filters: means of flushing at these points should be also provided.

They should not enter nor pass beneath buildings. Their mouths should be protected so as to prevent the gases being driven back by the wind: man holes should have moveable covers, a side chamber for ventilation, and iron steps for descent. The side chamber to have a charcoal screen or filter. There should also be the means of flushing them. Even when there is good fall, unless means for flushing exist, the sewers become offensive during drought. This was pre-eminently the case at Stoke Damerell near Devonport, where in the summer season, and especially in sultry conditions of the atmosphere, very pernicious emanations arise from this cause.

Emanations from sewers and cesspools.—It may be remarked that the deleterious properties of air from sewers vary with the extent of ventilation. In those that are ill-ventilated, it contains one grain of organic matter in 60 cubic feet.

Fresh sewage is not injurious: but that retained in cesspools, imperfect drains and sewers, fouls the subsoil and contaminates the wells. Its decomposition produces gases of a most noxious and injurious character; so injurious in fact, that instances are of frequent occurrence, of men being struck dead on looking into a drain or sewer, by the emanations therefrom, and which in less violent states, produce fever and other zymotic diseases. Similar results are produced by emanations from cesspools, an instance of which is related as having occurred at Gravesend as

lately as 1864; three men having successively lost their lives by thus falling insensible into a cesspool that had just been opened.

Such emanations have been ascertained to contain *fungi* and *vibriones;* to have an alkaline reaction with re-agents, and to induce rapid decomposition of animal matters exposed to them. In addition to those that are gaseous however, there are other poisonous emanations that arise from sewage. Of this nature is the peculiarly offensive oily-looking matter that adheres in drops to the top and sides of closed drains, and which has received the name of *Ethylomine*, one of the so-called "substitution compounds" of ammonia.

Cesspools.—The existence of cesspools in the vicinity of barracks occupied by troops, should be absolutely prohibited. Many instances of the dangers incurred by their presence might be adduced; thus, when in 1849, the then new Indian station of Mean Meer was formed, deep cesspools were excavated in the vicinity of barracks, and over them were placed seats as latrines. Before long, the air became tainted with their foul emanations: there was reason to suspect that their contents percolated through the porous substrata, and thus found entrance into the wells from which water had to be obtained. The writer of the present remarks stated in his Reports to the authorities, that these cesspools were calculated within a few years to induce outbreaks of cholera and fever; the cesspools however remained as they were, nor was it until the station had been twice ravaged by terrible epidemics of the scourge, that they were abolished. It was found impossible to prevent the evil that had already occurred however, in regard to the water of wells being tainted by their foul contents. Some years more were needed ere this could be effected.

Pickford gives an instance where in 1845, it was necessary to empty a cesspool in the centre of a large mansion occupied by several families. Within three hours after the opening of the cesspool, one member

and soon afterwards five others were attacked with vomiting and purging ; of the other families, eighteen were attacked, and one died three days afterwards. For months subsequently, diarrhœa and dysentery attacked those who took up their residence in the building, nor was it until the pit had been filled up with quick-lime that the evil ceased. This cesspool had received the contents of a water closet placed over it, and was discovered to have had its "trap" damaged.

When the author was in the "Buffs," stationed at Winchester in the above-named year, it was found that men under treatment in one particular corner of the regimental hospital, were frequently seized with typhus. An inquiry disclosed the fact that the part of the building where this occurred, had been built over what had in the time of Charles the 2nd been a cesspool; but which would seem to have been filled up, and its existence subsequently entirely forgotten.

Trenches.—Open deep trenches or as they are called in India "drains," are apt to become irregular and retain water. They act partly as filters through which water passes into the subsoil, leaving its impurities to ferment in the drain. They may be applicable to camps, but are not to stations.

Paving drains.—The best material for paving drains, is whin or granite, cut into pieces not exceeding 9 inches × 3, and 9 or 12 inches in length ; these when placed should be set on end, that is, 3 inches wide, and 9 inches deep. The foundation must be well prepared, firm and well drained. A bed of silted gravel or broken stone, 3 inches thick, to be spread over the prepared subsoil ; the paving stones then to be set in sand, and beaten down with a 9-lb. beater.

Subsoil drainage.—Subsoil drainage in the United Kingdom is usually carried on in military stations, or in agriculture by means of drain tiles laid in lines four or five feet below the surface, and 15 or 16 feet apart. Tubular earthen-ware tiles from one to six inches

internal diameter make the cheapest and best land drains. The joints should be sound, true and close; man holes should exist at all the main junctions; the mouth of the outlet drain protected by a wire grate: repairs should be seen to, and executed before the rains in tropical countries. There should be no direct communication with the surface by which other water than what filters through the soil may be admitted. They should only be made in cleared and open spaces, where dry subsoil is essential to health.

Evils from imperfect sewage.—Imperfect sewers, choked up drains, defective traps of cesspools and water closets, a filthy condition of the earth's surface; the vicinity of burial grounds, slaughter houses, and the conversion of tidal rivers into cloacœ maximæ, are fertile sources of zymotic diseases, especially typhus, diarrhœa, dysentery, and cholera.

Not only in China and in India are some of the rivers rendered absolutely loathesome by the filthy matters thrown into them, but in the United Kingdom they are in a few instances no less soiled.

So many are the evils that arise from defective drainage and under-ground sewers, that it may under certain circumstances become a question whether the total absence of drainage would not in a sanitary point of view be the more advisable. This was actually found to be the case within the hospital enclosure in Tientsin in the north of China, during the occupation of that city by our troops. There, as described in the author's work already noted, no system of drainage properly so called existed; a staff of natives was employed to remove all offensive matters, and the results were in every respect most satisfactory.

Sewers and drains in India.—In India, with the exception of the large cities, closed drains scarcely exist. In military stations, with one or two exceptions, they are open. Much of late years has been said regarding the relative advantages of these two

descriptions. In England, there are properly speaking no open drains, and it is notorious that many outbreaks of diseases and aggravation in the character of epidemics, where these do occur, arise from faults in construction and neglect of proper means of cleaning the closed conduits, that too often serve to accumulate rather than remove objectionable matters.

It is seldom that the exhalations from the open sewers in India are so dangerous in their effects as those from the mouths and trapped openings of the drains in England. Much of this difference arises from the fact that in India, poisonous emanations are removed by the passing breeze as they arise, whereas in England they being pent up, acquire a degree of intensity and virulence unknown in the former country.

But closed drains are unsuited for India for the most part, inasmuch as the level nature of the country renders it all but impracticable to keep them clean, and to obtain ready exit for their contents, except as already mentioned, by means of men specially employed to clean them out.

Circumstances may arise in which, although the buildings occupied by troops may be on all sides surrounded by accumulations of filth of every kind, it may on the score of health be more advisable to submit to the palpable evils arising from them, than by interfering with them, run the risk of producing evils of a probably much more serious nature.

In native towns in India and in China, the gutters of the street, every corner and every pit become receptacles for filth. In China, accumulations so extensive and so deep are common at short intervals throughout the towns, that bubbles of gas the product of decomposition may in the heat of summer be observed to rise, and as they escape, leave a succession of little ripples upon the surface. There may be acres of these, each individual receptacle having communication with another. It is obvious therefore, that an army in only temporary occupation of such a place,

could not possibly reduce it to a condition at all approaching one of cleanliness; and therefore discretion teaches us caution in interfering with what we could not completely remove.

Latrines.—On the subject of latrines, it may be here observed, that the Sanitary Commission recommends that to all barracks, there be whenever practicable, iron or earthen-ware water latrines well supplied with water, and drained to an outlet; and that if this be impracticable, cesspools be abolished, metal or earthen vessels used, and removed twice a day. In accordance with this recommendation, various patents are now in use at home, as for example, those of Jennings and McFarlane, which are both on the water principle.

It is further very properly laid down as a principle that their buildings should be situated to leeward of barracks; that they be well ventilated; have divisions between the seats; have sufficient light, and be so arranged that there shall be one for the use of each company.

Latrines in hot countries.—In tropical countries, latrines and urinals should be as at present, separated from the barracks, but connected with them by means of a covered way. In India, according to the plan by Colonel Crommelin, C. B., a break of ten feet is to be left in this covered way, so as to avoid all risk of the effluvia being conducted by it to the barrack-room.

Best kinds.—When stations cannot be effectually drained by reason of their flatness, as in the majority of those situated in the plains of India, the best kind of latrines seems to be the description in use in that country, consisting of metal vessels which can be removed twice a day.

Urinals.—Urinals are best placed in a separate building. They shoud not be under the same roof as the latrines, nor should they be drained into these. For removable urinals such as are applicable to India, metal or glazed earthen-ware is the best material. A free supply of water should be available for cleaning them.

Night urinals.—The custom hitherto has been to have one or more urine tubs placed at night, either behind the door of the barrack-room, or in the verandah. The first arrangement is obviously most objectionable on sanitary grounds; the second subjects the men to draughts of cold air, or perhaps to rain or sun. In the new plans of barracks recommended by the War Office Commission however, it is intended that a urinal for use by night shall be fitted up in a small apartment at one end of, but separated from the dormitory. If one be used as in former times, a little carbolic acid mixed with water put into it, before the utensil be employed for its purpose, will destroy offensive odours that might otherwise arise.

Acton's jets.—While these pages are being prepared, there are in progress of being erected in India, in connection with urinals, a description of jets for lavatory purposes, such as have been recommended by Mr. Acton. It is to be hoped that men may by this arrangement be induced to enter the places so arranged, and by making proper and timely use of these contrivances, avert in some degree at least the evils of syphilis from which so many now suffer.

Dry earth conservancy.—Much has recently been said and written on the subject of dry earth conservancy. That this is a most convenient and effectual means of rendering unoffensive, and removing the materials of sewage is now generally acknowledged; that it can be converted to profitable account has been in China demonstrated for many generations, and in Prussia for a number of years. As however, with many other measures connected with soldiers, their camps and barracks that have recently been adduced as if new and altogether independent of the medical profession, so with that of dry earth conservancy, we find this an old custom. Irrespective of these two localities, we learn that many years ago it was in use in America. Thus, Dr. Cutbush of that country is found to observe that "if the privies attached to the

buildings be not deep, a layer of earth should be thrown in every morning, and when nearly full, a new *fossé* should be dug."

Nor is it a new discovery in the United Kindom ; for we observe in the pages of Pringle, that author recommending the digging of deep pits for privies in camp, and the covering of the excrements with earth daily.

We find however, in that volume which contains the best of all directions for the maintenance of the physical and moral well-being of the whole human race, whether as communities or as individuals, ample evidence that among the Israelites of old, this very system was authoritatively established. Thus we read that Moses directed that they should have a place without the camp, whither they should go, that each should have a paddle in his hand, and that on easing himself, he should dig, and turn back, and cover that which came from him (Deuteronomy, chapter XXIII, *v* 13, What is this but dry earth conservancy ?

That the system of what may be called dry earth conservancy has been in use among the Hindoos from the earliest period of the history of that people, is apparent ; and in fact, minute instructions on the subject are given in their sacred books or shastras.

As a matter of curiosity, and because the subject has not so far as the writer is aware, been previously alluded to ; he obtained from a Hindoo, the following extracts from the shastras, which he now prefers giving precisely as the translation was given to him. It is as follows :—

" The translation noted below given from the writings found in " Shreentee Shaster," part named " Anhick Tuttow," entitled the names of Moonee or sages " Ungheera and Varuddaj."

Rising from the bed in the dawn of morning, wash your face with water, then in a lonely place, cover a small quantity of ground with straw, and on that discharge the functions of nature without speaking and spitting, &c.,—(writing of Ungheera.)

After the discharge of stools or urines, cover it up with earth, wood, or straw.—(writing of Varuddaj.)"

It is stated in the shaster that these rules were made only for the true Brahmins of that age.

The writer is further indebted to the courtesy of Dr. Thompson of Chinsurah in Bengal, for some other particulars regarding the use by the ancient Hindoos, of dry aluminous clay as a cleanser, and as used for the purposes of conservancy. According to notes kindly supplied by that gentleman. "In some works on Hindoo medicine, while referring to hygiene, as well as in other Hindoo treatises on general subjects, two methods of cleanliness are particularly noticed. With regard to the latter of these two, a person having to attend to a call of nature, is directed to go to a certain distance from his house, north, south, east, or west, as may be determined upon, but all according to given rules extant on the subject, and which chiefly refer to the direction of prevailing winds with reference to the dwelling. He is there to dig a hole, about a foot deep, with an implement which he carries for the purpose, and in this hole to satisfy his desire. He should then cover up the excreta, with the loose soil that he had previously dug up."

The Hindoo is then enjoined to make use of earth for further purposes of cleanliness, but it is stated that all the rules that bear upon this subject, are not strictly binding on all Hindoos properly so called, but are enforced as one of the fundamental rituals of their faith by the shastras. Women, children, and the sick however, are all exempt from them, except that they are enjoined to resort to this system of cleanliness as far as possible.

It is further mentioned in the paper just quoted from, that,—"the custom of washing the hands with mud and water after defecation, is as old as Hindooism, and is universally practised. In the Punjaub, the common people employ pulverised earth for washing generally. In Bengal, men often dab themselves with

mud to remove the stench and dirt from their persons; and the poorer class of women use dry soft earth for the hair as a substitute for soap.

As the system of dry earth conservancy is particularly applicable to the circumstances of India, various suggestions with regard to the best means of applying it have been submitted by the Sanitary Commissions in that country; and in one shape or another, the system is now successfully used in the greater number of our barracks and hospitals there.

Removal of ordure.—Ordure should be removed to a distance of one or two miles from barracks in a leeward direction, and there buried. In some countries it may be utilised as manure, and in China is eagerly sought for by the people for this purpose. There they either spread it in a liquid form upon their fields, or by mixing it with earth, convert it into a kind of *poudrette*. This they collect in dry heaps, removing from time to time for use just so much as may be necessary for fertilizing particular fields.

The simpler is the plan adopted for the removal of excreta, whether from barracks or hospitals, water closets or latrines,—the better. In the United Kingdom however, public decency, and the circumstances generally of the population render impracticable the very primitive means which are readily available in India, in China, and in many other foreign stations occupied by our troops.

Conservancy of "married" barracks.—The difficulty of maintaining in good sanitary condition, barracks occupied by married soldiers, is at all times a matter of notoriety. This no doubt depends in some measure upon the necessities of children who usually abound in such places, but also to a great degree upon the uncleanly habits of the class of women from which the wives of soldiers are for the most part taken. In such places, ventilation is often artificially interrupted, soiled clothes permitted to remain in the room, and even matters still more offensive; nor is it by

any means rare to find that children affected with contagious and infectious diseases are there carefully concealed by their parents, to the great danger of the masses.

CHAPTER XXXVI.

SLAUGHTER YARDS.

Points to be considered—Meat carts—Dimensions of slaughter yards—Construction—Cleanliness.

Among the very numerous subjects regarding which the opinion of an army medical officer may be solicited, or towards which his superintendence may extend, is that of slaughter houses: thus, when an army occupies a standing camp or holds military possession of a town, establishments of this nature demand his careful attention, as well to ensure the proper sanitary condition of the places themselves, as to guard against the risk of meat becoming affected by protracted exposure to emanations from them.

It is not to be considered that the few remarks which are now about to be made, have more than a very slight bearing upon the construction of slaughter houses or *abattoires*, as these exist, or ought to exist for the purposes of inhabitants of towns and cities; all that is aimed at, is to give briefly the principal points that demand attention in regard to temporary establishments of this nature, that the exigencies of military service from time to time call into existence.

Points to be considered.—In establishing a slaughter house or yard, the first point to be considered, is what must its dimensions be, in order that the requirements of the troops for whom it is to furnish beef shall be amply supplied.

With a view to arrive at this knowledge, we note that slaughter sheds should allow for each bullock a breadth of 8 feet, and of 4 feet for the centre drain; thus, for a double shed, a total breadth of 20

feet is required. In regard to length, that of the shed should allow 3 feet for each bullock, or for 160 bullocks in a double row, say 220 to 250 feet.

For pigs and sheep, the length of building required is $1\frac{1}{2}$ foot per animal: thus, a shed of 150 feet in length would, it is calculated, be sufficient for the daily slaughter of 400 of these animals; it being understood that they be placed in four rows inside, instead of two, as is the case with oxen: and that there be double sets of drains along the sheds for the more effectual removal of liquid refuse.

The shed in which carcases are hung up, may be of similar size to that in which the operation of slaughtering is performed: but altogether separate and distinct from the latter, and to windward of them. It is considered that these two, namely, the slaughter house and the yard should be enclosed by a low wall; thus, occupying per regiment a space of 70 to 80 square yards.

Pigs and other animals however, should neither be slaughtered on the same ground, nor their carcases hung up in the same shed.

It is almost unnecessary to observe that no animal should be fed on the slaughtering premises: the yard for this purpose may be adjoining these, but outside, and distinct from them.

Requirements.—All slaughtering places should have the advantage of free supply of water; free means of escape for their washings; and ready means for the immediate removal of offal. It is most essential that these be at once removed to a distance, and not allowed to decompose on the spot, so as to subject newly killed meat to the effluvia thus occasioned, as is unquestionably the case at times in India, and it is to be feared, in some other foreign countries as well. Indeed, there is reason to suspect that some slaughter yards that are under the direction of municipalities of towns, are not altogether free from the objection, which it is the object of this paragraph to

guard against, in so far as similar establishments refer to troops.

Meat carts.—Another matter in connection with slaughter houses, which deserves the attention of the medical officer, is the means employed for conveying the meat from these places to the different regimental ration stands. That clean carts should be used for this purpose, and for it alone seems apparent: yet it is to be feared that as a rule, very little attention is paid to the nature of conveyance used for this purpose. Carts of very questionable cleanliness have been used for this purpose, and probably some readers of these pages may have seen as the writer of them has, carcases of meat being conveyed in hack carriages, in which probably drunken and dirty persons, or what is equally likely, those affected with loathesome forms of disease may have shortly before constituted the "fare."

Dimensions of slaughter yards.—In making arrangements such as are described in this chapter, it is well to bear in mind that their dimensions must depend upon the strength of the force, and consequently upon the quantity of meat which the troops forming that force will consume.

With regard to these points, the experience gained in India furnishes us with certain rules for our guidance: thus, cattle and sheep being of the size already described in the chapter on rations, it is found that a "strength" of 1000 soldiers consumes daily 8 bullocks or 40 sheep.

In that country, cattle sufficient for a month's consumption, are at all times kept in readiness by the Commissariat Department; the average numbers of cattle thus amounting to 1200 sheep, or 240 bullocks.

These animals are kept in sheds, the space in which allowed to them being in the ratio of 6 to 8 superficial feet per bullock. The space required for stowage of fodder for them, still bearing in mind that we are considering the necessities for 1000 men, is 90 square yards.

It may however be well to take an actual example in this respect from the arrangements in force for a definite number of troops; we accordingly find that at Dinapore, situated on the banks of the Ganges, the force of British troops may be approximately laid down as 1,000 men; but wives, children, and officers, make probably a total of 1200.

From personal enquiry made upon the spot, it appears that for the supply of all these during a month, 250 bullocks and 300 sheep are required: and that these numbers are accordingly held in stock.

In the feeding shed, 36 superficial feet the breadth being 20 feet, are allowed for each bullock, so that the length of the building is thus represented, *viz.*—$250 \times 36 \div 20 = 450$ running feet. In that for the sheep, 8 superficial feet, the breadth being 12 feet, are allowed; making the dimensions of it $300 \times 8 \div 12 = 200$ running feet. The yard for fodder for all these is 200 feet $\times$ 120.

The largest number of animals slaughtered on any one day, is 12 bullocks, or 60 sheep: for this purpose, there is a shed of 25×15 superficial feet; and in the hanging room, each carcase is allowed 3 running feet.

Construction.—It is considered that under ordinary circumstances, there is no particular reason why the slaughtering stand itself should be under cover, unless the nature of the climate is such that heavy rain, snow or dust, be liable to fall upon the carcases which there are being skinned and cleaned. In the case of hanging sheds however, these should always be roofed, but so arranged as to be freely exposed to the wind, and to admit of thorough ventilation.

In slaughter houses of a merely casual nature, as for example, those connected with a standing camp or the temporary occupation of a military position, no other flooring is required than common earth; the harder soil being covered over to a depth of several inches, say four to six, by loose dry clay

or earth : should it become necessary however to erect places of this description of a more permanent nature, it becomes a question whether the flooring of these should not consist of stone or brick pavement.

In such a case it certainly seems that the most suitable description of floor is that which consists of flags well covered over by a thick layer of absorbent earth, so as to prevent the risk of the animals being bruised; and when saturated with liquid and other refuse, to admit of easy removal.

And in this place, the opportunity may it is hoped be appropriately taken to urge upon those concerned, the necessity which exists, not only on the ground of humanity but on that of mere expediency in conducing to the quality of the meat, that animals intended for the food of soldiers, and indeed, of all classes of persons, shall be put to death with the least possible degree of suffering to themselves.

Irrespective of the cruelty and barbarity of the means taken to slaughter cattle by many persons, the fact should be borne in mind that instances are on record of poisoning, and various unpleasant symptoms of less severity being induced by the use of meat of animals that had immediately prior to death been subjected to great pain.

Cleanliness.—Another point that deserves strict attention, is the necessity for the observance of most perfect cleanliness in the yards themselves. In order to illustrate what is more particularly indicated here, I may mention that I have in India, on the occasion of visiting a yard of this description, during the time the animals were being *murdered*, for that is the appropriate term, seen the excrement and other refuse of the animals being swept into the place in which their blood was collected.

This mixture may or may not have been subsequently used as human food ; but the possibility that it may have been, is sufficient reason for the circumstance being here alluded to.

CHAPTER XXXVII.

BAKERIES IN INDIA.

Improvements at home and in colonies—An example in India—Concluding remarks.

IMPROVEMENTS AT HOME AND IN COLONIES.—On home service and in the colonies, our troops have now for the most part their bread carefully prepared in clean utensils; from the mill in which the flour is ground, to the trough in which it is kneaded, and the oven in which the loaves are baked. In India, measures are in progress with a view to introduce into that country the improvements that have for years been established in all other of Britain's foreign possessions; these improvements however, are with the exception of a very few places still matters of the future; and therefore, for the purpose of accelerating their general adoption, it is hoped that a simple statement of what is the present condition of the arrangements at the great majority of stations, will best show the necessity there is for such a change.

AN EXAMPLE IN INDIA.—At Hazareebagh, for example, the building in which the operation of grinding wheat is performed, consists of no more enduring materials than *wattle* and *dab*. The walls are five feet high, the ridge pole about 10. There are two openings of about a square foot each in the two side walls, but these so closed by interlacing bamboos with a view to prevent the flour from being blown about, as to be useless for the purpose of ventilation. At one end is a door, and a small window similar to these. The opposite end communicates by means of a door with another apartment connected with the baking establishment. There is no roof ventilation;

the floor is of mud. The entire extent of the interior of this building presents a floor space of 30 feet × 20. Here there are 15 grinding places, all crowded together; occupying the entire length of the apartment, and a breadth of 11 feet. At each of these "mills," two women are employed in grinding;—these sitting with lower limbs bare and interlaced;—the mills between them. Probably ten more women are engaged in bringing grain, taking away, sifting, and cleaning that which has been ground.

Here however, we have the women actually engaged in grinding, crowded together to an extent which gives each a superficial space of 11 feet. It may be possible to imagine the effects upon them of the temperature during the prevalence of the hot winds, when in a well-cooled house it ranges to upwards of 90° F. But in this apartment, without ventilation, and with the additional fact of this class of women being the opposite of cleanly in their persons, an idea may be formed of the nature of the mixture served up as bread to our soldiers and our officers, as well as to their respective wives and children in India.

Yet the record of the mixture so ground up, is not altogether complete. Perhaps the men employed in preparing the dough are fully as cleanly as our bakers are at home. In India however, *toddy*, that is, palm juice is used instead of yeast, and in its process towards acetous fermentation is sufficient to "raise" the bread, and also in the majority of instances to render it sour before the day on which it is intended to be used has more than half passed over. Another process has of late been introduced, and is considered a triumph of art. It consists in mixing a portion of patent yeast with *dhye*, that is sour milk, and using the compound to give bread the required degree of lightness.

It is to be borne in mind that these remarks are not alone applicable to Hazareebagh. The arrangements

at that station are neither worse nor better than they are at others. It is specially noted, merely because the measurements of the grinding-room at that place happen to have been recorded.

Concluding remarks.—In India, the officers of the Commissariat Department are directly amenable, not to the military officers in command, but through the Commissary General to the Government of the country; hence it happens, that their arrangements are only under very exceptional circumstances brought within the strict supervision of the army medical officer. It is well however, that the latter by being made aware of the practice at present adopted in regard to the item of bread, should thus have his attention directed to the necessity for improvement, and manner in which it is to be most readily effected.

CHAPTER XXXVIII.

INSPECTIONS.

Preliminary—The date—Regulations enforced—Records—Sickness—Annual amount of—Precautionary measures—Barracks—Their condition—Accommodation—Conservancy—Rations and canteens—Personal cleanliness—Amusements—Water—Local malaria—Hospital—The wards—Excreta—Baths, &c.—Vicinity—Bedding—Kitchen—Diets—Diet tables—Attendance—Hospital a source of disease—Epidemics—Surgery—Instruments—Stores—Repair—Discipline—Convalescent wards—Complaints—Dead-rooms—Disposal of the dead—Recommendations.

PRELIMINARY REMARKS.—It has appeared to me that the inspectorial duties of administrative medical officers would be much facilitated, and the state of preparation of executive officers of the department for the periodical inspections to which they are liable more complete, were the latter in possession of a brief summary of the matters of detail regarding which on these occasions, they are usually called upon to give information.

It is quite true that the Book of Regulations contains explicit instructions regarding these inspections, and that if medical officers act up to the code of Rules therein contained, they need be at no loss or difficulty in regard to whatever points the attention of an inspecting officer may happen to be specially directed. Undoubtedly, there should on the one hand be no necessity for what is commonly called "brushing up" for an inspection, to the neglect of that continuous zeal and attention at all times, without which duties can never be performed in a satisfactory manner: on the other hand however, it is to be hoped that now-a-days there is no longer a desire on the part of inspecting medical officers to "catch" or "be down upon" their juniors in rank.

No words are strong enough to deprecate sufficiently such conduct. We should ever bear in mind that we are members of one profession, and that while inspections are a very necessary and important duty to be performed, it is most desirable that all feelings of a personal nature be rigidly banished on the occasion.

Perhaps the most convenient arrangement of the remarks that are to follow, will be to adhere to the headings of paragraphs that bear upon inspectorial duties as laid down at pages 28 to 31 of the medical regulations, giving under each, such hints in regard to details, as personal experience has led me to believe may be useful.

It may be premised however, that in order to facilitate duties of this nature and save correspondence, the inspecting medical officer should, some time before he commences his tour, apply through the general officer commanding the district, for a statement of all alterations that have been made in the buildings, drains, or other sanitary works at each particular station; of those in progress, and those about to be commenced.

The date—*Para.* 1.—It is customary to begin an Inspection Report by noting the date upon which the inspection of the barracks took place, that of the preceding inspection; by whom it was performed, and who have been the medical officers with the regiment or particular body of troops in the interval.

Regulations enforced—*Para.* 2.—The instructions on this head contained in the medical regulations need no comment. The executive medical officer should however be prepared to show that in all respects the regulations have been enforced in regard to protecting the health of the troops; for securing the sanitary condition of the hospitals, and for the careful treatment of, and attendance on the sick.

Records—*Para.* 3.—The books connected with the hospital that are to be kept, are detailed at pages 91

and 92 of the regulations, but it may be here observed, that each battery of artillery should have a complete set of records in every respect similar to those of a regiment. The books that are usually examined on these occasions are the following, namely:—

(*a.*)—The medical histories book: and it may be observed that with regard to the routine of inspecting it and the others, much valuable assistance is obtained from some printed instructions on the subject, circulated by Inspector General Beatson to medical officers under his superintendence.

According to these instructions, the medical histories sheets should be completed up to the date of inspection. It has sometimes been found that a difference of opinion has existed between military and medical officers, as to who should supply and sign to the correctness of what is commonly called the military portion of these documents; it may be well therefore to mention that the Commander-in-Chief in India has issued a General Order on this subject. The order in question is dated 13th July, 1865, and paged 316. It directs that the military part of the medical history sheet be filled in by the Surgeon from information given to him on a separate slip of paper by the Adjutant, and lays down that the signature of the officer commanding is not required to any part of the document.

It is desirable that at the commencement of a volume of these "sheets," the information noted at page 116 of the regulations be inserted: namely, the names of the commanding officers and dates of their appointments; the names of medical officers and dates of their appointments; the stations occupied by the regiment, with the dates of arrival and departure; and the barracks and hospitals occupied. The strength of all classes of the regiment, the numbers of recruits, of discharges on various grounds; the number of deaths, the numbers of attacks of illness; the average number constantly sick; the transfers to, and from the regiment.

Also notices of epidemics or unusual exemption from sickness; records of any new facts or discoveries by the medical officers; and the date of any important event connected with the regiment. It is intended that year by year such a summary as is here indicated shall be given, so that a medical history of the regiment or corps be thus gradually accumulated.

(*b*).—In connection with the admission and discharge book, information may probably be solicited in regard to the manner in which soldiers are admitted into, and discharged from hospital; that is, who sees them on each of these occasions. It may also be necessary to inquire into the manner in which men "attending hospital" are officially accounted for. It is well known that in some regiments, the numerical returns give a very erroneous impression in regard to the actual amount of non-effectiveness by sickness; many men who are unfit for duty being nevertheless shown upon these returns as effective. It may be observed that official documents should exhibit as nearly as possible the actual conditions they are intended to describe: and the discretion exercised by some medical officers in reference to the men they permit to "attend" hospital without being in it, requires to be carefully watched.

Dr. Beatson on 9th March, 1864, issued a circular directing that all men not fit for duty after one day's exemption, should be admitted into hospital and regularly "entered" upon the records; this recommendation although intended specially for one command, is of such importance, as obviously to commend itself to all.

(*c*.)—For the sake of uniformity in returns, it is necessary that the authorised nomenclature of diseases be strictly adhered to; medical officers if not in possession of the pamphlet containing this nomenclature, should apply for it without delay.

(*d*.)—It is desirable that in the copies of medical certificates retained with the regiment, all particulars

be entered, in the same way as in those that are disposed of in accordance with regulations.

(*e.*)—In connection with the manner of keeping Case books, the inspecting officer may inquire into the number of cases entered since the preceding inspection by each of the medical officers who have done duty with the regiment, and the number under registration on the day of the inspection. In accordance with a circular, dated Army Medical Department, 18th January, 1862, all cases of venereal ulcer must be entered in the case books, and to one dated 13th March of the same year, the cases of all men receiving extras are to be similarly entered. Should it however, from any circumstance have been impracticable to carry out the latter, a nominal list of the men who have had extras but whose cases have not been entered, will by the inspecting officer be required in duplicate, and explanation of the circumstance given.

An important point to inquire into, is the manner in which cases of men are entered. It is almost needless to observe that the record of each case, should from day to day be made at the time of visit, and at the bedside of the patient.

(*f.*)—The Letter book should be so kept, and carefully indexed, that there need be no difficulty in referring to any communication that has been despatched or received by the medical officer.

(*g-h-i.*)—The instructions contained in the Book of Regulations in regard to these records, namely, the *Diary*, the *Vaccination* and small pox register, and the *Register of recruits*, are so explicit as to need no further comment.

A list of all books and records in possession will be required in duplicate. It is necessary to see that the medical officer has in his possession, a copy of the medical regulations, and that all books of a public nature are regularly accounted for.

In addition to all these, the inspecting officer may desire to see the book-copies of all past returns and

reports, so as to satisfy himself that the series of such records is complete and properly kept: and it may be of use to medical officers to note in this place that in regard to these book records, the fewer the books through which they are distributed, the better. It is also desirable that particular books should contain records that are allied to each other, if indeed it be not practicable to restrict one to each particular subject. At all events, medical officers should endeavour to have all their records kept in such manner, that no difficulty need ever be experienced in obtaining information upon any particular subject, and in consecutive order for different years.

All medical, sanitary, and statistical returns and reports due up to date, should have been supplied, and copies kept of these as well as of every official document sent from the hospital, and of every "circular" received whether from the medical or military authorities.

Sickness—*Para.* 4.—The monthly admissions and deaths by zymotic, enthetic, pulmonic, and other classes of diseases respectively may be inquired into; the information either embracing the entire period since the preceding inspection, or simply for a year or six months according to whether the inspection takes place on foreign or home service. In connection with these points, information will probably be solicited as to the average strength of the regiment during the period; the average daily sick; the strength and number in hospital, or incapacitated for duty on the day of inspection; and number of admissions from all causes during the period.

With regard to the diseases that have been most prevalent, it will be well to note the circumstances to which such prevalence is considered to have been attributable, and the steps if any, that have been taken in reference thereto.

The number of deaths that have occurred among officers, soldiers, women and children should be

separately noted, as well as the diseases by which the mortality among these classes respectively has been occasioned: stating briefly any explanatory circumstances that may have been observed.

Unusual amount of—*Para.* 5.—When there has been any unusual prevalence of disease, a separate report of the occurrence should be made to the inspecting medical officer, together with a full account of the steps taken to prevent or mitigate it.

Precautionary measures—*Para.* 6.—And if any further steps or precaution are necessary, the inspecting officer should at the time communicate his orders in writing. If none are necessary, he should state the fact in his report.

Barracks—*Para.* 7—It seems to me that courtesy demands that an inspecting medical officer before entering a barrack, should intimate his intention to the officer commanding, and beg that an officer be directed to accompany him during his visit. Many amusing anecdotes are related of the reception given to a medical officer who, neglecting this course has entered a barrack of a regiment among the men of which he was a stranger: and of the even still more peculiar reception met with by some who have, undistinguished by the uniform of their rank, and unattended by a regimental officer, entered the quarters occupied by married soldiers while the latter were on parade.

It is required that the inspecting officer personally visit every building of whatever kind that is occupied or used by the various classes of persons occupying barracks; enquiring carefully into the sanitary condition of each in succession.

In order to render his report complete, he should describe the position and site of the barracks or station, with the physical characters of it, in so far as these have a bearing upon sanitation. He should mention whether they are situated in or near a town, or are at a distance from one; whether in the open country,

or surrounded by walls or fortifications ; whether on an elevation, a plain or in a depression; on the sea shore, or near a river : and he sould note the distribution and general arrangement of the buildings ; the materials of which they consist, the nature of their basement, the number of stories in each building, and the number of rooms, as well as means of access to them. When men occupy huts or tents, similar particulars in regard to these are required, as far as circumstances may permit.

When the stations or barracks that are being inspected are situated in the United Kingdom, or are of old standing abroad, it is only necessary to give information in regard to those of the points above noted that have not previously been recorded, or in regard to changes that may have taken place : when however troops occupy new or heretofore undescribed positions, it is essential that the fullest possible account be given of the points here alluded to, as well as of any others that have a bearing upon the sanitary condition of the troops.

He should be furnished with a tabular statement showing the length, breadth, and height of each occupied room ; whether barrack, guard-room, cells, school-rooms, &c., and of the average number of persons in each. In some instances it is the custom of medical officers to give the " cubic and superficial contents" of each apartment, but this obviously eaches nothing : *measurements* are required.

Similar information in regard to day-rooms will be required wherever soldiers have the advantage of these : but much writing and needless reference would be saved, were there in the office of each principal medical officer, a plan of the different military buildings within his district of superintendence.

Their condition—*Para.* 8.—Under this head, information will be required in regard to the means by which cleanliness of the barracks, both within and without is maintained ; as to the nature of the

ventilation ; the actual amount of ventilating space per person as represented by the superficial area of doors and windows, air tubes, and all other means of this description ; distinguishing also as far as may be practicable, the inlet space from that for the escape of foul air.

Where artificial means of warming are in use, their nature should be specified ; whether they consist of stoves or open grates ; whether the fuel be coal or wood : and in either case, the precise quantity allowed should be noted, mentioning at the same time the particular season of the year, and the sufficiency or otherwise of the quantity issued.

With regard to the means of lighting, it should be noted whether these consist of gas or lamps. If the former, at what hour are the jets extinguished, and under whose control the actual supply is. If the latter, what is the precise nature of the lamps ; what their proportion to the numbers of men per room ; what the quantity of oil to each light, and a statement of the number that are permitted to burn throughout the night.

A statement of the nature and condition of the men's bedding should be introduced under this head, together with some particulars as to its sufficiency or otherwise with reference to the climate of the locality.

The manner in which cleanliness in this respect is maintained, should be mentioned : as well as that in which the different articles are issued for the use of the troops.

It may be observed that the inspection of barracks occupied by married families should be made with as much care as that of the ordinary barracks, and that information on the above mentioned points should always be readily available for the officer who performs these inspections.

Accommodation—*Para.* 9.—With reference to the measurements of barrack-rooms, and the average

number of men in each, there need be no difficulty in from the data already obtained, stating the amount of cubic and superficial space per man in each room or barrack. It will be well however to note in the report these particulars.

Conservancy—*Para.* 10.—The state of the drainage, latrines, urinals, and ashpits where the latter are used, will be seen to by the inspecting officer, but the Surgeon or Assistant Surgeon should be prepared to give information in regard to any defects that exist, any improvements that might be made, and to any correspondence that may have passed in regard to these subjects.

Rations and canteens—*Para.* 11.—In the event of any item of the rations not having been considered good, it will be well if the Surgeon bring to the notice of the Inspector all particulars in regard to the times and circumstances under which the defects in this respect occurred. The description of vegetables, the quantity issued, the manner in which the supply is obtained should also be noted, as should any change that may have been made in the scale of rations during the year or period since the previous inspection; and a statement of the circumstances under which it was made. The effects of any particular scale of victualling on the health of the troops, if on foreign or active service, should be specially noted.

The manner of cooking and means of cooking the rations, demand very serious attention: so do also the means of affording the soldiers variety in these respects. In India, it is customary to enquire into the existence of a coffee shop or other means by which the men may obtain a cup of coffee in the early morning, and at which they may during other parts of the day partake of non-intoxicating beverages. It is well also to ascertain what is the nature of the beverages in question, as well as of other articles sold there: and as to who is responsible that their quality is good. The subject of extra messing also

comes under review at this time. It is desirable to know what is the amount per day each soldier pays towards this end, and in the purchase of what articles is the money so subscribed expended.

With reference to canteens, it is well to state whether those resorted to by the men are the property of private speculators of the regiment, or are mere places for the issue of malt liquors and spirits supplied by the Commissariat, as is the case in India.

Another point to be seen to, is whether there is simply a bar, at which the soldiers partake of their "allowance," or a room in which they may sit, and it may be, enjoy themselves by reading newspapers or indulging in games. It is also desirable to know the hours at which the men are permitted to obtain their daily quantity.

Under this head, it is well to inquire into the facilities they have to obtain liquor elsewhere than in the canteen, and as to the effects generally upon them of habits of intemperance or otherwise in which they indulge. In the event of a temperance society being in existence in the regiment, it will be important to submit a comparative statement of the rates of sickness and mortality among its members, and in men who are not its members.

Personal cleanliness.—*Para.* 12.—On the subject of lavatories and baths, it is necessary to inquire into the size and arrangements of the former; the proportion of basins to the numbers of men using them, the manner of supplying water for use, and the means for removing wasteage. In regard to the plunge bath, it is to be ascertained whether it is artificial or natural, as for example, a lake or river. In the former case, the means of supplying fresh water are to be inquired into, as well as those for removing what has been used, and the frequency with which it is changed. In either case it should be known what is the nature of the provision to ensure the troops making use of the bath, as well as the arrangements for guarding against

accidents while they are bathing. Similar information will also be required in regard to women and children; and in the United Kingdom, it will be well under the present head to inspect the arrangements in regard to the wash houses, laundries, and all places connected with these.

Amusements—*Para.* 13.—The games and means of amusement of the men may be briefly enumerated, and it is desirable to know to what extent these are taken advantage of. In the event of their not being so to the degree that might naturally be expected, it will be well to learn whether this be attributable to excessive duty or other circumstances that bear upon the men themselves.

Mention should be made under this head, of libraries, institutes, theatres, and lectures within the barracks, to which the troops resort. In the case of libraries, they may either be the property of the garrison; of the regiment; or there may be small libraries and reading-rooms for the use of individual companies of a regiment. Institutes and theatres may in like manner, be either the property of the garrison or of individual regiments.

Water—*Para.* 14.—The nature of the water supply must be described; including its source, the manner in which it is brought to barracks, whether by open canals, pipes, or carried by men or animals: notice will be taken of its sufficiency, and of the ordinary daily rate of supply. Its quality is to be detailed, and if practicable, a record made of its chemical analysis. In the event of the water exerting any special effect upon those who use it, particulars on this head should be entered into, and the steps described that have been taken to mitigate the evils. It should also be stated whether filters are in use, and if they are, of what description, and in what numbers. If other means of purifying water are employed, they are to be mentioned: and at the few places where evaporated water is made use of, notice should be taken

of the nature of apparatus employed, and as to its capabilities of meeting the entire requirements of the troops.

Local malaria.—*Para.* 15.—The instructions on this head that are contained in the regulations are so complete, that it is hardly necessary to add a word to them. It is to be presumed that whatever sources of malaria exist are of a nature that cannot be removed; when however, any steps have been taken for the mitigation of those that are present, they should be briefly described, and mention made of the circumstances that render impracticable their complete removal.

Hospital.—*Para.* 16.—The instructions above given in regard to the subjects to be noted under paras. 7, 8, 10, and 12, are equally applicable to the conditions of the hospital that come to be considered under the present heading. It may be well to observe however, that while in regard to these various points in connection with barracks, they are to be considered with reference to their bearings upon healthy men; it becomes necessary in reporting upon those that have reference to hospital to consider them in so far as they bear upon the conditions of the sick; retarding or accelerating their recovery.

The wards.—*Para.* 17.—In ascertaining the size of wards, the number of patients in each, and the cubic and superficial space allowed to individual patients, a similar course should be adopted to that described under paras. 7 and 9; bearing the fact in mind that the conditions of sick soldiers, their wives and children, are those towards which our inquiries in this as in the preceding respects, are to be directed.

It is necessary at this point to inquire into the nature and extent of accommodation for patients laboring under infectious diseases, or others that require segregation or seclusion, and into the condition generally of the provision made for them.

Excreta—*Para.* 18.—It is very desirable to see that the excreta of the sick, and all other offensive

matters, such as dressings and discharges of different kinds, are promptly removed from the wards. Receptacles for the former that are used only in the cases of bed-ridden patients or those that are nearly so should be air tight and the escape of gases from them further guarded against by deodorizing or disinfecting fluid placed in the groove of the vessel into which the lid fits. In the few instances in which it is absolutely necessary that excreta should be for a time preserved for the purposes of examination, the vessels containing them should still be removed from the wards.

Baths, &c.—*Para.* 19.—As already mentioned with reference to the means of ablution &c. for men in barracks, under para. 12, similar inquiries are necessary in regard to the sick in hospital. It is further necessary in regard to the latter, to inquire into the manner in which personal cleanliness is maintained, of patients who are long confined to bed or unable to take care of themselves. The means of administering hot and all other kinds of baths, must also be looked to.

Vicinity—*Para.* 20.—Here also similar information in regard to the vicinity of a hospital is to be given as already noted in para. 7 in regard to barracks. It is almost needless to mention that the presence in the vicinity of crowded or dirty portions of a town,—of manufactories,—grave-yards,—accumulations of refuse,—foul rivers, or any other source of pernicious emanations should be specially inquired into. Drains should not pass under any part of the hospital; if they are closed, they should be "trapped," and if open, should be scrupulously clean.

Bedding, &c.—*Para.* 21.—In addition to inquiring into the cleanliness and sufficiency of the bedding, linen, ward furniture and utensils, it may be well to observe what is the quality of these articles respectively; what the manner of supply; how are they exchanged when this becomes necessary; and with whom rests the actual responsibility as to their safe

custody, cleanliness, and state of repair? It is needless to observe that at some of our foreign stations there are no Purveyors.

Kitchen—*Para.* 22.—This paragraph speaks for itself. The sufficiency of the kitchen arrangements has to be inquired to.

Diets—*Para.* 23.—The quality, variety, and cooking of the diets, respectively demand notice; and in reference to the latter point, the capabilities of the servant employed as cook may be inquired into, when, as is the case in India, special qualifications on the part of this class of servant are not always insisted upon prior to his entering on his vocation.

Diet tables—*Para.* 24.—It is not sufficient that the diet tables are hung up in a conspicuous place other than in the wards. It is necessary that the patients have every facility of access to them, and it is also provided for in the regulations that one patient from each ward may be present at the time the diets are issued, so that all may thus be satisfied that justice is done to them in this respect.

Attendance—*Para.* 25.—In his inquiries into the state of the attendance upon, and nursing of the sick, the inspecting medical officer is called upon in the first place to record the result of his inspection in so far as it has led him to form an opinion as to the capabilities, zeal, and attention of the medical officers connected with the particular hospital: and here too it might perhaps be well, were he to take the opportunity to point out to the latter whatever defects or imperfections may have become apparent to him, in order that they may be rectified, and similar ones avoided on future occasions. With regard to attendants, their description, numbers, and degree of efficiency should be seen to. If men of the army hospital corps are employed, it is to be ascertained that they have received that special amount of training, as laid down at the third page of the proceedings of Colonel Kennedy's Committee on the subject.

Under the present head, the inspecting officer will find it most convenient to personally inquire into the condition of individual patients, the nature of their ailments, and the treatment being adopted. He will also compare the records of particular cases as made from day to day, with the results of his own examination.

Hospital a source of disease—*Para.* 26.—It is happily not often now that the hospital itself becomes the source of disease, yet it does sometimes happen that such is the case. When an instance of the kind takes place, most careful inquiry must be made into the probable circumstances that have led to it, and of the steps taken in reference to them. All the ordinary causes of unhealthiness of hospitals are to be in turn considered, and such steps taken on the spot, as may appear to be called for.

Epidemics.—*Para.* 27.—When an epidemic has shown itself in the hospital, attention is to be directed to the circumstances if any, that appear to have combined thus to localise it: and these being ascertained, steps must be taken accordingly, by the partial or complete vacation of the building for the time being, and until it has undergone a thorough cleansing and purification both as regards itself and its vicinity.

If wounds do not heal favorably, and cases of disease recover with ordinary rapidity, it may be assumed that either the hospital itself is in an insanitary condition, or that the wards are exposed to the influence of pernicious emanations from without.

Surgery.—*Para.* 28.—In examining into the state of the surgery, and the various points connected therewith as noted in the regulations, it is of the utmost importance that the qualifications of the person by whom medicines are prepared and dispensed, be inquired into. It is also essential, to ascertain according to what formula the medicines for issue have been prepared, and to trace the train of responsibility from the prescriber to the recipient of the medicine

prescribed. It is quite true that poisons should be kept in distinctive made bottles, and under lock and key: yet as an additional precaution, the inquiry above alluded to is very necessary.

Under this head, it is proper to inquire into the quality, sufficiency, and manner of disposal of articles of what are called reserve stores: that is, such as are held in readiness in order that a soldier may whenever admitted, obtain such articles of comfort or as extras, as his condition requires.

Instruments—*Para.* 29.—The condition and sufficiency of the surgical equipment and instruments demands strict attention. These should individually be examined, and the numbers of each description compared with the lists to be furnished by the medical officer in charge.

Stores—*Para.* 30.—In connection with the state of the hospital stores, it is desirable to inquire into the nature of the rooms in which they are kept, and observe the nature of the fittings of these, as regards shelves, drawers, &c.

Repairs—*Para.* 31.—The state of repair of the hospital and of all buildings connected therewith is to be recorded: and at the same time, if in the event of correspondence having taken place on the subject of any defect that exists, notice should be taken of the measures if any, that are in progress, or of the absence of such steps, as the case may be.

Discipline.—*Para.* 32—This needs no explanation. The necessity of discipline in a hospital is obvious: it must form the subject of report however, whether that in the particular hospital seems to be satisfactory, that due quiet and order in the wards are maintained, and the instructions given by the medical officer carried out.

Convalescent wards—*Para.* 33.—Unfortunately there do not yet exist many hospitals in which there are separate wards for convalescents; where such wards do exist however, the inspecting officer will do well to

carefully inquire not only into their state of cleanliness and ventilation, diets and attendance of their inmates: but also into the economy generally of them, including the state of the convalescents themselves. Where there are lunatic wards, and there are patients in them, the most careful inquiry should take place into the condition of each person: his attendance, food, clothing, treatment, and management generally. This would of course be necessary principally on foreign stations where it is not always practicable to send to lunatic asylums persons afflicted with mental disorders.

Complaints—*Para.* 34.—The various officers and persons connected with a hospital being assembled, it is customary to put the question to them as to the existence of complaints or disputes. It is fortunately a most rare occurrence to find that there are either the one or the other: but should any exist, it is made a part of the duty of the inspecting officer to endeavour to arrange them so that the service may not suffer.

Dead-rooms—*Para.* 35.—Operating rooms have not yet been provided for regimental hospitals, and there are seldom separate apartments as dead-rooms and post mortem rooms. The nature of such appliances as exist should be noted: as for example, the facilities afforded by the nature of the construction for investigating the pathology of disease, without unnecessary discomfort or inconvenience to the medical officers, and with every evidence of respect for deceased, whose body is the subject of examination. Light, free ventilation, ample space, free supply of hot and cold water, and suitable tables and sinks, are the principal requirements.

Disposal of the dead—*Para.* 36.—The manner of removing for interment the bodies of men who die, is among the final subjects to be inquired into. This may be done by a gun carriage, a hearse, a cart for the purpose; or as in India, by a dooly specially set apart and painted black. If funeral parties suffer from

exposure while on this duty, the circumstance must be mentioned, in order that it may be remedied. All arrangements connected with the disposal of the bodies of deceased soldiers should be conducted with *decorum*, and with a due sense to the feelings and opinions of their comrades: or if married, of their families.

Recommendations—*Para.* 37.—In closing the report of his inspection, the Inspector or Deputy Inspector General is directed to communicate with the military officer commanding on the spot and medical officer, in regard to such matters as in his opinion should be brought to their notice respectively. It is necessary that copies be attached to the Inspection Report of such suggestions or recommendations as may have been made: and it may be observed in conclusion, that the remarks upon each particular head connected with the report of an inspection, should be so explicit and complete in themselves, as to obviate as much as possible the necessity of further reference and correspondence in regard to them.

APPENDIX A.

FIELD ARRANGEMENTS DURING THE FIRST SIKH WAR.

In the 10th volume of the Indian Register of Medical Science, is an able and interesting account by Dr. Taylor, (now Inspector General Taylor, C. B.), of the arrangements in the 29th regiment for meeting the casualties that occurred during the first campaign against the Sikhs, including the battles of Ferozeshah and Sobraon.

Unfortunately this account was not available in sufficient time to render it practicable to enter remarks upon it in their appropriate place in this volume: as however, some very valuable lessons are to be gathered from the narration, it is considered advisable to give in the form of appendix an abstract of a few of the more striking points, rather than omit all mention of a Report that contains so much as it does, of what is of value to the army medical officer serving in India.

During the nine days preceding the battle of Moodkee, the 29th regiment traversed by forced marches a distance of 20 and 30 miles per day; the bakers belonging to the Commissariat Department were not able to bake the daily quantity of bread during this time, so that flour made into coarse cakes by being mixed with water and kneaded, were issued to them; these the soldiers had to get fried in "ghee" or butter, and eat.

On 21st December 1845, the first day of the battle at Ferozeshah, the men were under arms at 2½ A. M.: and from that time till they fell wounded, continued so. They had also to march a distance of 7 to 8 miles along a dirty road; each man carried 60 rounds of ball ammunition, and two days' provisions cooked; the day was very hot; and no means of obtaining water along the road existed.

Of the wounds that occurred, the greater number were by cannon shot: and on account of insufficient transport, the wounded were left on the field from that date till the 24th,

exposed to the powerful heat of the sun by day, and the disproportionate cold by night; and suffering terribly from thirst, so much so, that some of the men were seen to drink their own urine. In the meantime, many of the men could not be attended to, nor was it until the latter date, when they were taken upon country carts into the neighbouring station of Ferozepore, that their injuries were dressed.

The deficiency of means of succour and transport is thus accounted for. During the halt of the regiment at Moodkee, all baggage and tents were ordered to be left at that place; hospital baggage and tents, as well as others; such articles of hospital equipment however as were essential for the field, were by Dr. Taylor unpacked and arranged in a dooly, such as cases of instruments, sponges, plasters, lint, bandages, and a few medicines, and in another dooly some brandy and wax candles. As a further precaution, Dr. Taylor placed in twelve other doolies, cooking utensils and water skins filled with water, and arranged so that all weakly men were left at Moodkee.

Instead of 76 doolies, with six bearers to each, the regulated allowance to a regiment, the 29th foot on account of the suddenness with which preparations for the campaign had to be made, could only be provided with 24 doolies, and to some of these there were only five bearers; however, a great part of even this number of bearers deserted.

On the regiment being thrown into line for the purpose of attack, the doolies and hospital attendants who had accompanied it followed immediately in the rear. When the first wounded fell, the whole of the hospital establishments were halted, and the bandsmen employed to bring to the field hospital so formed, the further wounded. It was soon found however, that wounded from several regiments were brought to the spot, all crowding in, and beseeching at the same time for assistance.

Had there, Dr. Taylor says, been more means of keeping order and arrangement, much more might have been done: as it was, much mischief arose from parties of other regiments, and even officers coming to the rear; and in spite of remonstrances, taking away the doolies, and helping themselves to the water.

Darkness having set in, the candles were lighted, in order that the medical officers might continue their attendance upon the wounded. It was found that these lights attracted the fire of the enemy: orders were accordingly received to extinguish these, and for the hospital to join its regiment.

With the few doolies it was impossible to move all the wounded. Ammunition camels, officers' horses, and stray horses were all employed, yet some of the hopelessly wounded had to be left where they lay. On the way to the regiment, many other wounded men were passed, all of whom implored to be taken on. This could not be done, but fifteen were collected to one spot in the trenches, and there left with a view to be removed early the succeeding morning; soon after day light however, these men were found murdered, and with their throats cut.

As Dr. Taylor and his establishments were in the dark, endeavouring to find their regiment, they were fired upon by the enemy. The natives immediately threw down their *petarahs* with instruments and every thing else, and made off; every particle of hospital equipment was lost in the dark, and the wounded were dispersed. At last the regiment was found; the men bivouacing, silent, and without light; but nothing more could be done for the wounded that night.

On the succeeding morning, the regiment speedily retook the enemy's camp, on the other side of which it then occupied a position at a distance of more than a mile from where it had bivouaced. During this advance, many wounded as well as dead were passed, but to the former little relief could be administered, and the renewal of the fight about mid-day prevented them from being collected.

On the 23rd however, parties were out all day collecting the wounded, who were being sent as collected to Ferozepore, on hackeries; and the whole of the hospital establishments from Moodkee having now been brought on to that place, the men all received every assistance. It may be of importance to note moreover, that of 29 officers and 761 rank and file who entered the battle of Ferozeshah, 3 of the former were killed, and 3 wounded. Of the latter, there were killed 52, and wounded 234, making a rate of casualties among officers, of 20·7 per cent., and among men, of 30·75.

On 10th February, 1846, the day of the battle of Sobraon, the 29th regiment was under arms at 4 A. M., and at day break the battle commenced.

About noon, this regiment came into action. It had in order to reach the batteries, to traverse about a mile, and in doing this, and capturing the battery opposed to it, there were out of 30 officers, 1 killed, and 13 wounded, and out of 508 men, 35 killed, and 128 wounded; that is, of casualties, 46·6 per cent. of the former, and 32 per cent. of the latter.

The wounded on this occasion also were removed to Ferozepore, and soon afterwards, on the declaration of peace, as many

as required to be sent away, proceeded down the Indus by boats, and embarked for England.

Dr. Taylor gives an account of the occurrence of hospital gangrene among the wounded at Ferozepore, attributing the disease to the circumstance of the large number of injured persons who were crowded into the hospital and barrack buildings at that place.

APPENDIX B.

Instructions to medical officers preparatory to entering action, by Dr. H. B. Macleod, Superintending Surgeon, Army of the Sutlej.

1. He invites all medical officers to meet him to organize some plan of combined action.

2. A convenient spot, such as a village or dry nullah, out of the immediate range of shot to be selected; here senior medical officers to assemble, provided with instruments; here the first succour to be given, and operations that are necessary performed, and cases selected for conveyance to the receiving hospital in the rear.

3. Medical officers to see to the state of their instruments.

4. Each medical officer will place such instruments, appliances, medicines, and comforts, as he may require, in a dooly distinguished by a flag, and placed under the charge of the hospital sergeant, who will prevent it from being taken away under any pretence whatever.

5. Each medical officer to have upon his own person a pocket case of instruments and a flask of brandy.

6. Some arrangement should be made so as to have ready a light and portable operating table.

7. Field tourniquets should be distributed to non-commissioned officers and intelligent privates.

8. The water carrier should be present with an ample supply of water.

APPENDIX C.

On the transit of troops from Nova Scotia to Canada.

In the Departmental Blue Book for 1862, is an interesting account by Inspector General Muir, C. B., of the measures used in transporting from Nova Scotia to Canada, the troops

who were dispatched from England on the occurrence of the "Trent" affair. A brief abstract of these is here given.

In little more than a month, a force of over 7,000 men fully equipped for service was landed from England. With a view to the accommodation of these men at halting places on the way between St. John's and Riviere-du-loup; it was at first intended to erect shanties or log huts; it was found however, that the men could be comfortably billetted at the different places of this nature; with the exceptions of Petersville and St. Francis. Huts were accordingly erected at these two places.

The men had in England been supplied with warm clothing, consisting of a seal-skin cap with ear lappets; a woollen comforter; two woollen jerseys; two pairs woollen drawers; chamois leather vest; two pairs long woollen stockings, seal-skin mits, and a pair of jack boots; a pair of blankets; and a pair of mocassins were added at St. John's, and the sleighs in which the men were to travel, provided with two or more buffalo robes each.

A quarter of a pound of meat was added to the daily ration, and half a gill of rum included.

Each sleigh capable of containing eight men was drawn by two horses; the men sat *vis a vis*; the bottom of the conveyance being filled with hay or straw. The men were made to pass from a warm room into the sleighs, and during transit were encouraged to get out and run along side.

They generally started at 7 to 9 A. M., reaching their halting place about 5 P. M. They had a hot meal before starting, another with tea or coffee at noon, and a hot substantial supper awaited them at their billets, prepared by stationary cooks, or cooks sent on in advance; rum on arrival was served out to them at noon or at supper.

The men moved in detachments of 150, with their proper proportion of officers. Small hospital establishments were formed at each of the nightly halting places; in addition, each detachment was accompanied by a medical officer, who carrried a small supply of medicines and medical comforts.

If no medical officer was available, these were entrusted to the care of the officer commanding.

When the number of medical officers admitted of one being stationed at each of the mid-day halting places, this was done.

During the time that the troops were being moved in this way; that is, from 6th January to 10th March the weather was very cold; the thermometer having once

indicated—25° F., but as there was little wind, this intense cold was little felt.

By means of telegraphic communication, reports were hourly received of the progress of each detachment, and the movements of others were thus regulated.

So good was the health of the men while in transit, that of 6,818 men and officers, not more than 70 required attendance, and only four men died, namely, two *from drinking*, one from pneumonia, and one whose disease is returned enteritis. Eleven cases of frostbite occurred, and the other attacks seem to have been mild ones of diarrhœa.

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R.

S.