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ST. GEORGE & ST. JAMES 1848



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VENTILATION ILLUSTRATED :

A Tract for the Schools

OF

RICH AND POOR.

LONDON :

JOHN CHURCHILL, PRINCES STREET, SOHO,

AND

B. WERTHEIM, ALDINE CHAMBERS, PATERNOSTER ROW.

1848.

PRICE SIXPENCE.

Frederick Shoberl, Junior, Printer to His Royal Highness Prince Albert,
51, Rupert Street, Haymarket, London.



The Samaritan Fund Committee of the St. George's and St. James's Dispensary, London, in the course of their attempts to carry out plans of Ventilation in the houses of the working classes, have met with difficulties arising from the ignorance of the landlords as well as of the tenants, concerning the necessity of providing some distinct plans of Ventilation in all inhabited rooms. The Committee have therefore felt it to be their duty to issue the present tract; and, by thus diffusing information on the important subject of Ventilation, they hope to create a want for it among all classes of the community, and especially among the working classes, who suffer so much disease from continually breathing the impure air of close and confined apartments.

JOSEPH TOYNBEE, F.R.S.,

Honorary Secretary.

Subscriptions for the Samaritan Fund are received by the Bankers, Messrs. Call and Co., Old Bond Street; by the Collectors, Mr. Mason, 16, Duke Street, Grosvenor Square, Mr. York, 16, Marshall Street, Golden Square, or by the Resident Medical Officer at the Dispensary House, 60, King Street, Golden Square.

The sick poor of St. George's and St. James's parishes should apply at the Dispensary for Ventilators on Monday, Wednesday, and Friday, at one o'clock.

VENTILATION ILLUSTRATED.

1. It has lately been found out that, up to the present time, people in all parts of the world, the rich as well as the poor, have never taken care to have enough air to breathe in their sitting-rooms, bedrooms, work-rooms, schools, churches, and shops. This want of a sufficient quantity of pure air has caused many kinds of illness, among which are Colds, Consumption, Scrofula, and Fever.¹

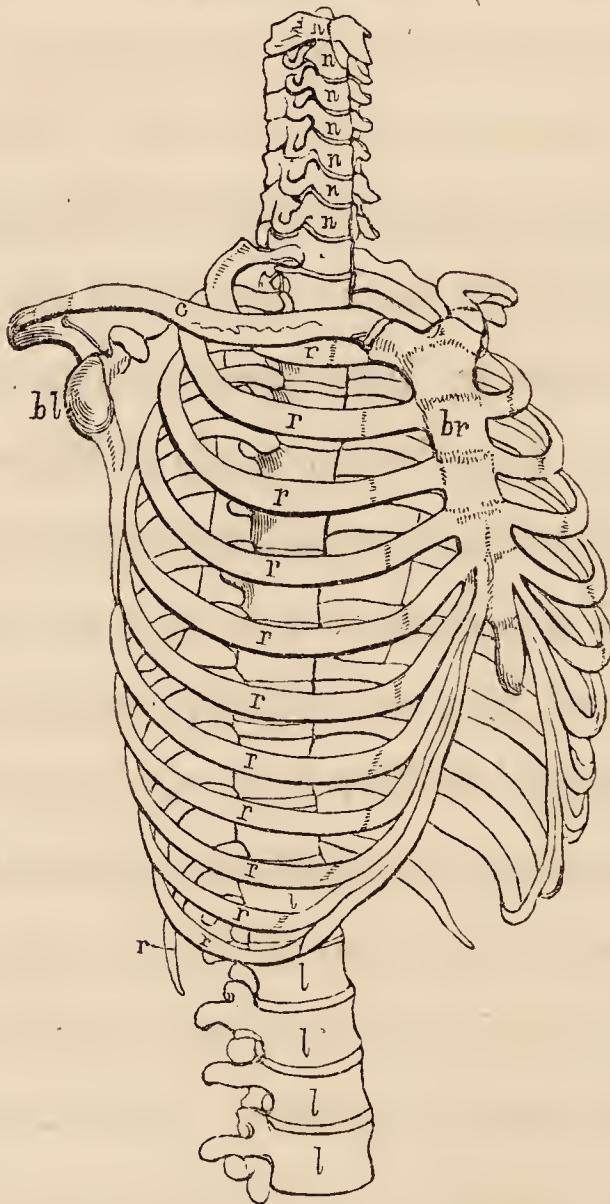
2. All men, women, and children, from the moment they are born to the time of death, are continually rendering the air impure; that is to say, they draw air into the chest, and send out bad air, many times every minute. Mr. Pepys has shown that plants thrive upon the air that has been used by

¹ See Appendix.

animals, and that the leaves are always purifying it for the use of man and beast.

3. The bony chest, which has in its inside the lungs and the heart, forms the upper half of the trunk of the body; the arms are fixed to its sides.

FIGURE 1.

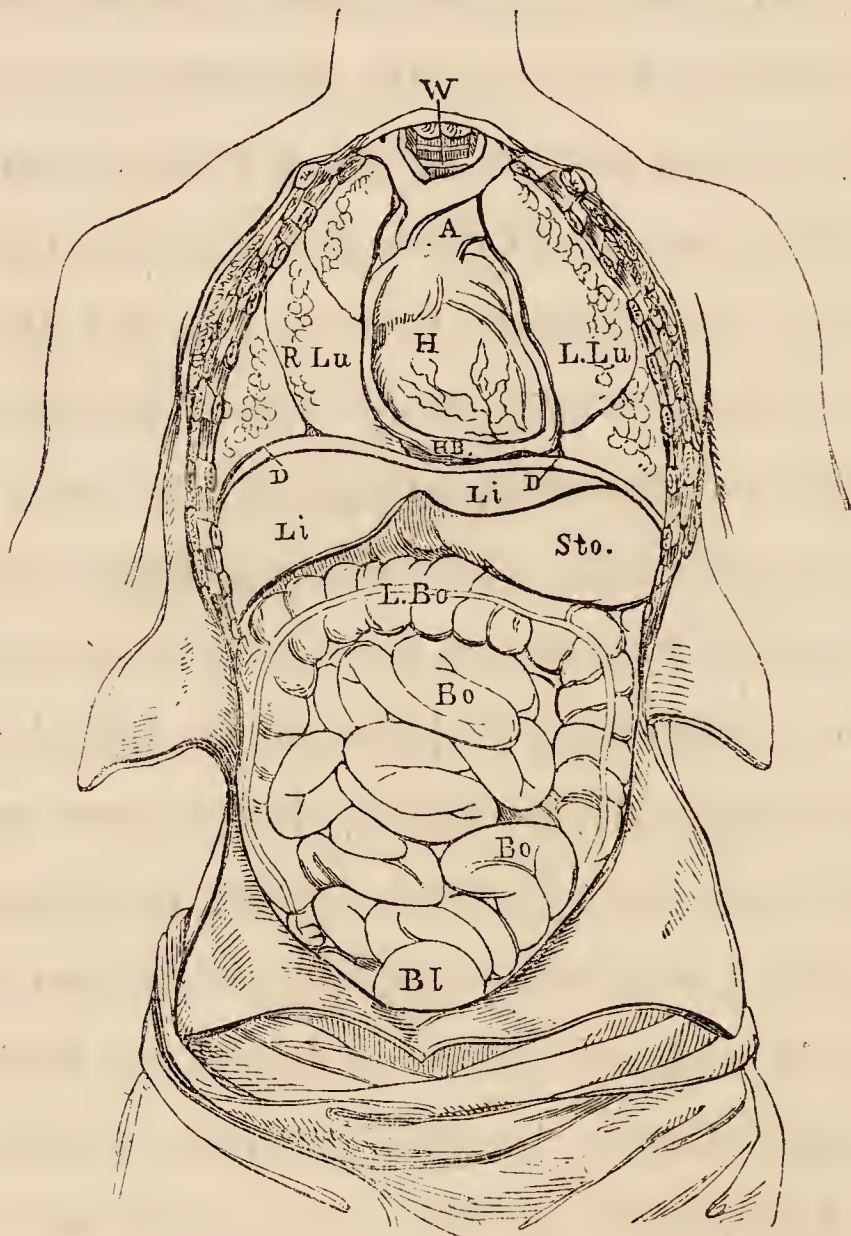


The chest (Figure 1) is made up of a great number of bones: *br*, the breast-bone, forms its front part,

the bones forming the back-bone are behind; *r, r, r,* the twelve ribs are on each side, and they are seen to join the breast-bone in front, and the small bones of the back behind. The seven bones of the neck, *n, n, n,* are at the upper part of the chest. The lower part of the chest is separated from the stomach, liver, and bowels by the midriff, or diaphragm. The five bones of the loins, *l, l, l,* form the back-bone below the chest. The collar-bone, *c,* and *bl,* the blade-bone, which form the bones of the shoulder, are at the sides of the upper part of the chest. It will be seen that the lower part of the chest is the largest part; it is also the most moveable part, and every time air is drawn into the chest it should dilate or swell out, and therefore should not be pressed upon. Every one will therefore see how hurtful stays must be, which pinch the lower part of the chest, and make it the smallest part, when Nature, in order to give us health by letting the lungs play freely, intends it to be the largest. The spine wants no aid from stays, and many ladies who have left them off feel very much better and more active, in mind as well as in body.

4. When the breast-bone and the front parts of the ribs are taken away, as in Figure 2, the chest is found to contain the heart, *H*, which in a living person can be felt to beat through the ribs on the

FIGURE 2.



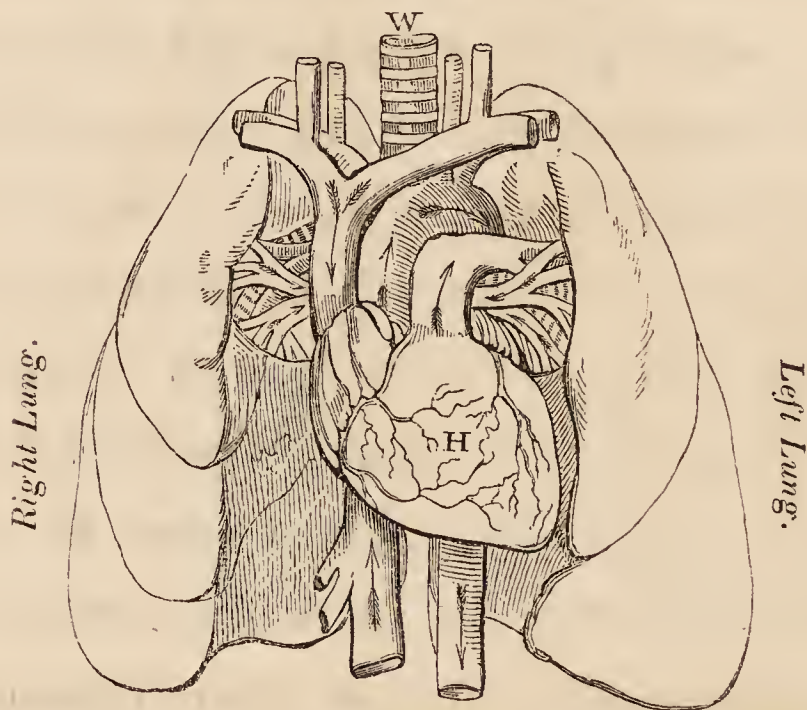
left side. The heart lies in the heart-bag, *HB*, which is cut open: from the upper part of the

heart, the large pipe *A*, the aorta, is seen to pass, which carries the blood all over the body. *W*, the windpipe, is also seen, through which the air passes, from the back of the mouth, into *R Lu*, the right lung, with its three divisions, or lobes, and into *L Lu*, the left lung, with its two lobes. Below the lungs and the heart, which lie in the chest, is *D D*, the midriff, or diaphragm, which separates the chest from the liver, *Li Li*, the stomach, *Sto*, the large bowels, *L Bo*, the small bowels, *Bo*, and the bladder, *Bl*. Upon looking at this Figure, it will be seen that the liver, stomach, and bowels, as well as the heart and the lungs, must all be pressed upon and more or less injured by the usage of stays. Mr. Whitfeld, surgeon, of Ashford, in his valuable tract on the subject of stays,¹ says:—that women ought to measure from twenty-seven to twenty-nine inches round the waist, but most females do not permit themselves to grow beyond twenty-four; thousands are laced down to twenty-two, some to less than twenty inches; and that by means of wood, whalebone, and steel the chest is often reduced to one half its proper size.

¹ Elliott and Son, Ashford.

5. When the lungs, which by butchers are called the lights, are taken, together with the heart, out of the chest, they are seen, as in Figure 3, to be small above, and large below. The outer parts of the lungs are round, where they line the inside of the ribs; the inner parts are hollowed to receive the heart, *H*. The heart has many pipes at its upper part, some of which, as is shown by the course of the arrows, are for taking the blood away, and others are for bringing back the blood. The three lobes of the right lung, and the two lobes of the left lung, as well as the windpipe, *W*, are well seen.

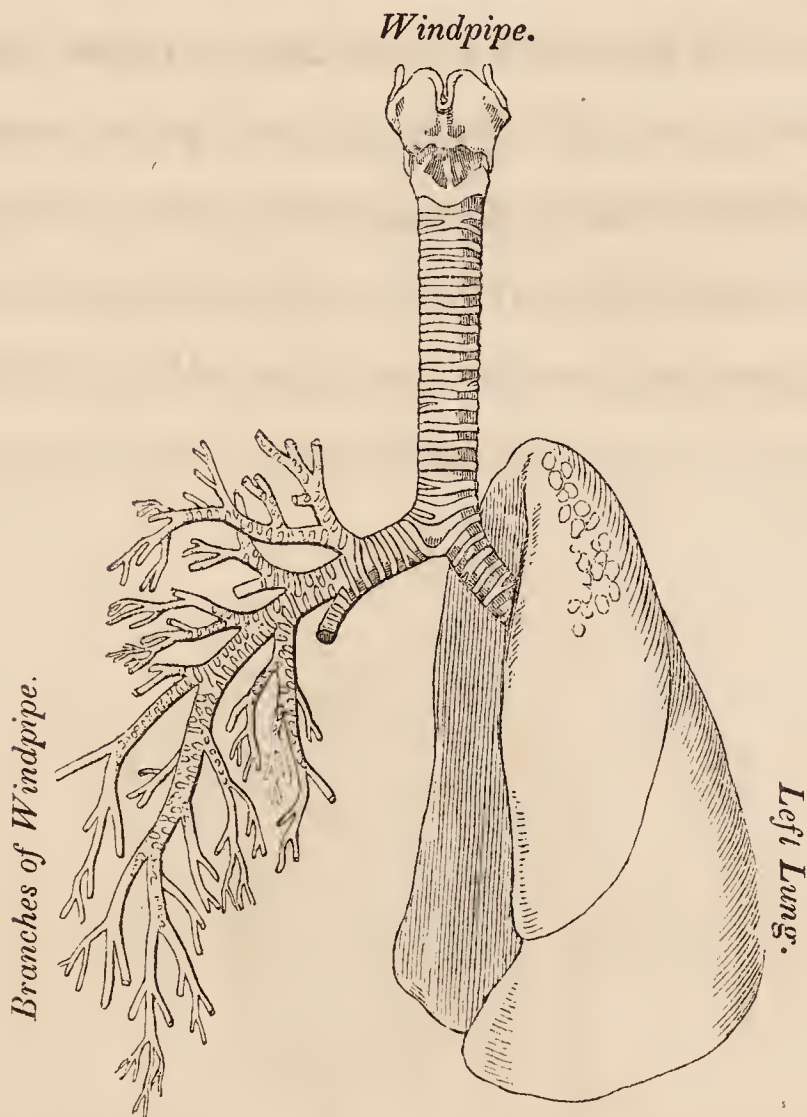
FIGURE 3.



6. In Figure 4 the windpipe is seen: it commences above at the back part of the tongue, and goes

down the middle of the front part of the neck, where it can be felt by the hand in a living person; and it is seen in Figures 2 and 3 to pass into the chest, where it divides into branches. One of these branches, Figure 4, goes to the right lung, and one to the left lung; and in the lungs these branches

FIGURE 4.

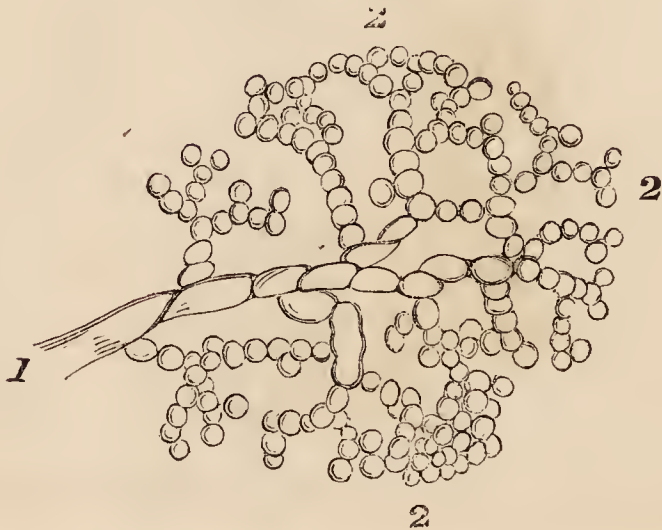


divide into very little pipes, which are so small that they cannot be seen by the naked eye, and these

end in the small bladders, or air-cells of the lungs, seen in Figure 5. The windpipe is made up of numbers of rings; it is quite hollow, so are all its branches. The use of the windpipe is to carry air into the lungs, and out again when it has been used.

7. The little bladders in which the branches of the windpipe end are called air-cells; they are seen in Figure 5. They make the lungs quite spongy; they open into each other, and are quite round. It is said that there are one hundred and seventy millions of them in each of the two lungs of every living person, and every time breath is drawn in, the air goes down the windpipe, then through the

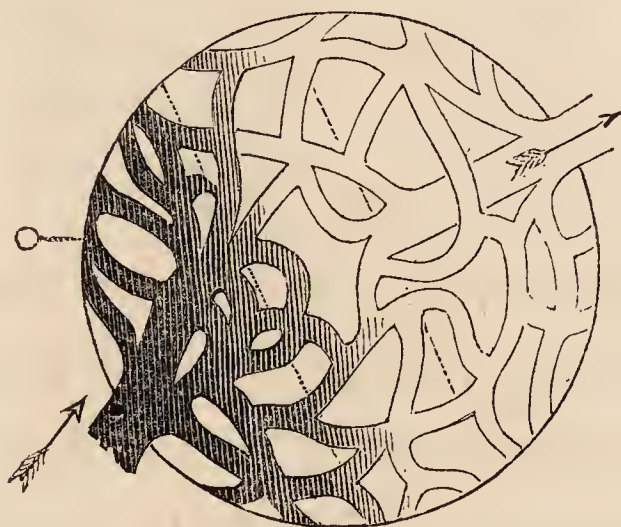
FIGURE 5.



branches in the chest, one of which, 1, is seen in Figure 5, and fills the little bladders, or air-cells, 2, 2, 2, which make up the lungs.

8. Besides the air, blood is always coming in and going away from these little bladders which make up the lungs. If we look at one of these bladders, as in Figure 6, made very large by being put under the microscope, we shall find that the blood comes into the bladder or air-cell quite dark, and that it goes away of a light red colour; this light red colour is shown in Figure 6 by the lines with no dark between them. The way the blood goes is shown by the arrows. The use of these many little bladders, or air-cells, of which the lungs are made up, is to take in the fresh air that is

FIGURE 6.

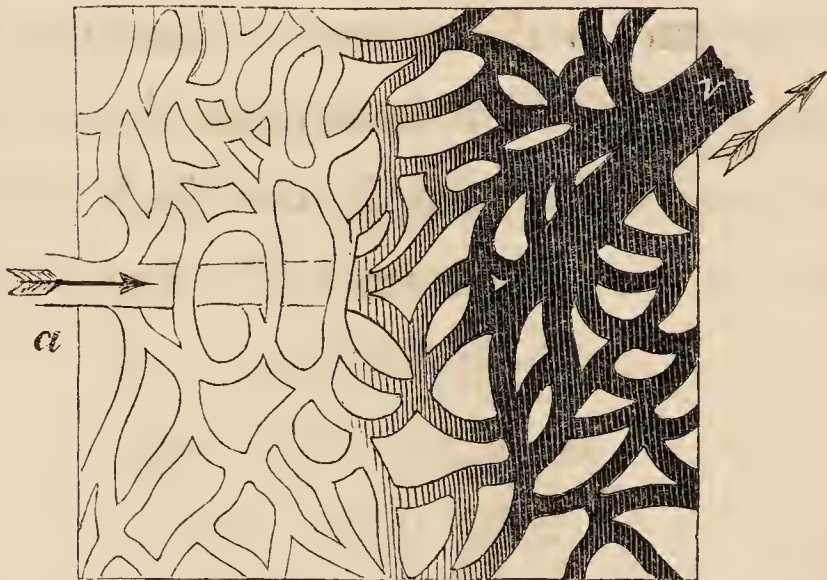


breathed, so as to purify the blood which is always going through these little bladders.

9. After the blood has been made pure and red by

meeting with the fresh air in the lungs, it is carried all over the body by means of the arteries, Figure 7, *a*. In its course, it gives out warmth, and strength, and life, and by the time it gets into the veins, *v*, it is quite dark and bad again. When the web of a frog's foot is placed under the microscope, the blood can be seen, as in Figure 7, going from the artery *a* into the vein *v*, changing its colour, and

FIGURE 7.



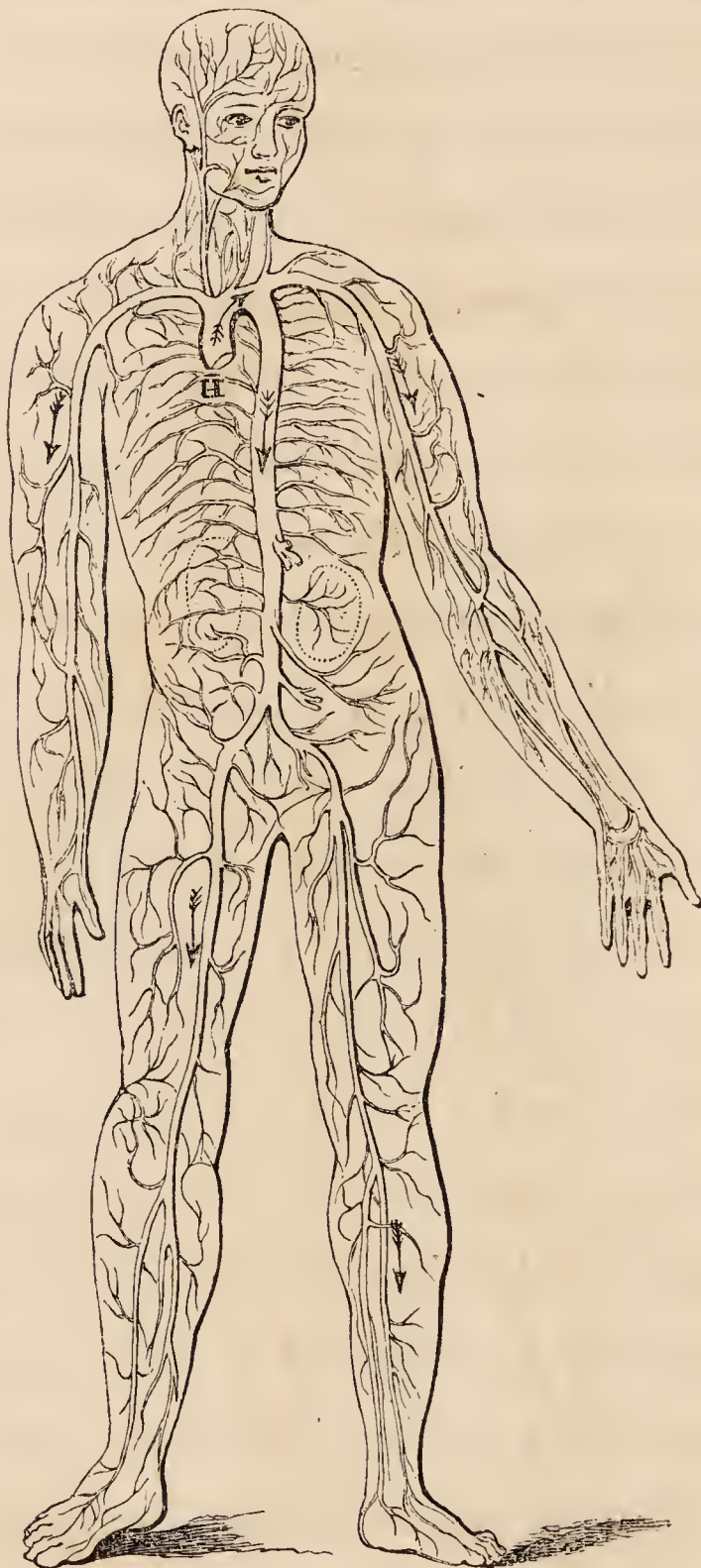
becoming impure, just as it does when it goes through the arms, legs, head, and body of man; when it has become bad, it goes to the lungs, to be made pure and of a bright red colour again; for this reason the lungs ought to be in a very good state, as they have very important work to do, and if they cannot do their work well, bad health must follow.

10. If we look at the drawing of the finger, Figure 8, we shall see how the blood from the artery *a*, when it gets to the end of the finger, enters the small vessels *i*; the capillaries or vessels between the arteries and veins, (therefore called intermediate) from which the vein *v* takes its rise, to carry the dark blood back to the heart and lungs. In Figure 8, the artery is placed on one side of the finger, and the vein on the other, in order to show well the way in which the blood goes from the artery into the vein; in the living finger there really is an artery and a vein on each side, and all over the body these two vessels are placed close to each other, sometimes so near as to be difficult to separate. In Figures 9 and 10 the arteries and veins are supposed to be separated from each other, and a drawing is made of each in this state, because in reality the two are so bound together, one sometimes being in front of and concealing the other, that it would have been impossible to show both in one Figure.



11. In Figure 9, the pipes or vessels called arteries are shown, which commence at the heart *H*, and carry

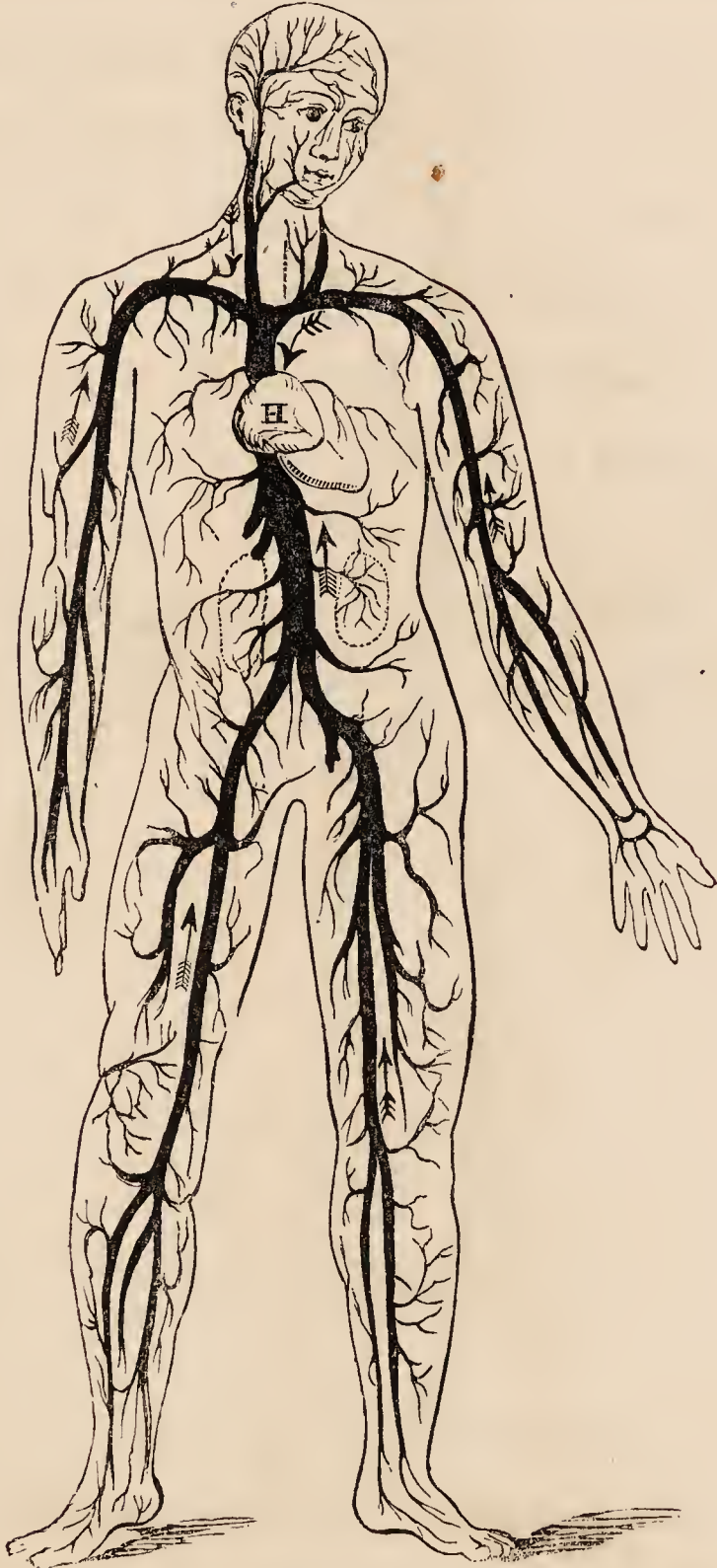
FIGURE 9.



the pure blood all over the body; the course of the blood is seen by the way the arrows are directed.

12. In Figure 10, the pipes or vessels called veins are shown, which commence at all parts of the body,

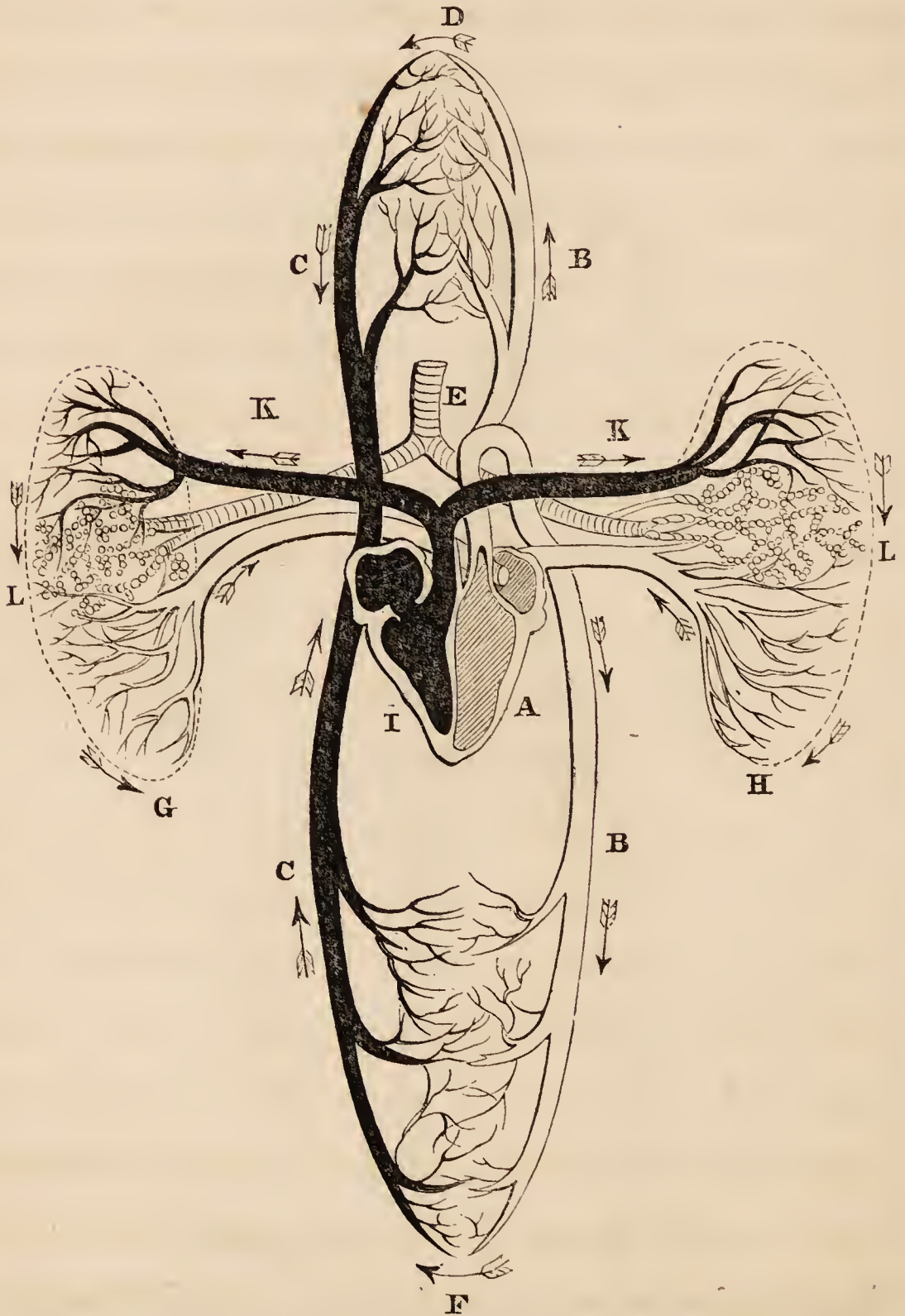
FIGURE 10.



and carry the impure blood back to the heart, *H*;
the course of the blood is seen by the arrows.

13. It can now be seen how the blood is always moving, and changing its colour from a bright red

FIGURE 11.



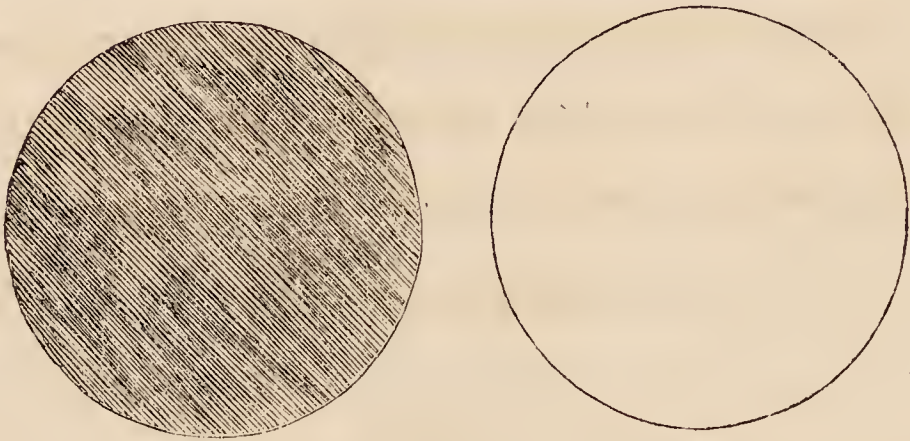
to dark purple as it passes through the head, arms,

legs, and body, and how in the lungs it changes from dark purple to a bright red colour. In Figure 11, *A* is the left side of the heart, from which the pipes called arteries, *B B*, carry the pure blood to the upper part of the body *D*, and to the lower part of the body *F*; the blood passes into the veins *C C*, and becomes dark-coloured, and, by means of the veins, it gets to the right side of the heart *I*; from the right side of the heart it is sent by the vessels *K K* to the two lungs *L L*, through the little bladders which are seen to be continued with the windpipe *E*; it then passes into *G* and *H*, the vessels which are shown by the arrows to carry it into the left side of the heart *A*, from which we started to describe the circulation.

14. Now it is quite certain that it is of very little use for the blood to be continually going to the small bladders or air-cells of the lungs in order to be made pure, if these little bladders do not contain fresh and pure air. It must also be understood that the air which has once been breathed becomes bad, from its having given off its good parts to the blood, and from its having become loaded with a large quantity of impure gas and moisture which come

from the body. This moisture is seen at once by breathing on a pane of glass, and it is often of a very unpleasant smell. In Figure 12, two of the little bladders of the lungs are seen; one containing pure air, the other dark one full of air which has been breathed.

FIGURE 12.



15. The air which has once been breathed is so bad that it is in fact no longer air, but

FIGURE 13.

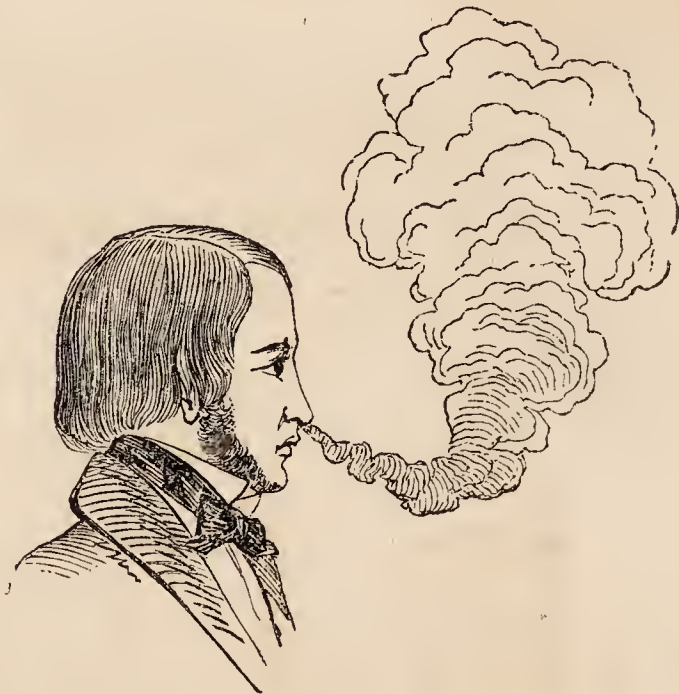


has become an impure gas. To prove that the air is bad, take two bottles of clear lime-water, as in Figure 13, and with a straw blow for a

few minutes into one, so that the air from the lungs may pass into it; at the end of this time the lime-water will become quite white and milky, as in the left bottle: but if fresh or common air be blown through the other bottle with a pair of bellows, the lime-water will remain quite clear, as in the bottle on the right.

16. The air which comes out of the lungs through the mouth or nose is always warm, and being on this account lighter than the air outside the

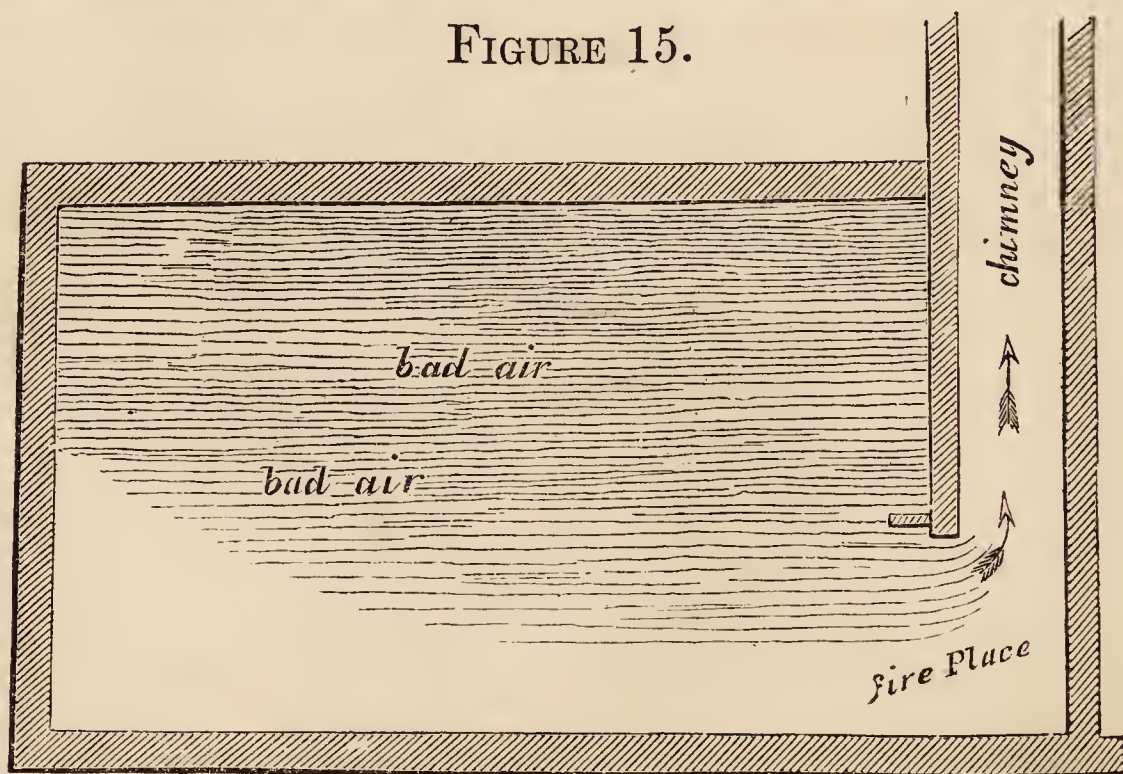
FIGURE 14.



body, it goes upward, and in sitting-rooms, schools, churches, and all other places which have a ceiling, the bad air rises to the upper parts, as in Figure 14.

17. As the bad air goes upward and cannot get away, in a very short time a room, or church, in which people are sitting, or a school or factory in which children are at work, gets quite full of bad air which has been breathed, and, as is seen in Figure 15, the *bad air* comes down again to be breathed, as it can only get away at the fireplace, which is below the heads of the people in the room. Ill health, shown by paleness of face and weakness, also colds, fever, and consumption, and other dis-

FIGURE 15.

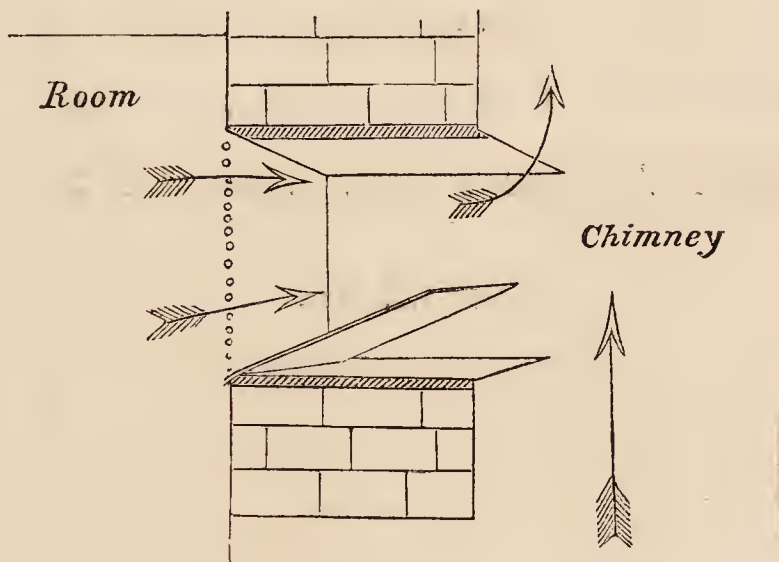


eases, are produced by breathing this bad air over and over again.

18. It is quite plain that, as the bad air which comes

from the lungs goes upwards to the top of the room, there ought to be some way of letting out the air at the top of the room, to prevent its coming down again to be breathed. This is managed by Dr. Arnott's valve, Figure 16, which may be fixed by any bricklayer in a hole made into the chimney, close to the ceiling of the room; by means of it, the bad air, as is seen by the arrows, escapes from the room, and is drawn up the chimney.

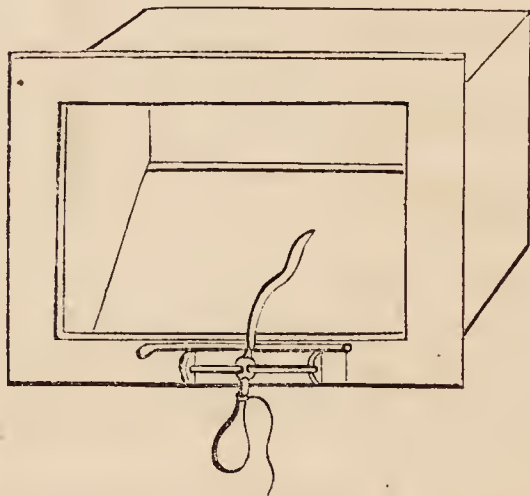
FIGURE 16.



19. This valve, invented by Dr. Arnott, which is a very great boon to mankind, and, when brought into still more general use, will be the means of preserving the health of thousands, both among rich and poor—is also seen in Figure

17, quite separate. The flap to which the ball is fixed is finely balanced, so that it shuts if any smoke tries to come into the room from the chimney. Should the fire draw badly, so that the smoke always keeps the valve closed, then the throat of the chimney should be narrowed, a gas light may be burned in the valve, or a blower, made of a piece of tin, zinc, or galvanized iron, may be hung before the fire; it may be made with a hinge, so that it can turn up, to let kettles and pans be put on the fire. Dr. Arnott's valves are sold by Mr. Edwards, 20, Poland Street, Oxford Street, for 7*s.* 6*d.* and upwards, and various kinds, from 3*s.* to 6*s.*, are

FIGURE 17.



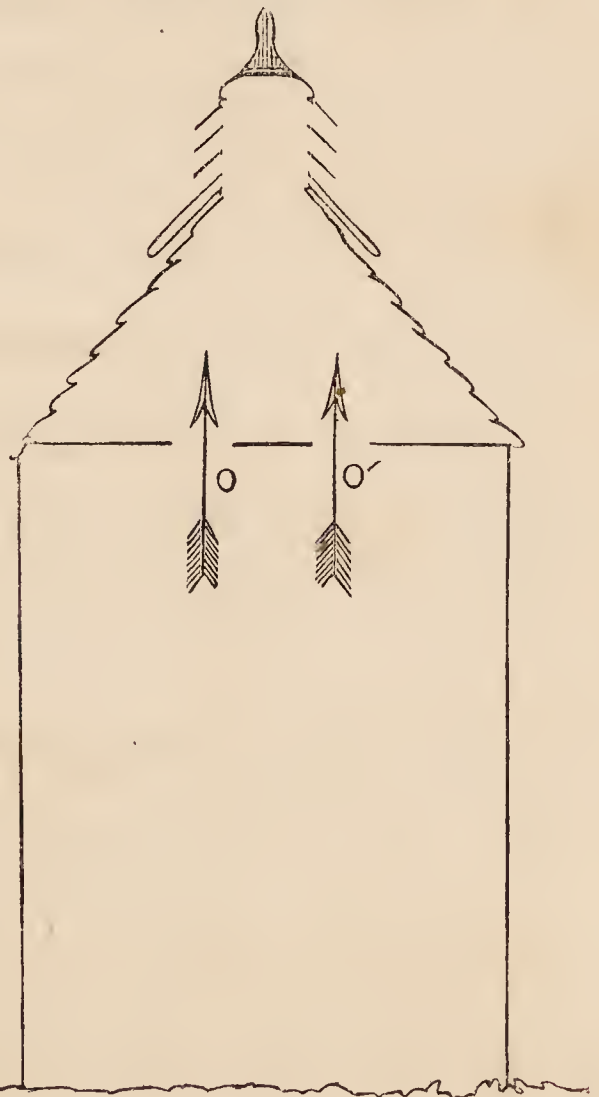
made by J. Allen, 22, Guildford Street, Wilmington Square, who also makes the blowers. Poor

people who have had the ventilators and blowers put into their rooms say that their health is better, the air is much purer and lighter, and the moisture no longer collects on the panes in the window.

20. In large rooms, as school-rooms, work-rooms, chapels, churches, &c., Arnott's valve is not sufficient to carry away the large quantity of bad air which is given off. Where there is a false roof,

as in Figure 18, openings, a foot or two in diameter, may be made in the ceiling, and then on the top of the false roof one or more cowls should be fixed, so that the wind, by blowing upon them, may draw out the bad air. To take away the bad air from these larger rooms, pipes may be also carried from the upper part into the nearest

FIGURE 18.



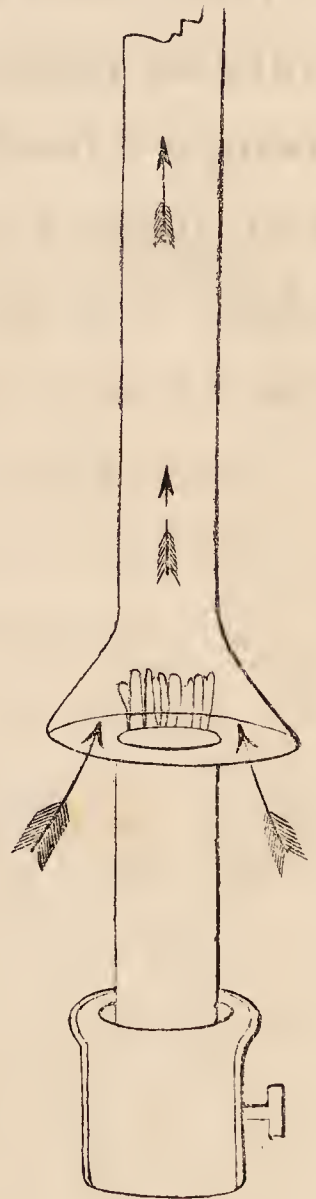
chimney, or a gas light should burn in the tubes going out of the room, in order to make a draught upwards; or the fan invented by Messrs. Lambert and Grant, of 21, Elizabeth Street, Eaton Square, worked by a small pressure of water, may be used to pump away the warm and noxious air. Dr. Arnott's air-pump, for pumping air into or out of a room, is a most valuable invention. It consists of a box made of wood, with cloth valves, and a piston, which is worked by a lad or by a weight. For places where numbers of persons are collected in too small a space, it has been found of the highest benefit. It is made by Mr. Davis, of 24 and 25, Upper Cleveland Street, Fitzroy Square. On board ship the utility of this pump has been very great, and it ought to be used in all passenger ships.

22. Gas lights and oil lamps, in burning, give off even a much larger quantity of bad air and moisture than the lungs of human beings. One common candle uses as much air as a man; and every pint of oil in burning gives off a pint of water and three pounds of bad gas. This bad air should of course no more be allowed to escape

in the room than the gas from a charcoal-fire. One plan for carrying away this bad air from gas lamps is seen in Figure 19, and consists of a tube of tin or other metal, placed over the gas light, and carried into the chimney, or into a false roof with a cowl on the top. In those

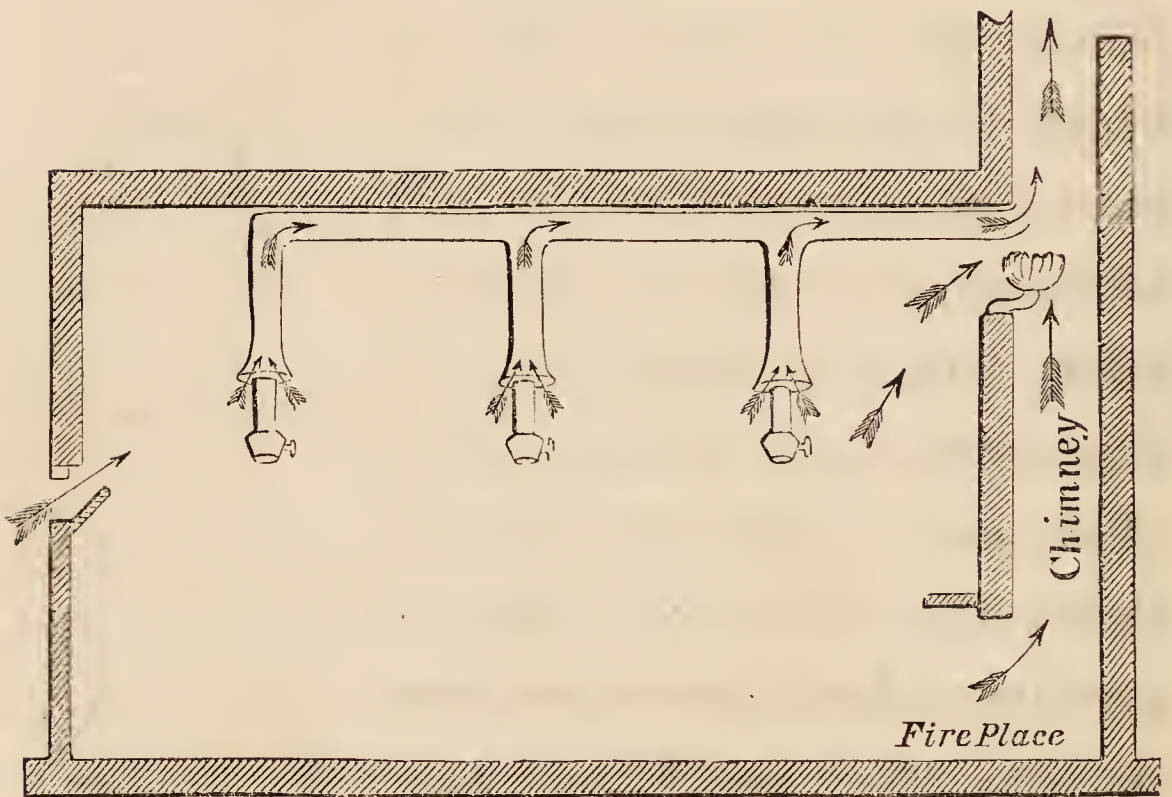
churches, schools, ragged-schools, shops, drawing-rooms, &c., in which these tubes have been placed, the greatest comfort and advantage have followed, both to young and old; silversmiths find that these tubes prevent their plate from tarnishing; silkmercers, their goods from fading; ironmongers and cutlers, their wares from rusting. They ought to be universally used, and above all, no bakers, butchers, grocers, or provision dealers should be without them. But, as Messrs. Lambert and Grant have shown, they require care and judgment in their use in order to ensure success.

FIGURE 19.



23. In Figure 20 a room is seen, with three gas-lights, over each of which a tube is placed; these tubes open into one common tube, which is carried into the chimney through a large opening, in which there is also burning a gas light, to draw away the bad air from the rest of the room.

FIGURE 20.

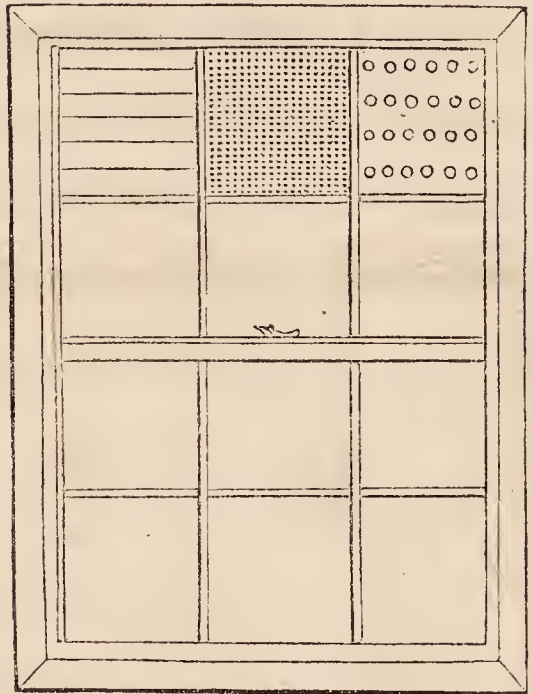


24. It is quite clear that the warm and bad air will not go away from rooms unless plenty of fresh air is also brought in. Up to the present time, people have left the air to come into a room as it best can, through chinks at the door and windows; it is therefore clear that the quantity of air that gets into

a room must depend upon chance, and some rooms will get many times more than others—and often those which require the most get the least. There should be a regulated supply, as each person in the space of every minute requires a quantity of air double his own size. The

FIGURE 21.

plans for letting fresh air into rooms, as seen in Figure 21, are, to take out a pane of glass, and fix in its place bars of glass like a Venetian blind, as on the left side; or a plate of perforated zinc, costing a few pence,

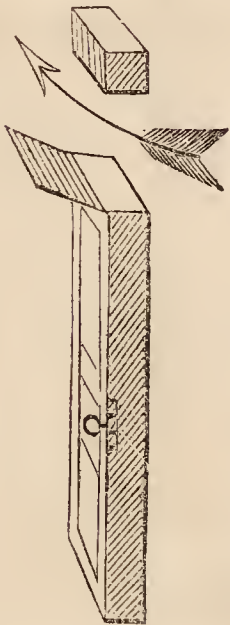


as in the middle, or a ventilator of it made to open and shut, which may be obtained at Mr. Stamper's zinc warehouse, 15, Quickset Row, New Road; or a pane of perforated glass, as seen on the right side, invented by Mr. Bowie, may be inserted; its price is at the rate of a penny a hole, and it can be obtained at 144, Strand. Even if none of these plans are adopted, the window should always be left a

little open at the top; a plan which is followed by a great number of persons at the present time, even during the night, who find no ill effects from the night air, but sleep soundly and comfortably, instead of heavily and restlessly, as they used to do.

25. Another plan for admitting fresh air into a room is, to take out a part of the upper panel of a door, and to fill up the space by perforated zinc, or to fasten a piece of wood on the inside, as in Figure 22,

FIGURE 22.



so as to direct the air upwards.—

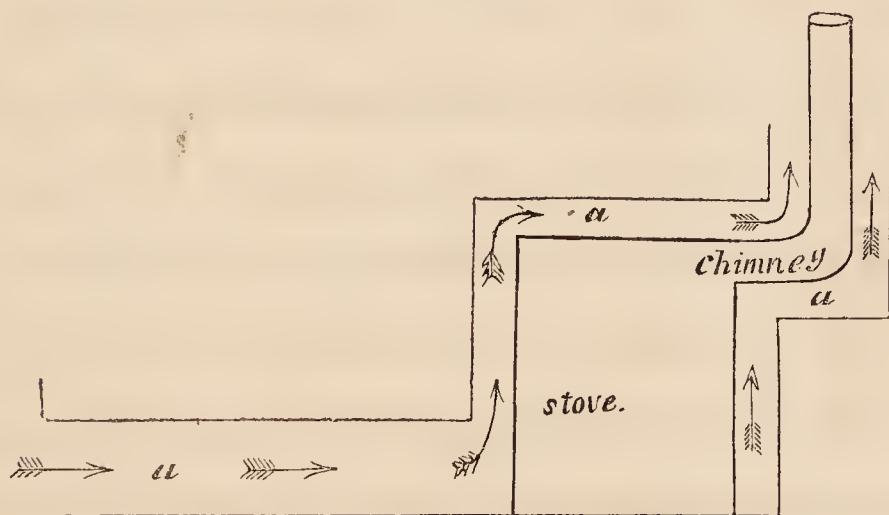
Those who do not wish to cut into the door may have the door of the room in which they sleep left slightly a-jar, and it can be guarded by a chain similar to that used in outer doors, which allows of the door being opened a few inches, but not more, and which prevents any one

outside from entering. This plan is very applicable to the bed-rooms of schools.

26. But in cold weather it is very important that *warm* air should be let into the room. This may be done by having a space, or air chamber

behind the fireplace, into which the air can enter by a pipe from the outside, and when it gets warm it is allowed to come into the room: this plan has been put in practice by Mr. Edwards, 20, Poland Street. In a school-room, or church, or any building with a stove, as in Figure 23, a pipe or channel, which may be made of wood or tin, should be brought from out of doors to the stove, where it should enter a case, made of brick or iron, surrounding the stove, and then the air, when warmed, can be allowed to pass into the room by the side

FIGURE 23.

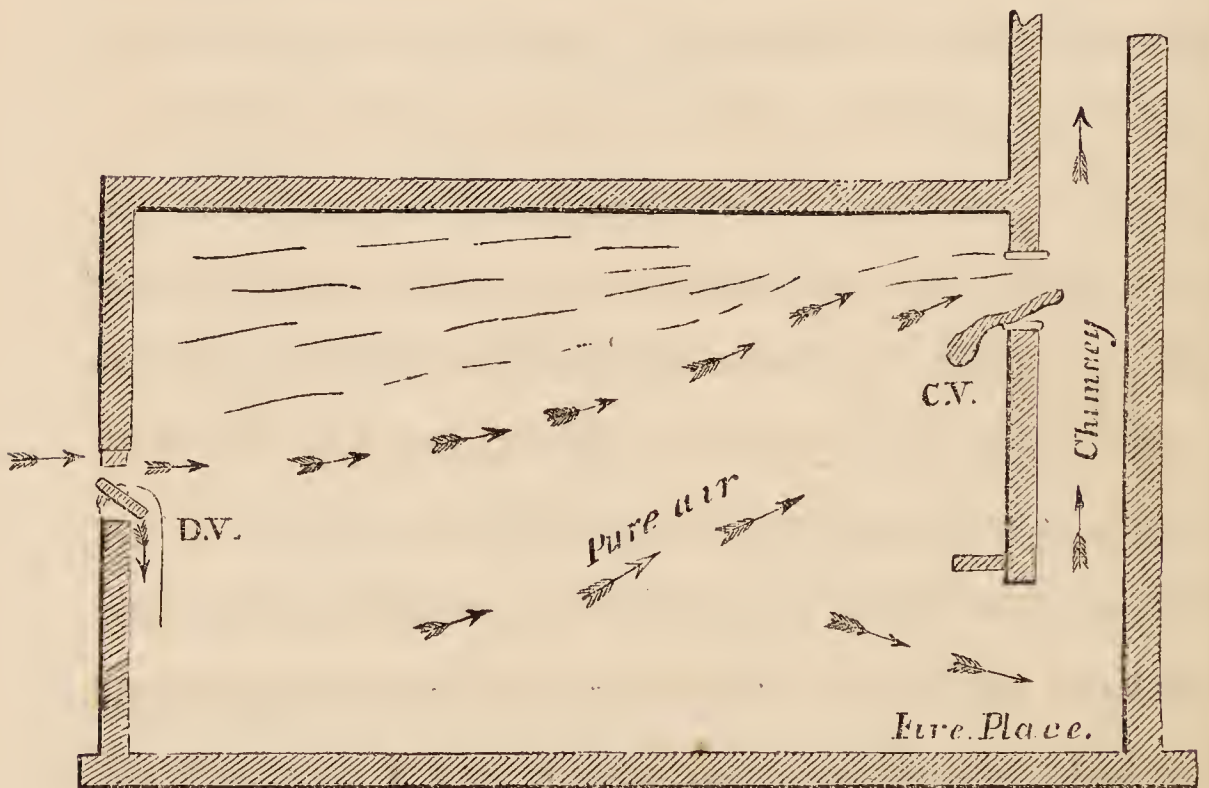


of the chimney. To make sitting-rooms warm in cold weather, a funnel should be placed over the fire, so as to prevent the large quantity of warm air going up the chimney, or a Warm air Cir-

culator should be used. These are made by Mr. Edwards, 20, Poland Street, and Mr. Rein, of 110, Strand.

27. Let us now in Figure 24 look at a room which is well supplied with air, and in which the bad air is allowed to go away, one that is ventilated in a way that many persons have lately carried out, and which may be done at a very little expense. Dr. Arnott's chimney valve, *C.V.*, is placed in the chimney at the upper part of the room. A door

FIGURE 24.



ventilator, *D.V.*, is placed at the upper part of the door; fresh air also comes in through a pane of

perforated glass. It will be seen that in this room the people would have plenty of pure air to breathe, while in the room shown in Figure 15 the inmates would have to breathe very impure air.

28. In conclusion, let it be remembered that unless every sitting-room, bed-room, work-room, school, church, chapel, hospital-ward, or barrack-room has some special means for letting in fresh air as well as others for letting out bad air, it is quite certain that the men, women, and children who live in or frequent these places must sooner or later feel the ill effects in the shape of diseases of various kinds, affecting the body and the mind (varying from lowness of spirits to constant ill-health). It is hoped that those who read the suggestions contained in this little address will feel that, if they live in rooms where plans of Ventilation are not carried out, they neglect a leading duty, viz., the preservation of the health with which God has blessed them, and they must not repine should disease and its accompanying ills reduce them to a state of misery and dependence.

APPENDIX.

CONSUMPTION.—Sir James Clark, Physician to the Queen, enumerates, as the exciting causes of Consumption, “long confinement in close, ill-ventilated rooms, whether nurseries, schoolrooms, or manufactories;” he also says, “if an infant born in perfect health, and of the healthiest parents, be kept in close rooms, in which free ventilation and cleanliness are neglected, a few months will often suffice to induce tuberculous cachexia”—the beginning of Consumption. Persons engaged in confined close rooms, or workshops, are the chief sufferers, from Consumption: thus, of the 233 tailors who died in one district in London, in 1839, 123 died of diseases of the lungs, of whom 92 died of consumption. Of 52 milliners, dying in the same year, 33 died from diseases of the lungs, of whom 28 died of consumption. Dr. Guy reports, that in a close printer’s room he found 17 men at work, of whom 3 had spitting of blood, 2 had affections of the lungs, and 5 had constant and severe colds. After reading these sad facts, who can deny that the chief cause of Consumption is the respiration of bad air?

SCROFULA.—Sir J. Clark says, that “children reared in the workhouses of this country, and in similar establishments

abroad, almost all become scrofulous, and this more, we believe, from the confined impure air in which they live and the want of active exercise, than from defective nourishment." Dr. Arnott has published an account of a badly ventilated school where the children were dying of scrofula, and in which double the number were afterwards kept in good health, after plans of ventilation had been carried out. Mr. Toynebee reports, "the general climate, the cold, the damp, and the soil, were at first accused of the great number of deaths among the animals in the Zoological Gardens; but it is now clearly ascertained that it principally arose from defective ventilation. I found that scrofula was the greatest cause of their mortality. Since the dens have been ventilated, the previous complaints have much diminished." Professor Baudelocque says, "the development of scrofula is constantly preceded by the sojourn, more or less prolonged, in air which is not sufficiently freshened. This is the only cause which is always met with, isolated or united to circumstances whose action is very secondary. Invariably it will be found on examination that a truly scrofulous disease is caused by breathing bad air, and it is not always necessary that there should have been a prolonged stay in such an atmosphere. Often a few hours each day is sufficient; and it is thus that they may, in the most healthy country, pass the greater part of the day in the open air and yet become scrofulous, because of sleeping in a confined place where the air has not been renewed."

FEVER.—Mr. Chadwick states that a building at Glasgow, called the Barracks, being an assemblage of dwellings

for the work-people, contained 500 persons, every room being tenanted by one family. The consequence was that fever was scarcely ever absent from the building, and, in the last *two months* of 1831, there were *fifty-seven cases* within its walls. All attempts to induce the inmates to ventilate their rooms were ineffectual; when the proprietors, at the suggestion of Mr. Fleming, a surgeon, fixed a simple tube into the ceiling of each room, and these tubes, communicating with the chimney of the factory furnace, the foul air was drawn out of the rooms. *The effect was, that during the ensuing eight years fever was scarcely known in the place.* The report of the London Fever Hospital, for 1846, shows that 130 patients (more than one-fifth of the whole admissions in the year) came from Marlborough House, Peckham, a Night Asylum for the Houseless Poor, where the whole of the sleeping room for 50, sometimes 100 people, does not afford a larger bulk of air for respiration than is appropriated in the wards of an hospital to three patients.

Note.—Those who are desirous of entering more at length into the subject of Ventilation, are referred to the “Manual of Public Health.”

