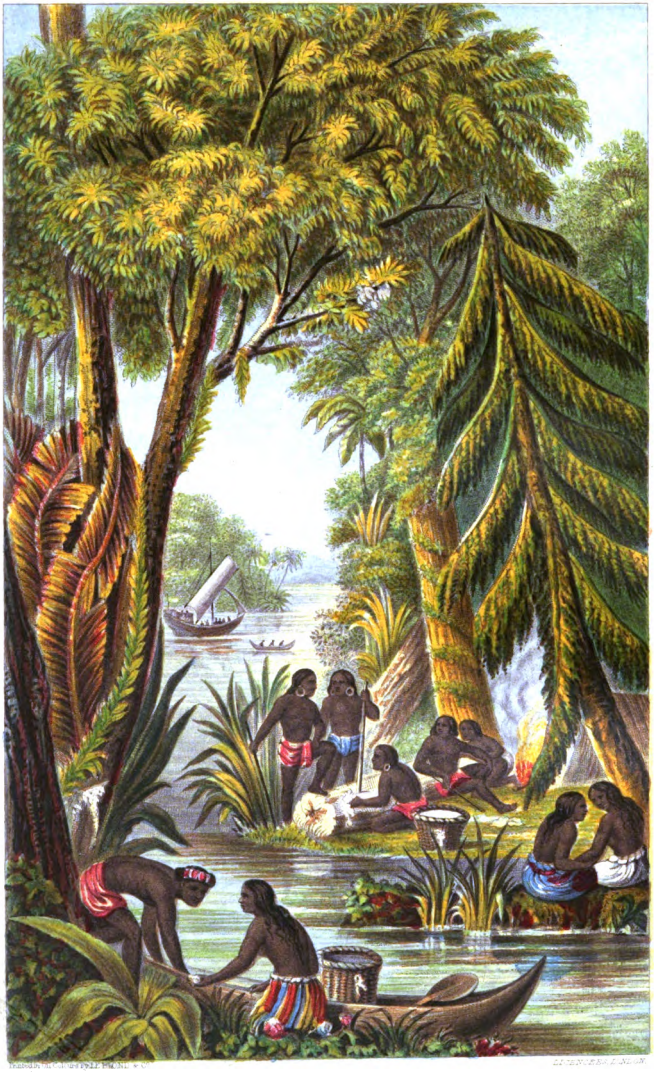

THE GATHERING OF GUTTA PERCHA.

GUTTA PERCHA,

ITS

DISCOVERY, HISTORY,

AND

MANIFOLD USES.

ILLUSTRATED BY

AN ENGRAVING IN OIL COLOURS

AND SIXTY ENGRAVINGS ON WOOD.

LONDON:
BENJAMIN L. GREEN, 62, PATERNOSTER ROW.
1851.

LONDON:
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MARK LANE.

CONTENTS.

LIST OF ENGRAVINGS.

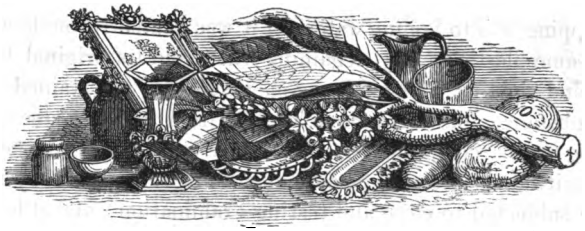

Fig. 1. Group of Gutta Percha Manufactures.

GUTTA PERCHA:

ITS DISCOVERY, HISTORY, AND MANIFOLD USES.

I.

LITTLE more than seven years have elapsed since the discovery of Gutta Percha. During this time it has come into more various use, perhaps, than any other substance existing; and yet it is comparatively but little known. Many persons still look upon it as a curiosity, and regard its applications as amusing toys. Others value it chiefly as a protection against wet feet; or, at most, as an assistance to the deaf. We hope to show that it is much more than this, that the practical are far more concerned in it than the curious, and that there is reason to anticipate its becoming, before another seven years have run out, an article of domestic and daily use in every house in England.

Like many other useful substances and inventions, Gutta Percha seems to have had two discoverers about the same time. The one was Mr. Thomas Lobb, an agent of the well-known florists, Messrs. Veitch of Exeter, who visited the East Indies, on a botanical mission, in the year 1842 or 1843. The other was Dr. Montgomerie, assistant-surgeon to the Residency of Singapore, on the Malay peninsula. He observed one day, in the hand of a native woodsman, a parang, or wood-chopper, the handle of which was composed of a singular looking substance. This excited his curiosity. "I questioned the workman," says the doctor, "in whose possession I saw it, and heard that the material of which it was framed could be moulded into any form

by dipping it into boiling water till it was heated through, when it became plastic as clay, regaining when cold its original hardness and rigidity." Dr. Montgomerie further ascertained that the substance, like caoutchouc, exuded from a forest-tree; and having procured specimens in various stages of preparation, transmitted them to the Society of Arts in London. They were there subjected to close and testing examination; and at length the gold medal of the Society was awarded to the doctor, as for a very valuable discovery. Scientific men speedily perceived a few of the great capabilities of Gutta Percha, and a demand for it commenced, which has now created an important trade; the annual importations amounting to many hundreds of tons.

It should be mentioned that *Percha** is the Malay name for the tree itself, *Gutta* for the derived substance. Our young school-boy friends will, perhaps, suggest that "gutta" in Latin signifies "drop," and conclude that the word was therefore adopted by our learned men to denote the *droppings* of the tree. This will be a mistake, however. The likeness to the Latin word is only a coincidence. "Gutta," like "percha," is pure Malay. The material, so fast coming into English use, cannot boast an English name!

The extent of territory occupied by the Percha tree, in its several varieties, it is impossible even to guess. It is known to abound not only on the Malay peninsula, but in the neighbouring island of Singapore, in Borneo also, and other islands of the vast Oriental Archipelago. The old Arabian explorers of the East, declared with somewhat of hyperbole, that those sunny seas were studded by "Twelve thousand isles;" and it is probable that the tree is scattered over half a million square miles of territory. Little fear, therefore, of the supply becoming exhausted! At present, however, the trade is almost confined to the settlement and island of Singapore. "It is singular enough," writes the *Examiner*, "that although the Portuguese, Dutch, and English had, one or other of them, been nearly three centuries and a half on the spot where the tree grows, its valuable produce became known to Europeans only in 1843." The tree is ranked by

* The *ch* is soft.

botanists among *sapotaceous* plants; *i.e.* those that exude a milky sap. The woodcut on next page represents its leaves, flowers, and fruit; and our frontispiece* admirably delineates its noble and beautiful aspect, as it towers above the other trees of the tropical forest. The fruit appears to yield a "concrete and edible oil, used by the natives with their food," likewise, a kind of ardent spirit; and other accounts represent the flowers as being also employed as articles of diet. The wood, being soft and spongy, is of little use as timber.

The sap, or *gutta*, circulates between the bark and body of the tree, in vessels whose course is marked by black longitudinal lines upon the wood. The milky fluid exudes from notches cut at intervals down the trunk, and is received in vessels where it immediately coagulates. It was formerly the custom to fell the trees before collecting the juice; but this plan is now proved as unnecessary as it is wasteful, the notches neither injuring the tree, nor preventing a second accumulation of sap. The Gutta Percha Company have wisely embarked a considerable capital in seeking to promote the "tapping," instead of the "felling" of the trees. The thickened fluid, before finally hardening, is kneaded into compact oblong masses, generally about half a cubic foot in size. This part of the work is performed by women, as represented in the frontispiece, which faithfully depicts, not only the ordinary appearance of the native Malays, but the character of the internal forest scenery of the magnificent islands which they inhabit. The blocks made up for exportation are not always of one shape. The eccentricity or genius of some barbarian forester will sometimes vary them amusingly. We have seen one fashioned into

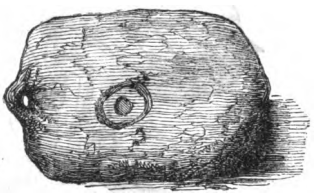

Fig. 2. Block of Gutta Percha.

* Copied from a large oil painting executed by Mr. E. M. Granville, a talented young artist of Bristol. The painting is now in the possession of the Gutta Percha Company, 18, Wharf Road, City Road, London.

It is a question indeed whether the composition of the two substances is not precisely the same, the small quantity of oxygen detected in Gutta Percha being derived from the air during the process of purification. "Exposed to a temperature of 248°, it melts, and in cooling, remains in a semi-fluid adhesive state, partially decomposed in fact, and when set on fire it burns very readily with a dense smoke." At a temperature of about 200° it becomes soft and ductile, though without stickiness, and can be moulded into any shape, which it retains on cooling. In its solid state it is far more rigid than caoutchouc, being only slightly elastic. Its specific gravity is ·975, that of water being 1·000. Its tenacity and durability are extraordinary; indeed when it does at length wear out it may be renovated and re-manufactured. It is repellant of, and completely unaffected by, cold, fresh or salt water, or damp. Of heat and electricity it is a non-conductor. It is alkali and acid proof, being affected only by *highly concentrated* sulphuric and nitric acid. The most powerful acetic, hydro-fluoric, and muriatic acids and chlorine have no injurious effect upon it. Its power of resisting frost is extraordinary. And of its singular acoustic properties we shall speak more at large, a little further on.

II.

Having been permitted to inspect the Gutta Percha Company's extensive works, (Wharf Road, City Road, *London*), we are enabled to give a brief sketch of the method in which the raw material is purified and prepared for use, which may be amusing to our readers. The process is in many parts highly ingenious. First of all, the blocks are taken to the *cutting machine*, a large solid disc of iron revolving vertically at the rate of 200 turns a minute, against the extremity of a sloping iron table. Three sharp knives, projecting somewhat like the iron of a carpenter's plane, are set upon its surface. The block of Gutta Percha placed upon the table slides down to the disc, where it is caught by the knives and rapidly sliced into shavings, which fall into a receptacle beneath. This

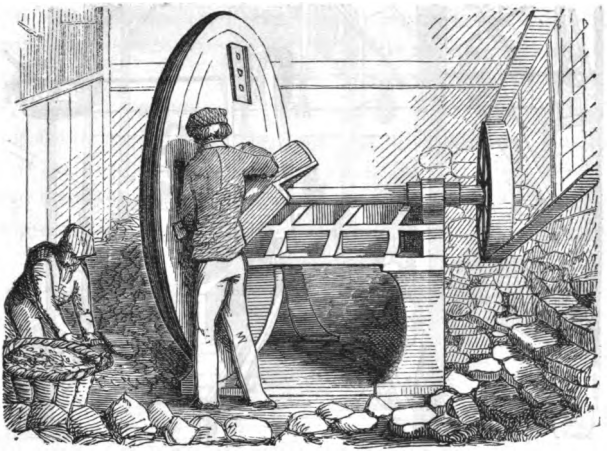

Fig. 5. Cutting Machine.

apparatus, it should be remarked, as well as most other parts of the machinery, is set in motion by two steam-engines of fifty horse power, the boilers of which, constructed under a recent patent, evaporate *eleven* lbs. of water to *one* lb. of coal, and very effectually consume their own smoke.

Fig. 6. Slice of Gutta Percha.

It is next necessary to separate the pure material from the dirt and other extraneous material with which Malay carelessness has mingled it. This is no easy matter, Gutta Percha being one of the most tenacious of substances. The slices are first thrown into great tanks, to which the waste steam of the engine is conveyed, for the purpose of boiling. This process softens the whole into one mass, and separates the more considerable impurities, which are left at the bottom of the vats. It is next thrown into what some of our northern manufacturing friends call a "teaser," a sort of large circular box, containing a cylinder or "drum," set all over with rows of bent jagged teeth, which is made to revolve at the rate of from 600

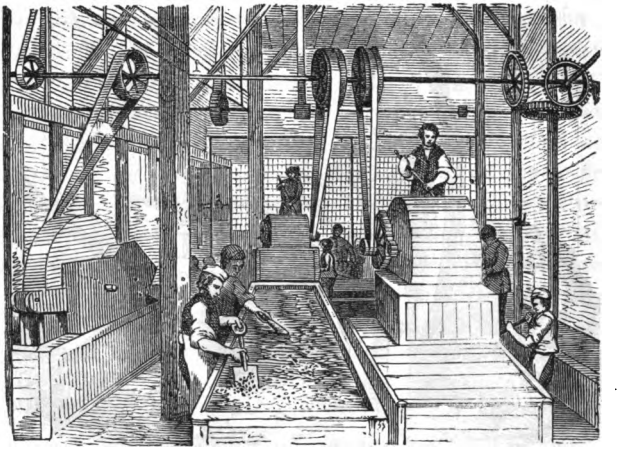

Fig. 7. Teaser.

to 800 turns in a minute, and of course tears the material all to shreds. These fall into a vat of water underneath. Here the Gutta Percha being lighter than water floats upon the surface, while the impurities disengaged from it by the rough handling it has just undergone, sink to the bottom. The purification is thus completely effected, and the fragments of Gutta Percha, crisp and clean, are ready for the next operation.

A second boiling follows, which has the effect of blending the purified substance again into a warm soft mass. In this state it is handed over to the "kneaders," as they are quaintly called. Not indeed of the "softer sex;" for these "industrious housewives" are nothing else than "thick, strong, round iron boxes, about three feet long, and a foot and a half deep." They occupy the floor at one end of the spacious apartment, and one observer, at least, has compared their appearance to "a large family of iron bolsters." Perhaps their gentle name has been bestowed upon them from their office, which is to *knead* the material into a compact and homogeneous body. They are also called "masticators" for the same reason. The warm ductile mass, placed inside the box, is received by a revolving drum, kept hot by steam, with a cogged surface, by which it is carried

round and squeezed up very forcibly against the sides of its narrow tenement. So powerful indeed is the pressure, that the door of the "masticator" needs to be doubly secured, or it would be forced from its hinges. This operation thoroughly expels every air bubble, solves every knotty point, and reduces the Gutta Percha to a uniform consistency.

The kneaded mass is now carried to the "rolling machine." This precisely resembles what many of our readers have seen in

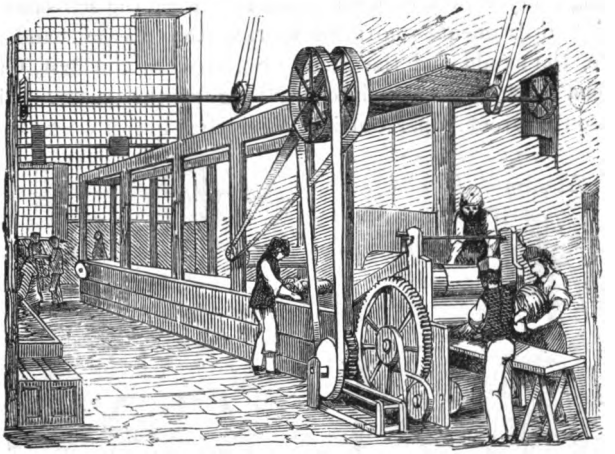

Fig. 8. Rolling Machine.

a paper-mill. The Gutta Percha, placed on bands of felt, is passed between large steel cylinders, distant from each other by the thickness required; and after a long journey, up and down, over and under, in the course of which it gradually cools and hardens, appears at the other end a smooth firm flat sheet, and is wound upon a drum till the requisite length has been worked off. Any thickness may by this means be attained, down to the extreme tenuity of the "Gutta Percha tissue," so successfully employed as a substitute for oiled silk, hydropathic bandages, &c. If the sheet should be too thick to cool by merely ravelling the distance, it is blown upon as it passes, by a fan like that of the winnowing machine.

It is here that the operation of cutting into longitudinal strips is performed. When these are required, the sheet just

before quitting the machine encounters a range of knives set upright in a frame, edge foremost, distant from each other by the breadth wanted. These slice the material, without interrupting its progress, into bands, which as before are severally wound upon a drum.

The sheeting thus prepared, is susceptible of an almost infinite diversity of treatment. And accordingly several busy workshops are crowded with artizans, actively engaged in producing every variety of form and article with the self-same all-potent instruments—BOILING WATER, the plastic hand, the knife, the mould and the press. Softened by the first, Gutta Percha may be turned into anything by the latter. Here Wilson's Patent Paper Cutting Machine is in full work, shear-

Fig. 9. Cutting and Stamping Room.

ing through a heap of broad stout bands to divide them into squares for shoe-soles; there a sharp edged frame is borne down upon piles of these square pieces, cutting out the soles themselves, in half-dozens at a time. There workmen at revolving tables bearing inverted iron moulds, are turning out buckets, bowls, bottles, "sou-westers," and cabmen's hats!—Others are modelling bosses for flax-mills, pump-buckets, rings, whips and cricket-balls. Elsewhere, cord and even thread are being manufactured with curious ingenuity. A stamp bearing

Fig. 10. Bucket without Seam.

Fig. 11. Cornish Miner's Hat.

Fig. 12. Sou-Wester.

a number of sharp close parallel lines is brought down upon a sheet of Gutta Percha, so as to cut it nearly through. The narrow slips are then severally torn off and polished up by hand for use. In another apartment cisterns, trunks for emigrants, and even gentlemen's portmanteaus are being lined. Then words would fail to describe the variety and elegance of the ornamental mouldings, medallions, pen-trays, bread trenchers, picture frames, ink-stands, watch stands, and fancy

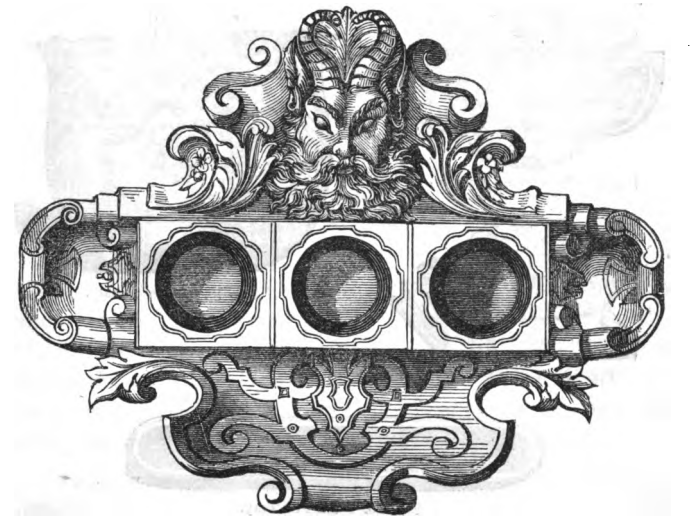

Fig. 13, Library Inkstand.

Fig. 14, School Ink Stand.

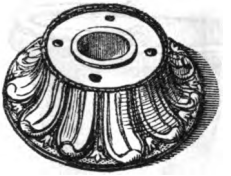

Fig. 15. Round Inkstand.

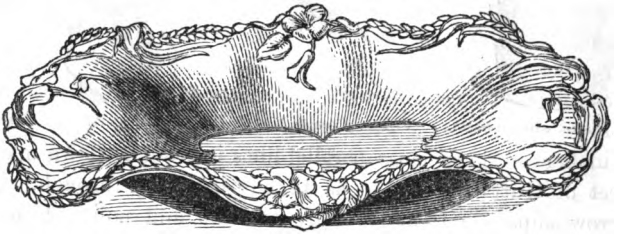

Fig. 16. Bread Tray.

Fig. 17. Two-hole Inkstand.

Fig. 19. Fancy Basket.

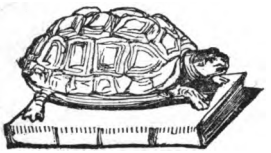

Fig. 18. Tortoise Inkstand.

Fig. 20. Plain Pen Tray.

baskets, which are being stamped from electrotyped copper dies, or smaller wooden moulds. These moulds, we may remark, are all made upon the premises—a business of itself—and many of them display not only the hand of the skilful copyist, but the original mind of the artist. The beautiful lustrous surface that many specimens display, and the variegated imitation marble of others, are imparted by chemical means. A fine smoothness, however, is produced by mere manipulation. One medallion that we saw interested us much. It contained an excellent likeness of the late Louis Philippe. The original medal was struck to commemorate the passing of the law regarding Railways, June 11, 1842, and bears on the reverse, together with an allegorical design, the appropriate motto, "DANT IGNOTAS MARTI NOVASQUE MERCURIO ALAS." * Only three impressions were taken, when the die was destroyed. One of the three however, came into the hands of a gentleman, who has kindly allowed it to be perpetuated in Gutta Percha.

The manufacture of tubing occupies a department by itself. The process is most simple and ingenious. A mass of the softened material is forced by a piston through a steel cylinder, terminating in a mould that consists of a solid circular piece of metal set within an iron tube, the space between the two being the thickness required. The Gutta Percha thus plainly leaves the mould in a tubular shape, but would as evidently collapse at once unless subjected, until it cools, to an even pressure both within and without. To accomplish this, it is received from the mould into a canal of water about fifty feet in length, along which it travels, being wound off at the other end. The water, filling up the interior, and pressing equally upon the exterior, preserves the tube in perfect shape and cools it into hardness. The "feeding" cylinder is so contrived that no pause occurs in the transmission of the material; and a tube of 500 feet has been manufactured without a single break, being the longest ever made of any substance whatever.

* "They (railways) give to Mars unheard-of speed, and to Mercury new swiftness."

III.

We proceed now to speak of a few of the principal uses to which Gutta Percha has been applied.

One of the first, and still perhaps the most extensive, is that of soleing shoes. For this it possesses a combination of properties that make it especially suitable. It is a bad conductor of heat; a Gutta Percha sole therefore, is cool in summer and warm in winter. It is a repellant of moisture, the sole therefore does not, like those of cork or hair, absorb the dampness of the atmosphere. It is a non-conductor of electricity, and this we believe, is of no small importance in its bearing upon health. The durability of Gutta Percha, its cheapness, and the ease with which the sole may be securely fastened upon any shoe, new or old, add much to these recommendations. It is true there have been disappointments; and that a prejudice has been raised. The advocates of Gutta Percha must expect to hear that there is NOTHING LIKE LEATHER. Sometimes, no doubt, the sole has peeled off. This, however, has always arisen *from its not having been put on properly.* There is a right and a wrong way of doing every thing. Where the directions are exactly followed, there will be no danger of this kind. Mr. Thomas Horlock, a shoemaker, at Uxbridge, has however, recently published a method of attaching the sole, which appears even more simple and secure than the former plan. He says:—"The method which I wish more especially to introduce to your notice, is more mechanical in its principle, and consequently, more to be depended on, and more easily accomplished; and by which you may attach Gutta Percha soles with as much certainty as you can the leather sole to the upper, with awl and end. I found it out quite by accident, of which I will give you the particulars, as it will help you the better to understand it. One day, as I was about to put a new pair of Gutta Percha soles on some strong boots, on trying to pull off the remains of the old Gutta Percha soles, I found, that even with the aid of my pincers, I could scarcely tear them away. I could not imagine what made the Gutta Percha stick so fast to the leather sole, but on examining, I found that

some *holes* made by pulling out several nails in the original sole, had got *filled up* with the Gutta Percha, thus forming so many rivets, or keys which locked the two soles together. It at once occurred to me that this plan might be adopted with great advantage by making holes over the entire sole, and having made a suitable tool out of an old file, I at once reduced it to practice, and found it to succeed, even beyond my expectations,—since I adopted it, not one pair has failed out of some hundreds."*

One great advantage, experienced by the shoemaker himself, we may just refer to. The LEATHER SOLER stoops to pursue his work, and in many cases suffers from a contracted chest; while the GUTTA PERCHA SOLER stands upright, and works with ease and comfort.

Fig. 21, Leather Soleing.

Fig. 22, Gutta Percha Soleing.

It has been objected that Gutta Percha soles will soften and become sticky before the fire. No doubt they will! They are not intended to be laid before the fire, but for damp, wet, out-of-door work. Gentlemen who put their feet on the hob should do it in slippers. It is singular, when an article is re-

* The tools required for Mr. Horlock's method are very simple, and engravings of them with full directions are given in his tract: "A few words to Journeymen Shoemakers about Gutta Percha."—Published by W. Strange, London.

commended as an antidote to cold, to reply that it will not stand fire! As to the suspicion, now and then expressed, that in some cases, the ordinary warmth of the atmosphere will injuriously soften these soles, it is sufficient to say, that Gutta Percha is constantly used and found to maintain its rigidity in the tropical heat of its native countries. It requires, in fact, a far higher temperature than the atmosphere ever gains in any quarter of the globe to soften it, when used as a shoe sole.

A feeling against these soles once arose from a singular circumstance. It should be known that Gutta Percha, like leather, improves by keeping. The soles therefore are generally retained in the Gutta Percha Company's warehouses at least twelve months before distribution to the dealers. In 1848, however, it happened that the stock became exhausted by the rapidly increasing demand. The requirements of customers made it necessary, though against the wishes of the Company, to infringe upon the reserve. A quantity of Gutta Percha imperfectly seasoned thus came into the market. It did not wear well. The report then became current that it was adulterated. Others proclaimed its failure. And in many quarters it gained an undeserved bad name, which for aught we know may cling to it to this very day.

Thus much for objections. On the other hand we have seen hosts of testimonials from medical and non-professional men, attesting in the strongest terms the value of Gutta Percha soles. The prevention of chilblains, and of the many diseases that arise from damp or chilled feet, is unanimously ascribed to them. Several physicians of eminence state that they constantly wear these soles; one "would not on any account be without them." Another "likes them equally well for summer and winter wear, a little difference in the thickness only being desirable." Another "considers Gutta Percha soles in every respect, as valuable and as necessary to health *as is flannel.*" Another has "used them with very gratifying results for about two years, and" he adds, "I never send my little boy to boarding school without a good supply of them, and always strongly recommend them to my patients and friends." Another has caused all the soldiers of a regiment (the 33rd) "to be supplied with Gutta Percha soles

from the regimental stores." The testimonial of the Governor of the great Greenwich Naval School, shows them to be in constant use by 800 boys; in every kind of weather, and in all descriptions of gymnastic exercise, with the happiest effect upon

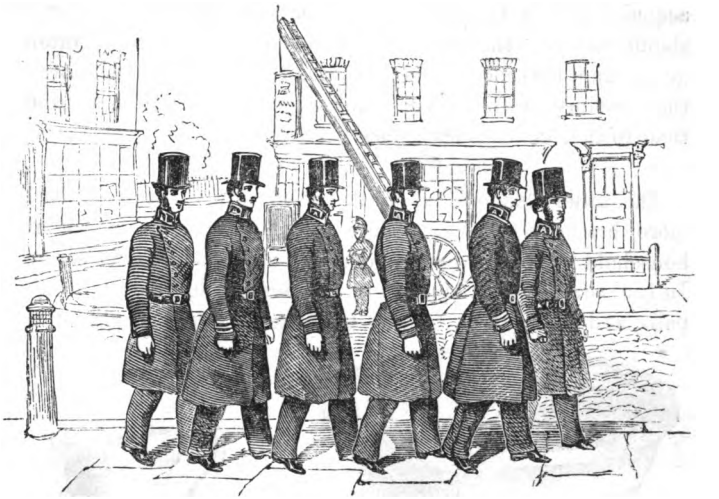

Fig. 23, Police at Liverpool.

health and comfort. Nineteen officers of the Liverpool Police force, who have for a length of time worn Gutta Percha soles, say,—"Being daily on duty in all weathers, we have had ample opportunity of testing them; and not only have we derived great comfort from their wear, in consequence of their keeping the *feet so warm and dry*, but from their cheapness and great durability, we find them much more economical than leather soles." And lastly, Sir John Ross gives this among his reminiscences of the Polar regions; "I have worn patent Gutta Percha soles during the last two years, and have found them most valuable for preserving the feet dry and warm. They are very superior to leather, being not only perfectly waterproof, but also more durable and cheaper. To sailors, especially those proceeding to the Arctic regions, Gutta Percha will prove a *warm friend*, owing to its peculiar property of resisting the frost."

One of the medical men above quoted suggests, "the art of putting it on is so easily acquired, that if the trade will not do

it satisfactorily, *the public may do it for themselves.*" Happily this difficulty is diminishing every day, and seems likely before long to disappear. Mr. Horlock's advice to brethren of his craft is wise: to dismiss prejudice, to make themselves fairly acquainted with the claims of this new substance, and if these should approve themselves, to adopt it in the spirit of intelligence and enterprise, seeing that after all it belongs more to the province of shoemakers, and might be more to their profit, than to that of any other class.

IV.

The other domestic applications of Gutta Percha must be more briefly dismissed. There is not a department of the household where its versatile qualities might not render service. In the SCULLERY, it appears in the form of light and durable pails, and bowls that cannot be broken. The bucket of the

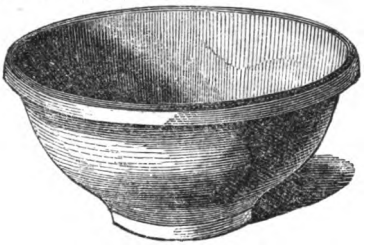

Fig. 24, Bowl.

Fig. 25, Mug.

Fig. 26, Clothes-line.

pump is made of it; and in the corner lies a coil of clothes-line which no amount of bad weather can spoil. On the shelves of the KITCHEN we see the handsome bread trencher manufactured by the Gutta Percha Company, bearing embossed upon its ample rim the emblematic ears of corn. Beside it are ranged a set of imitation vine-leaf dessert plates, of a rich green colour. And

Fig. 27, Bread Trencher.

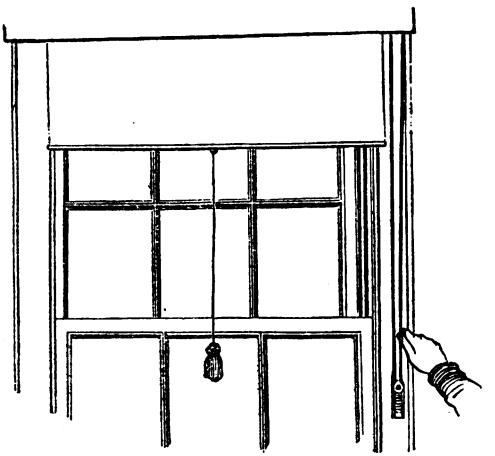

Fig. 28, Window Blind Cord.

there stands a vessel that would be a drinking *horn* if it were not of Gutta Percha. Into the NURSERY itself this material has found its way. That doll which so resolutely preserves its form and beauty, however tossed about by its little proprietress, or roughly handled by the baby brothers, is of Gutta Percha, coloured for the purpose. There, too, lies a Gutta Percha ball, as light and elastic as childish heart could wish. Indeed the desideratum of indestructible playthings bids fair to be attained! In the PARLOUR, the cord of the window blinds and the rings of the curtains are of Gutta Percha. The former is cleanly, lasting, neatly joined, and does not stretch with use; the latter glide noiselessly along the pole, a merit which the nervous, the aged,

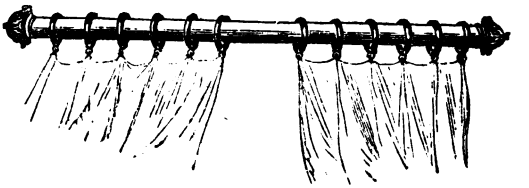

Fig. 29, Curtain Rings.

and the weak will estimate. The card-tray on the centre table,

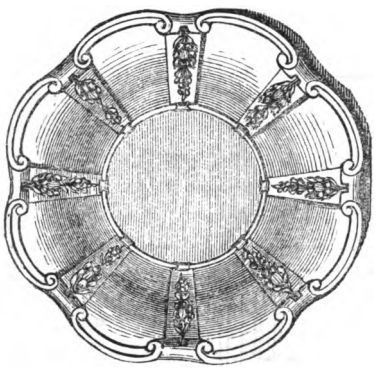

Fig. 30, Card Tray, Fruit Pattern.

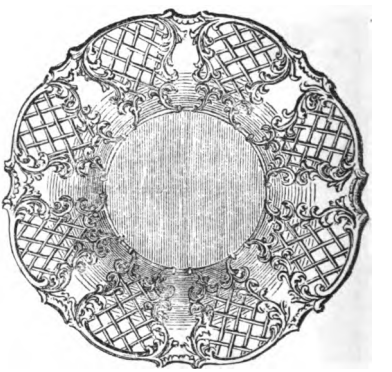

Fig. 31, Round Card Tray.

the inkstand on the cheffonier, the watch-stand on the mantelpiece, and the flower-stand in the window, are all modelled of the same material.

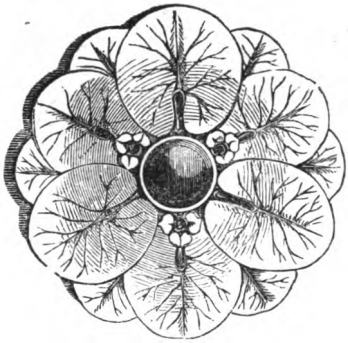

Fig. 32, Lily Inkstand.

Fig. 33, Watch Stand.

Those elegant picture frames, that elaborate cornice above the window curtains, that neat centre piece on the ceiling, and those massive brackets in each recess, all of which so nearly resemble the most exquisite wood carving, are of nothing more than Gutta Percha. And the difference of tint, from that of burnt wood to that of polished marble, is as surprising as the variety of form. In the DRAWING

Fig. 34, Stag's-head Bracket.

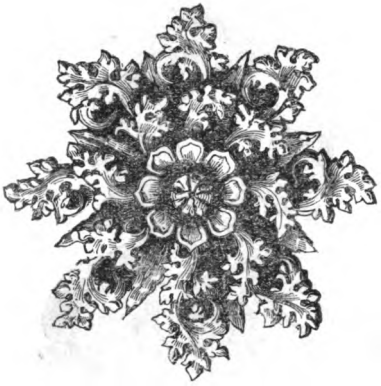

Fig. 35, Centre Piece.

Fig. 36, Bracket.

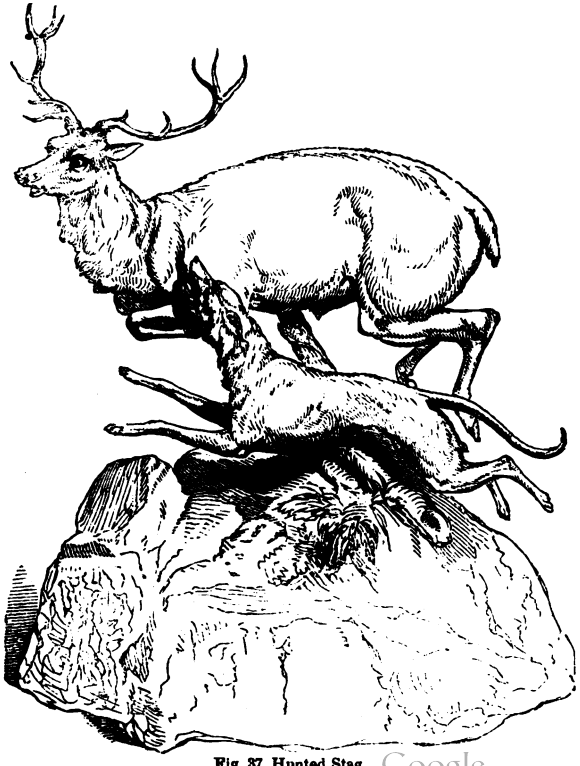

Fig. 37, Hunted Stag.

ROOM we see a statuette of elaborate finish, representing 'THE HUNTED STAG,' the *chef d'ouvre* of the Gutta Percha Company's Modelling; and an elegant flower-stand.

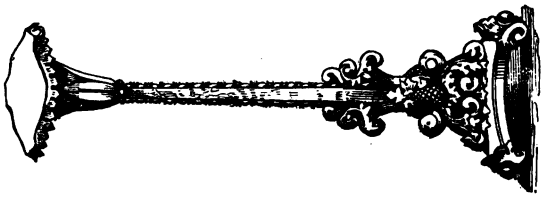

Fig. 39, Flower Stand.

Enter the STUDY, and beside applications similar to the foregoing, we perceive Gutta Percha paper-weights, pen-trays,

Fig. 39, Paper Weight.

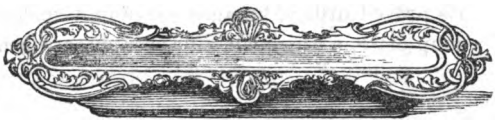

Fig. 40, Ornamental Pen Tray.

portfolios, and envelope boxes. A folio Bible, with handsome embossed Gutta Percha back and cover, lies on the side table, and near it stands a splendid globe engraved in relievo for the

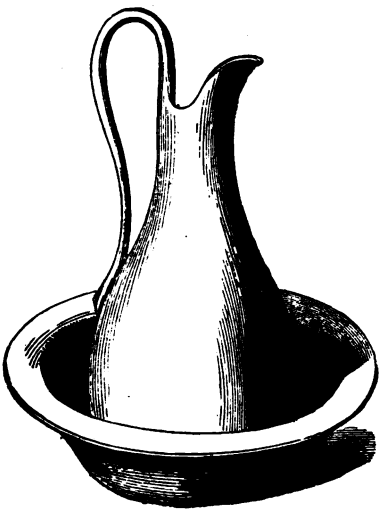

Fig. 41, Basin and Ewer.

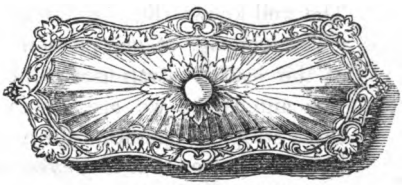

Fig. 42, Tooth Brush Tray.

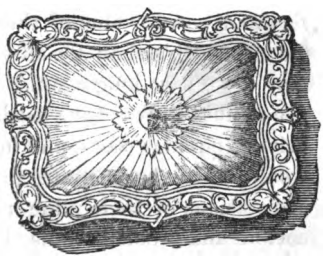

Fig. 43, Soap Tray.

use of the blind. In the BED-ROOM, it appears in the moulded frame of the looking-glass, and—instead of earthenware—in tooth and soap brush trays, a washing bason, ewer, and footbath. Then not to mention other uses, should there be unfortunately a room in the house with damp walls, the "Gutta Percha paper" effectually prevents the evil, and if placed underneath other papers, preserves them from discolouration and decay.

It is nevertheless important to bear in mind the one circumstance that limits the use of this material. It will not do where the employment of *heat* is necessary. This we have heard called a "fatal objection" to the value of Gutta Percha. As if we were to decline its employment in the thousand cases of its proved utility, because we cannot make of it a tea-cup or a soup-plate, a saucepan, a fire-screen, a warming-pan, or a poker!

V.

From the house we proceed to the *manufactory*, where the use of Gutta Percha, though similarly limited, is almost as various. Its chief value here perhaps is in the form of *mill bands* and *driving straps*. For this purpose it is unquestionably far more durable, more easily joined, and cheaper than leather. The well-known firm of Truman, Hanbury, Buxton & Co., say, "The stoppage of one portion of our works through the failure of the leather strap used to be of daily occurrence, but with this annoyance we are now never troubled. We have had these straps in operation for nearly three years, and are assured by our engineer that *they effect a saving to us of at least* THIRTY POUNDS *a-year*." Abernethy & Co., ironfounders of Aberdeen, write, "We have now had Gutta Percha bands working here *for three years*. One of them has been driving the fan blast for our smith's shop for all that time, and for anything we see, may drive it as long again. The speed of the fan is about 1200 per minute. We have used them with complete satisfaction, driving circular saws, and in some cases where leather bands would have been quite inapplicable from damp." Similar attestations of their value might be given from railway works, cotton and woollen mills, bleach and dye works, ship yards,

saw mills, brick yards, corn and paper mills. Where cross bands are used, care must be taken that they do not rub; otherwise the friction will create the heat which is so fatal to the use of Gutta Percha. The "Patent Gutta Percha *Packing*," for steam-engines, &c., will also be found more durable and economical than any other at present in use. Its preparation is peculiar, as it resists the action of heat. With regard to the value of Gutta Percha for the *clacks of cold water pumps*, the following letter will speak for itself:—

November 22nd, 1850.

DEAR SIR,

In November 1848, we got a small piece of Gutta Percha from you, which cost 1s. 6d. We have used it in the clack of a 9-inch cold water pump for two years. The engine has been constantly worked, and when the Gutta Percha gave way, as it sometimes does in the course of working, the same piece was heated, and again put into use. This practice has continued for the time stated above. Now we found that Ben leather, *best quality*, which we used previously for twenty years, had to be renewed on an average every two or three weeks, the annual cost of which was from 25s. to 30s.

(*Signed,*) THE LANCEFIELD SPINNING CO.
Per JAMES CRAIG, JUN.

To MR. S. WILSON, Candleriggs, Glasgow.

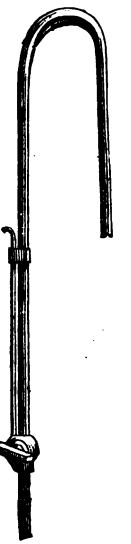

Fig. 44, Syphon.

It is extensively used, also, for *bosses* for flax and woollen manufacturers, flax-holders, shuttle-beds, bobbins, felt edging for paper-makers, washers, &c. Also, for funnels, syphons, bowls, ladles, oil-cans, "and many other articles too numerous to mention."

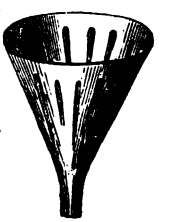

Fig. 4, Fluted Funnel.

VI.

The SURGICAL applications of Gutta Percha are highly valuable. W. Lyon, Esq., Senior Surgeon to the Glasgow Infirmary, recommends its use for splints in cases of club-foot, simple and compound fractures, necrosis, amputations, and diseased articulations. His paper on the subject, which contains a very full account of the methods of application, may be found in "Ranking's Half-yearly Abstract of the Medical Science," vol. viii. Art. 60.* Alfred Smee, Esq., F.R.S., Surgeon to the Bank of England, attests its "great value" in cases of scrofulous joints, fractures, divided tendons, and severe sprains." William Bird Herapath, Esq., Surgeon to St. Peter's and Queen Elizabeth's Hospitals, Bristol, writes:—

"As a means of applying splints to fractures or dislocations, or to severe sprains requiring mechanical support, its excellencies are unrivalled. The facility with which it can be cut, moulded, or fashioned to suit our purposes, completely sets the carpenter at nought, and enables us to save many valuable hours when called to casualties requiring immediate attention. To the surgeon in country practice it is invaluable."

Similar testimony from many other practitioners might be adduced. That of F. Stainton Hodge, Esq., Surgeon, is remarkable. He says,—"I hereby certify that I have, during a stay of six weeks in Calcutta, in several cases used Gutta Percha (which I took with me from England) for Splints, *and did not find it in any way affected by the temperature, which was, on an average, ninety-two up to ninety-seven*, and can safely recommend them to surgeons in general."

In the form of thin sheeting, Gutta Percha has also been used with very great advantage as a substitute for oiled silk, both in ordinary and hydropathic practice. Its extreme tenuity and lightness, its non-conducting properties, it being not only perfectly waterproof, but unaffected by acid or metallic preparation, such as are often used in lotions, &c., together with its

* It is republished by Watson, Kirby Street, Hatton Garden, in a Pamphlet, entitled "Gutta Percha for Surgical Purposes."

great cheapness, are recommendations that will be obvious. The sheeting forms also "an excellent substitute for cotton or linen, to spread adhesive plaister, or soap plaister upon, as cold water can be used to lower the temperature about a wound, without loosening the strips of plaister by which the edges are kept together." Gutta Percha dissolved in chloroform is also itself an admirable plaister for cuts and wounds. A few drops of the solution being applied, the chloroform quickly evaporates, and leaves the Gutta Percha dry behind, in the form of a thin skin, or tissue, which firmly unites the edges of the wound, and though almost invisible, effectually preserves it from the air until the cure is effected. This solution is sold as a "patent medicine," under the name of *Traumaticine*.

For *Stethescopes* this material is coming into extensive use. Dr. Benson of Dublin thus writes:—

"I prefer the Gutta Percha Stethescope to every other. It conducts the sounds, both of the organs of respiration and of circulation, as least as well as any other instrument, whilst it has advantages over all in the following particulars:

'*First.*—It is lighter than any other.

'*Second.*—It is not so easily broken or injured.

'*Third.*—It is a bad conductor of caloric, and therefore does not feel so cold to the patient's chest, nor to my own ear.

'*Fourth.*—And not being so hard as wood, it does not hurt the patient so much even when pressed strongly against the chest.'

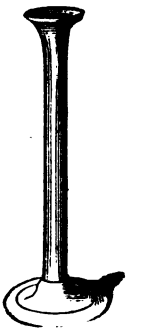

Fig. 46, Stethescope.

"I have now been using the same instrument for twelve months, and find it as good as at first. I cannot say that any other instrument served me so long and so satisfactorily—some were cracked by a fall, of others I lost the ear-piece—or the screw of the ear-piece got out of order."

Dr. Foucart (the gentleman in whose arms Sir Robert Peel expired) has invented a most ingenious Clavicular Splint made of Gutta Percha. Its peculiar advantages are, that it can be *instantly* applied in case of the dislocation of the arm,

thus saving the patient from much suffering; whilst, from the lightness of the material, the inconvenience arising from the old wooden and iron splints is avoided. The following sketch will give our readers a view of the splint when applied to a patient. Gutta Percha has also been employed with success for catheters, &c. A pamphlet, before quoted, further remarks—

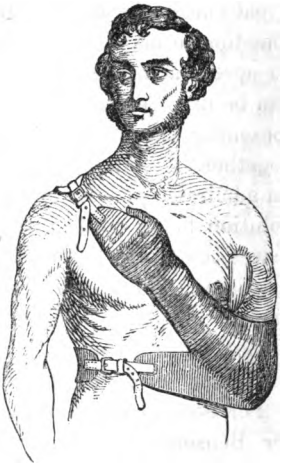

Fig. 47, Clavicular Splint.

"The Gutta Percha Pessaries, (particularly Coxeter's Patent,) and Bedpans, may be confidently recommended by surgeons to their patients —their use will at once prove their superiority over those ordinarily employed. The non-affection of Gutta Percha by acids or alkalies renders it especially adapted for any chemical purposes, and Mr. Herapath makes the following remark—

'With respect to Gutta Percha as an article to supply our

Fig. 48, Acid Pourers.

wants instead of earthenware, I am sure it will only have to be known to be appreciated highly; no fractures can occur, however roughly the utensils may be used.'"

The last observation is one which managers of lunatic asylums or prisons will especially know how to estimate.

In Dental Surgery, Gutta Percha promises to effect remarkable improvements. It has long been in use for filling teeth, and has been employed in the fabrication of false palates. But it is

in the construction of the bed and sockets for artificial teeth that the dentist will find its real value. Mr. Edwin Truman of the Haymarket, has invented and patented a process, by which the requisite firmness, durability, certainty of fit, and comfort to the wearer are attained with great success. He uses the pure white Gutta Percha,* moulding it over a frame of gold wire, by which the teeth are held in place, and plating with gold every part of the surface that is subject to friction from the tongue or cheeks. The Gutta Percha, unlike other vegetable substances and ivory, is completely unaffected by saliva or acid, while its economy and lightness give it obvious advantage over gold itself. A full and interesting account of the process has been printed, entitled, "The Construction of Artificial Teeth considered, with a view to the introduction of the patent Auroplastic principle." Licences to work it are granted on easy terms by the patentee to respectable members of the profession. Mr. Truman very properly says: "I should not have patented the invention, but that I was determined it should not be in the hands of those who have no right to the name of dentists. The cheapness of the Gutta Percha would have led to much mal-practice and imposition; and that which is good would, from mis-use and want of skill in the application, have been lost to the dentist, by falling into bad repute."

VII.

In connexion with the practice of CHEMICAL and ELECTRICAL Science, this substance possesses obvious and peculiar advantages. Here we may be allowed to quote from a paper of great value, "On the Scientific Applications of Gutta Percha," read by Mr. H. Mercer, before the Liverpool Chemists' Association, in September last. He says, "For ladleing or pumping the caustic alkalies it supersedes the iron ladles, the lead or iron pump barrels, the leather clacks and buckets, and makes very good and durable washers for metal pipes, and lining for

* This is important. We have heard complaints of the Gutta Percha used for filling teeth becoming offensive; in these cases it has turned out that the material used was defective in purity.

spouts, or may used as piping or spouts itself, if need be. Though carbonized by sulphuric acid, it is of such little consequence, that Mr. Gibbs, of the Bristol vitriol works, uses it in his pumps for buckets, instead of leather, and finds it more economical; as, while the very best leather required renewing twice a week at least, the Gutta Percha will stand the same wear and tear for three months without any repair. For dilute nitric acid, it is used by the gold refiners to line the various vessels used in the refining process; and by calico printers to cover the rollers on which the patterns are etched, an application for which it is well adapted. Its resistance of the action of iodine and bromine, enables the daguerreotypist to use it for his iodizing and bromine pans; an application particularly valuable to those migrating photographers who are continually complaining of the damage and breakage to which their apparatus is subject. For fluoric acid it will make excellent bottles; and, I am sure, no one will regret the absence of those annoying lead bottles we have always been obliged to put up with, and which were almost as often to be found empty as full, if kept long in stock. But of all chemical processes, that to which it is best adapted, and for which it is coming into most extensive use, is that of holding muriatic acid, instead of glass carboys or leaden cisterns. This application was made at the suggestion of Mr. Wilson, the manager of Price's Patent Candle Company, where large quantities of this acid are used, and which had to be carried in glass carboys from Messrs. Muspratt's works, here in Liverpool. Several wine-pipes were lined, and carboys made, which have answered the most sanguine expectations; and now there are continually pipes of muriatic acid travelling along the railways! Messrs. Muspratt say, they feel convinced that no manufacturer will, in a short time, use any other material but Gutta Percha for the conveyance of muriatic acid. For vinegar casks, and oil cisterns, it might be advantageously employed; for funnels, syphons, capping for jars and bottles, &c., it answers well."

Electrically, its variety of service is even greater, from its excellent non-conducting properties. It is curious, however

that some pieces of Gutta Percha are better non-conductors than others. Professor Faraday attributes this fact to there being a little free moisture sometimes worked up with it, which of course, injures its insulating powers. It is advisable, therefore, to employ pieces specially manufactured for electrical purposes. "When heated before the fire, and kneaded by the fingers, it will insulate as well as shellac, and without its brittleness and liability to break." This property is strikingly illustrated by a fact observed by Mr. Brunton, chemist to the Gutta Percha Company. "By connecting one pole of a galvanic battery with the earth, and asking a spectator to touch a wire from the other pole, if the party wear Gutta Percha soles and heels he will not receive any shock; if leather soles or heels, the circuit will be completed, and the party show the usual symptoms of having been electrified. Mr. Statham very much astonishes visitors by taking, or refusing to take the shock at pleasure; he contrives to do this by standing on his Gutta Percha soles one moment, and on his leather heels the next!" Gutta Percha would also excellently answer for the disc of a plate electrifying machine, or even the cylinder of the ordinary one, as it is a remarkably good excitant of electricity. Sparks may be produced in a dark room, and all the phenomena of attraction and repulsion shown, by simply rubbing a piece of the Gutta Percha tissue with a silk handkerchief. For insulating stools, handles of discharging rods, and even Leyden phials and battery cells, it answers exceedingly well.

To the *Electrotypist*, Gutta Percha is of peculiar service. Mr. Mercer says:—"For taking moulds of casts or medallions, he could not have a better thing; the impression it takes is so exceedingly sharp, and being unaffected by acid or mineral salts, may remain any length of time in the battery without the least injury. And as a covering for the battery itself, I let a practical electrotypist give his own opinion; it is Mr. Palmer, Electrotypist to the three National Art Unions. He says:—'The advantages to me as an electrotypist, by the use of Gutta Percha, have been very great, by its protecting properties from acids. Before our troughs were lined with Gutta Percha, we

could not long keep the acid from the wood; and when once it entered, a leakage soon followed, and the atmosphere in our battery rooms became so impure that our health was affected; we were continually having new troughs, batteries, and other wood vessels, which led to a very serious expense: these losses have been avoided by the use of Gutta Percha, and so valuable is the article, in my estimation, for chemical and other purposes, that we have abandoned the use of wood, glass, and earthenware, in every thing to which Gutta Percha can be applied.'"

VIII.

We shall speak of the Electric Telegraph presently. Meanwhile we notice another class of applications of Gutta Percha, especially in the form of tubing, which in these days of scientific drainage and sanitary reform, promise to be as useful as they are opportune. The adaptation of this material for the conveyance of WATER was early seen. For this it is fitted not only by its non-absorbing qualities, but by its extraordinary strength. A ¾ inch pipe has resisted a pressure of 337 lbs. on the square inch. At Stirling, a pressure of 450 lbs., which "burst the rivets of the leather hose, and scattered them in all directions," produced no perceptible effect upon an inch-and-a-half pipe of Gutta Percha. Its power of resisting frost adds to its value—water taking three times as long to freeze in Gutta Percha as it does in lead. There is also no apprehension of these tubes bursting in case of a sudden thaw. Moreover, which is of far greater importance, Gutta Percha delivers and retains the water *in a state of perfect purity*. Every one ought to know, that the carbonic acid, or fixed air in water, decomposes lead pipes, and creates a powerful poison. The purer the water, *i. e.* the more free from saline ingredients, the more rapid is the destruction of the lead. At Woburn Abbey, the leaden pipes of the works used to be eaten through by the water in less than two years. At Ventnor, "Sir Raymond Jarvis, having occasion to repair the pumps which supply his mansion, found to his amazement, that the large leaden feeding-pipe was almost

entirely eaten away by the water, and *the interior covered with a white poisonous crust.*" In each case the lead has been replaced by Gutta Percha. At Claremont Palace, our readers will remember, how thirteen of the household of Louis Philippe became dangerously affected, and the ex-king with his suite were compelled to remove to Richmond. The cause was ascertained to be the impregnation of the water with lead, at the rate of a grain to a gallon! It is impossible not to believe that there are many similar but unsuspected instances. Of the greatest importance is it, therefore, that a material so dangerous should be superseded. And not in tubing alone; Gutta Percha is equally useful in the *lining of cisterns.* At first, indeed, some disagreeable flavour is slightly communicated to the water; but this speedily disappears. Baths might also be cased with it; indeed we have heard of a gentleman whose portmanteau, lined with Gutta Percha, was made to answer the double purpose of a splash-bath in the morning, and (speedily drying) of a receptacle of his clothes during the day! For other purposes where tubing is required for the conveyance of water, as in watering gardens, sprinkling water in malting, washing windows and carriages, &c., Gutta Percha is found very serviceable. It is also used for the stowage, transmission, or spreading of *liquid manure* upon farms. As it is completely unaffected by animal salts, tanks lined with the material will contain the manure for any length of time. And from the strength and flexibility of the tubing, it is employed as hose to discharge the liquid over the field. Indeed, to use the words of the *Ayr Advertiser*, "before Gutta Percha came into use, a few years ago, such a plan could not have been adopted. It is the *only substance* known that combines the essential requisites." In "high farming," therefore, it would seem indispensable; not to mention its other agricultural uses, as in the form of light whips, traces, &c., which make it at least a candidate for the oft-claimed title of the "Farmer's Friend."

IX.

Gutta Percha is as impervious to salt water as to fresh. Manifold, therefore, are its uses on shipboard. For buckets, basins, flasks, bowls, &c., it will before long be regarded as a *sine quâ non* by every shipmaster. In the form of life-buoys, it will doubtless save many persons from an ocean grave. These buoys, which have nearly double the buoyancy of those made of cork, "are made in four air-tight compartments, so that in the event of one failing, the buoyancy is not destroyed." It may be worth while to suggest that on an emergency a couple of equal sized bowls would make a very effectual buoy. Place their edges for a minute upon the steam-boiler, or other heated surface, then clap them together; they will instantly adhere, speedily cool and harden, and the hollow air-tight vessel thus extemporized would be buoyant enough to sustain one or two persons in the water for a considerable time.

The late expeditions in search of Sir John Franklin have proved the value of Gutta Percha in a remarkable manner. Each of them took out sledge boats of this substance for use among the masses of ice. Fitted with a skate, the boat served as a sledge; floated, it would carry five or six persons with ample provision; at other times it might be folded up, or converted into a wrapper or bed tent, safe against the cold, that three or four men might sleep under. Its weight was only *eighteen pounds!* Well might Captain Forsyth, the Captain of "Lady Franklin's Expedition," say, "The Gutta Percha boat proved an invaluable acquisition." Moreover, after undergoing all the rough work of the voyage, "it returned to England not in the least damaged, and in almost as good condition as when she left." For ordinary life-boats we need not say that Gutta Percha must prove very useful. Beside their buoyancy, they cannot be stove in by rocks, &c. No ship, in fact, should go to sea without them.

Mr. Snow, who went out in the Prince Albert Expedition, has given a most favourable report of the Gutta Percha boat used in that expedition, which we extract from the *Illustrated London News* of February 22nd, 1851.

"The value of Gutta Percha as an article applied to boats, could, perhaps, never have been better tested than during the late voyage of the *Prince Albert* in search of Sir John Franklin; and I feel very great pleasure in giving my humble testimony to its undoubted merits. Having, in almost every instance, had charge of the Gutta Percha Boat,* in the various examinations of the coast we made, and in rough passages through the ice, I had good and ample opportunities of giving her a fair trial, and the result was highly satisfactory. As an article with which I had previously been but little acquainted, I was at first cautious in the extreme, whenever I was away in that particular boat; but at last, I preferred her to any other, and would not have hesitated to have gone any distance for any length of time in her. The men (old whalers, long accustomed to the ice) in like manner gave her the preference, and considered her far superior for such service to the ordinary boats generally used.

"The first trial she received was off the Greenland coast, when we were surrounded by icebergs. I proceeded in her to a large berg, for the purpose of procuring water, and it was found that she pulled lightly, and swam as buoyantly as we could wish. The various pieces of ice that she unavoidably ran against did her no injury, and they glided past her without leaving the slightest indentation or mark of the contact.

"On the night of the 17th July I again had an opportunity of testing her qualities. In searching for the Danish settlement of Upernavick, I proceeded in her for several miles through the various inlets and channels abounding in the "Woman Islands." On one occasion I had her pulled up high on the rocky beach, while landing to examine, and I could not perceive the slightest mark of a scratch, from the rough nature of her bed, such as an ordinary boat would have received if I had attempted the same with it. Upon returning to the ship, we ran through a small stream of rather close ice, and I was agreeably surprised to find how quietly the Gutta Percha appeared to slip through it, and how well it resisted the different attacks it received. As a memorial of our visit, and the value we attached to the article of which our boat was made, the inlet we were then making our way through was called "GUTTA PERCHA INLET;" a name it will no doubt always retain, and be remembered by among whalers.

"Frequently after this the boat was in use, and principally among heavy ice. Indeed, when one boat alone was required, the Gutta Percha boat was that invariably used. Every one saw its superiority to the ordinary boats; and it was kept incessantly at work, boring, breaking, and crossing the ice at all times.

"But the severest trial it endured, and endured successfully, was on both my

* "The wooden work of this boat was constructed by Messrs. Searle & Co., of South Lambeth. The covering with Gutta Percha was done at the Gutta Percha Company's Works, Wharf Road, City Road, London."

visits to Whaler Point, Port Leopold. To those unaccustomed to the nature of such ice as was there met with, it will be impossible fully to conceive the position a boat was placed in. The mere transit to and fro among loose masses of ice, with the sea in a state of quiescence, would have been quite enough to have proved or not the value of Gutta Percha boats; but when, as in the present case, those masses were all in restless agitation, with a sea rolling in upon an opposing current, it might have been well excused—and without deteriorating from the previously attested goodness of the article—if it had not been able to have resisted the severe shocks it received. My first visit was difficult enough, but the second was far worse; and nothing but the exigencies of the service would have warranted me in attempting to force a way as I did. My dependence, however, was upon the already well-tried qualities of the boat. Sliding through and over the ice; sometimes lifted completely out of the water by the sudden contact of a restless floe; and at others thrown sideways upon an adjoining craggy piece, I think it would have been next to impossible for any other kind of boat to have been otherwise than crushed or stove on the instant. The sketch I have forwarded to you will convey some faint idea of this. The weather was rather foggy, and it was very early in the morning. The men were fatigued with their night's work, and I was anxious to give them a little rest on the shore, as well as again to examine the locality. Accordingly, I endeavoured to get across the barrier of ice that intervened as well as I could; and the position

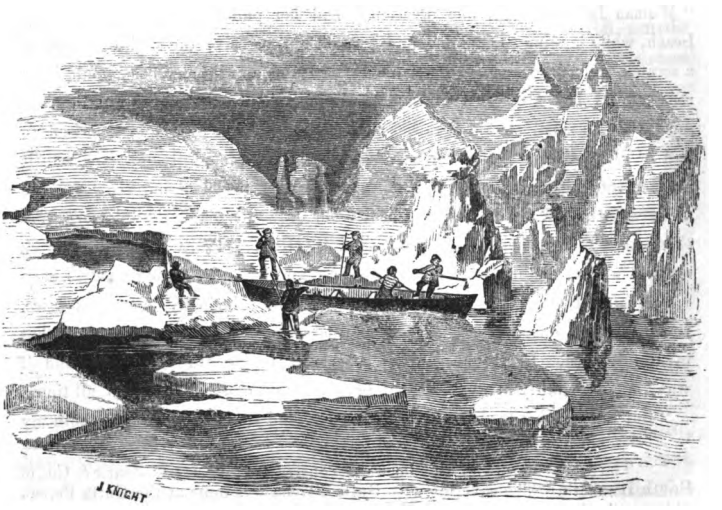

Fig. 49, Gutta Percha Boat.

—of which the sketch gives an idea—was one where the boat is suddenly jammed between two floes, but is raising herself upwards by the Gutta Percha resisting the first blow, and sliding along and over the lowest piece on its left bow. One man is assisting her by trying to haul her along; two others are guarding her ribs with boat-hooks and ice-poles; another prising her stern off from a small berg; while I am directing the movements necessary to get her onward. My published journal will give any more details, and it will only be necessary for me to say here, that she got across and came out again without the slightest injury; and though we, of course, took all the necessary care to prevent that injury, yet my conviction is that *no other but the Gutta Percha boat could have accomplished it.*

We have hitherto left unnoticed the wonderful acoustic properties of Gutta Percha. As a conductor of sound it is unrivalled. "Ear trumpets of every form and shape have been

Fig. 50, Long Ear Trumpet with Bell.

Fig. 51, Ear Trumpet.

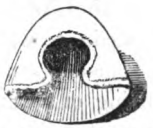

Fig. 52, Ear-cornet (Back).

Fig. 54, Ear-cornets with Steel Spring.

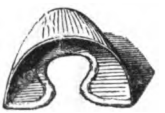

Fig. 53, Ear-cornet (Front).

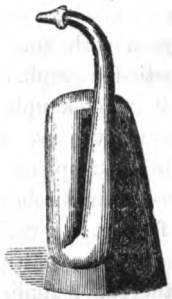

Fig. 55, Portable Ear-trumpet.

Fig. 56, Long Ear Trumpet.

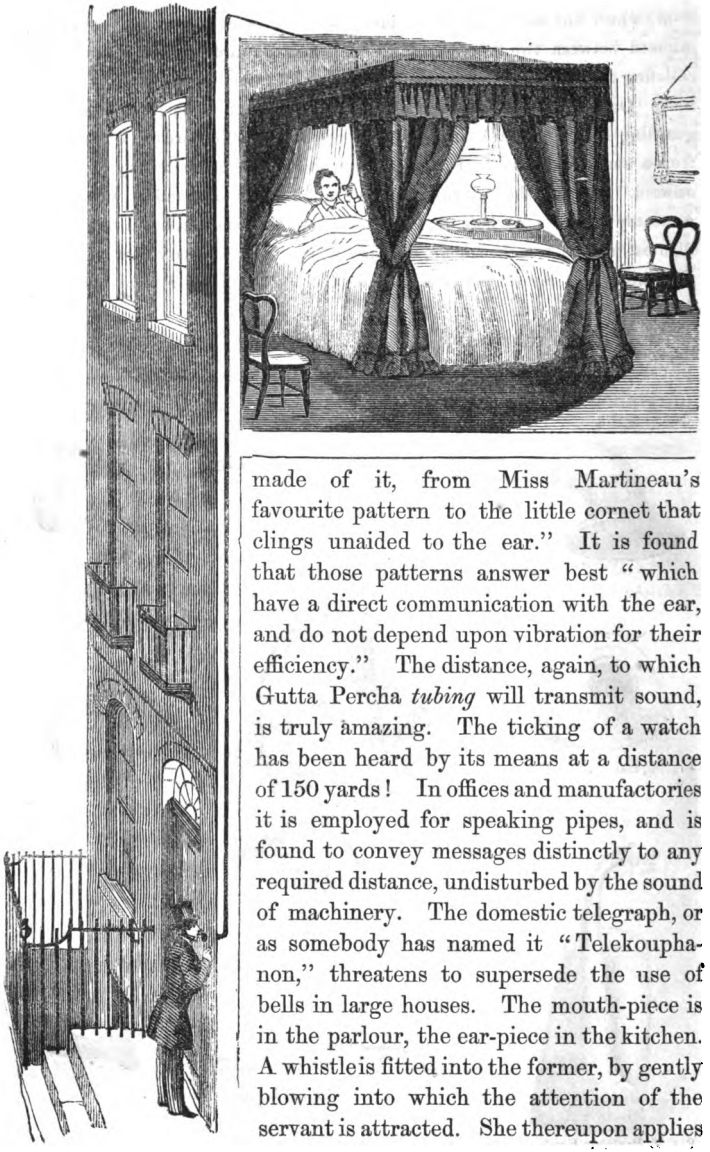

Fig. 57, The Medical Man's Midnight Friend.

made of it, from Miss Martineau's favourite pattern to the little cornet that clings unaided to the ear." It is found that those patterns answer best "which have a direct communication with the ear, and do not depend upon vibration for their efficiency." The distance, again, to which Gutta Percha *tubing* will transmit sound, is truly amazing. The ticking of a watch has been heard by its means at a distance of 150 yards! In offices and manufactories it is employed for speaking pipes, and is found to convey messages distinctly to any required distance, undisturbed by the sound of machinery. The domestic telegraph, or as somebody has named it "Telekouphanon," threatens to supersede the use of bells in large houses. The mouth-piece is in the parlour, the ear-piece in the kitchen. A whistle is fitted into the former, by gently blowing into which the attention of the servant is attracted. She thereupon applies

her ear, and the mistress gives her orders. An important saving of time and footsteps is thus effected. Another application is in what has been called the "Medical Man's Midnight Friend," as shewn in our engraving. Respecting this, H. Aston, Esq., M.R.C.S., of Walton, near Preston, writes, "I have had the Gutta Percha tubing carried from my front door to my bedroom, for the transmission of communications from patients in the night. I have it brought to my pillow, and am able with the greatest facility to hold any communication with the messenger in the street, without rising to open the window, and incurring exposure to the night air!" On shipboard, again, if a Gutta Percha tube be carried from the deck to the mast-head of a ship, a conversation may be distinctly carried on even during a storm, between the man on the look-out and the captain. It might also be used for conversation between the captain and the helmsman when in the cabin. For instant communication also from the bottom to the surface of mines in the case of danger, who can estimate its probable value, or the saving of life which it might effect!

A series of very interesting experiments have just been made on board H. M. ship *Excellent*, at Portsmouth, proving that even amid the roaring of the cannon, messages can be transmitted, or the word of command given through a Gutta Percha tube, from the quarter-deck to any part of the ship. The Admiralty have given instructions that two of the ships of the line shall be forthwith fitted up with these speaking tubes.

The hearing apparatus for churches, chapels, and other large buildings, is perhaps more widely known than any other acoustic application of Gutta Percha. From a funnel open in front of the preacher, a tube is conveyed under the wood work or floor to the pew in which the deaf person sits. An ivory terminal is fitted to the end of the tube, and on applying it to the ear every word spoken is distinctly heard. There are a host of testimonials from ministers and their deaf *hearers*, to the entire success of this plan. A lady at Preston had never heard a sermon for 20 years; Gutta Percha now places her on a level with the rest of the audience. The Duke of Devonshire, in

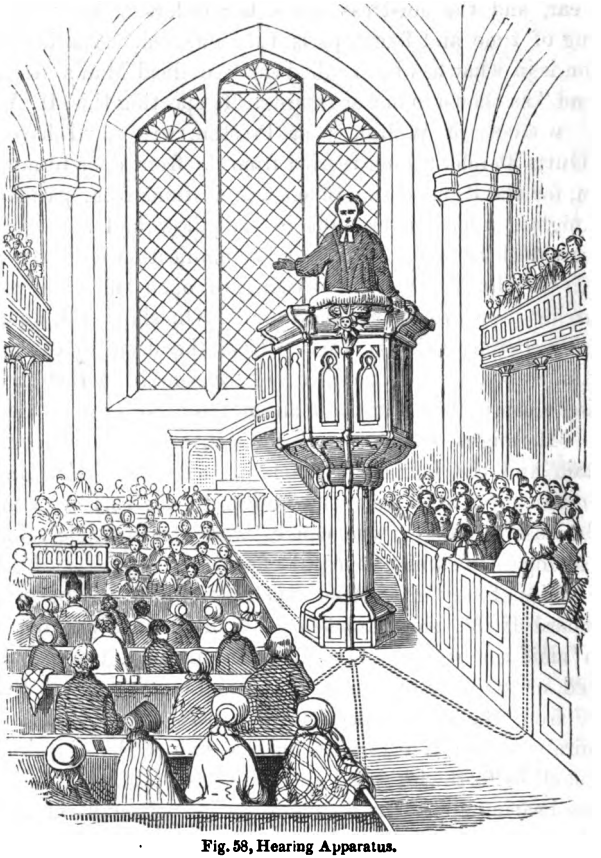

Fig. 58, Hearing Apparatus.

Lismore Cathedral, is enabled by the same assistance to hear distinctly every word of the service and the sermon, at a distance of between 30 and 40 feet from the reading desk and pulpit. In a word, many in all parts of the country "are now able to hear distinctly, to whom public worship was previously little known more than a silent homage to the Creator, and to whom public teaching was altogether inaudible."* An orna-

* Rev. H. Allon, of Islington.

mental funnel may be placed in the front of the pulpit, or, if preferred, the funnel can be concealed in the book-board.

Fig. 59, Ornamental Gutta Percha Funnel.

Mr. J. H. Heeps, of Liverpool Street, Bishopsgate Street, has fitted up what is termed "a deaf pew," in one of the provincial churches. A number of terminals are placed at equal distances around the pew, and every Sabbath now presents the gratifying sight of *eight* deaf persons seated in this pew, listening with delight to the truths of the gospel.

Fig. 60, Railway Conversation Tube.

The "railway conversation tube" is a useful application of the same principle. By its means, two persons can keep up a lively chat, and be mutually audible, though speaking in whispers, amid all the din of a railway carriage; the subjects of remark remaining all the while profound secrets to the rest of the passengers!

XI.

In conclusion, the ELECTRIC TELEGRAPH has given occasion to the crowning triumph of Gutta Percha. Our readers know the principle upon which this telegraph performs its marvels. It is simply the imperative necessity that the galvanic fluid (if it is a fluid) should pass from one pole of the battery to the other. It must also pass by a *conductor*. Let the poles

therefore be but a few inches apart, and if the nearest conductor be a wire that starts from London, and communicates with the ground at Edinburgh, or Paris, or Calcutta, by that road it will go with the swiftness of light, exciting on its way the ordinary electrical phenomena in every apparatus set to mark its progress and register its tidings, then returning straight through the earth and water. This viewless spirit, however, like more material beings, will never take more trouble than it can help, and if, consequently, it can get to the ground—by a conductor again—before it reaches its destination, it will do so and leave the messages beyond its turning point undelivered. To insulate the wire from the ground, therefore, as well as from any other body that might accomplish the too friendly purpose of a conductor back again, has been a prime concern with the constructors of electric telegraphs. No expedient so well effects this as a casing of Gutta Percha. By land it answers perfectly, along the dark damp walls of the railroad tunnel, and even when the covered wire is imbedded in the earth, as has been proved upon the London and North Western Railway. Still more remarkable is its success under water; Edward Highton, Esq., Telegraphic Engineer to the railway just mentioned, writes:—

"I have had, for experimental purposes, some of the Gutta Percha Covered Wire, laid in the German Ocean. It has now been submerged in the sea for *more than a year*. Where the wire is placed, marine insects eat away and completely destroy pine timber, of great thickness, in less than seven years. The Gutta Percha covering to the wire, however, remains *intact*, although a portion of it is fastened to timber, which, owing to the ravages of these insects, has already been renewed. Up to this period, I have every reason to be satisfied with the results of this experiment with Gutta Percha Covered Wires submerged in the sea."

Accordingly when the bold proposal came forth of uniting England and France by telegraph, it was felt at once that only by the aid of Gutta Percha could the great enterprise be accomplished.

After innumerable and delicate experiments, the plan was matured. Every imaginable precaution was taken to prevent failure.

At length, on the morning of the 28th of August, 1850, a steam vessel left Folkestone, bearing in its trail the covered wire made fast to the English shore, and in the evening the two countries were within the speaking distance of a moment.

The machinery employed in the preparation of the covered telegraph wire is highly ingenious. Two pairs of heated polished iron flatting rollers, one vertically above the other, are fed with soft Gutta Percha cylinders, which they deliver on the other side as flattened sheets. These are made to travel onward, and in the interval between them there also travels a row of copper wires. These three, *i. e.*, the parallel sheets of Gutta Percha and the intervening wires, all meet between a pair of grooved cutting rollers, not quite close together. The grooves are of course the size of the required Gutta Percha casing, and each wire precisely "hits" the centre of a groove. The whole, therefore, appears on the other side as a band of covered wires, which may either be left together, as in the telegraph for railway tunnels, &c., or pulled apart into single pieces. The wires, thus incased, are then soaked for a considerable time in water, which is sure to "find out" any flaw, though invisible to the naked eye, which might prevent complete insulation. They are afterwards individually tested by a powerful galvanic battery, when if they stand the trial, they are pronounced fit for use.

It is true that untoward accidents have for a time delayed the completion of the Submarine Telegraph. These, however, are being fast remedied. In a very short time the wire coil, doubly protected from the edge of rocks or the tricks of ignorance, will re-appear. Several lines are to be laid across the channel in cables of cocoa nut fibre; and if one should fail or be injured, the others will be ready. Probably by the time of the opening of our World's Exhibition, London may be able to converse with Paris, and our gracious Queen, if it so please her, to bid her "cousin," Louis Napoleon, to the glorious gathering. And such communication, once begun, can never stop. The greatest difficulties have been vanquished; the rest is comparatively plain. It is easier now to cross the Atlantic with the telegraph, than five years since it was to span the British

Channel. The boast of Puck is outbidden by a mightier spirit: A "girdle" will full soon be "put about the world" in far less than "forty minutes."

It is not to the eye of the man of science merely, that the Electric Telegraph is the greatest discovery of this marvellous age. The philanthropist and the Christian must more than sympathize in his exultation. For, though it is certain that no merely physical influences can effectually unite men in spiritual brotherhood, it is something to have conquered outward causes of distrust and alienation. Neighbourhood is a great reconciler. Nations, whose courts and capitals can converse together, will not be very likely to go to war. The discovery, too, has been made at a propitious time. Providence has always given such aids to progress at the period precisely needed. Thus, in this nineteenth century, when the universal heart of mankind is longing for peace, one outward help at least appears in the development of the mysterious galvanic power, and another in the discovery, amid the Eastern Seas, of that material which perfects its practical use. In like manner, we cannot doubt, that the physical and the spiritual still work together in the line of God's predetermined purposes, until the noble desires of "Festus" shall be fully realized:—

> We pray
> That all mankind may make one brotherhood,
> And love and serve each other; that all wars
> And feuds die out of nations, whether those
> Whom the sun's hot light darkens, or ourselves
> Whom he treats fairly, or the northern tribes
> Whom ceaseless snows and starry winters blench.
> Savage, or civilized, let every race,
> Red, black, or white, olive or tawny skinned,
> Settle in peace, and swell the gathering hosts
> Of the great PRINCE OF PEACE. Then all shall be
> One land, one home, one faith, one friend, one law,
> Its ruler God, its practice Righteousness,
> Its spirit Love!

RICHARD BARRETT, Printer, 13, Mark Lane, London.