Specification of John Imray : respiratory apparatus.

Dec. 22nd May. N° 1852.

SPECIFICATION

OF

JOHN IMRAY.

LABORATORY APPARATUS.

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A.D. 1873, 22nd May. N° 1852.

Respiratory Apparatus.

(*This Invention received Provisional Protection only.*)

PROVISIONAL SPECIFICATION left by John Imray at the Office of the Commissioners of Patents, with his Petition, on the 22nd May 1873.—A communication from abroad by Henri Fayol, of the Coal Mines of Commentry, Allier, France.

I, JOHN IMRAY, of No. 20, Southampton Buildings, Chancery Lane, in the County of Middlesex, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN APPARATUS FOR SUPPORTING RESPIRATION AND LIGHT IN SUFFOCATING ATMOSPHERES AND UNDER WATER," to be as follows :—

This Invention relates to apparatus for supporting respiration and light in suffocating atmospheres and under water, and consists of improvements in the respiratory apparatus, in the portable air reservoirs, in the air pumps, and supply tubes in the lamps, and in the diving dresses employed for this purpose.

The respiratory apparatus employed when air is supplied at little more than atmospheric pressure consists of a mouth piece and tube with a branch outlet having valves so arranged that in inhaling air the valve in the tube opens while that in the branch closes; while in exhaling, the valve in the tube closes, and that in the branch opens.

The mouth piece, tube, and valves are all made of caoutchouc, and the mouth piece is provided with projecting lips which fit against the interior of the mouth of the operator. The valves being light flaps of caoutchouc held in the middle over a glass ring are opened and closed by the act of respiration without sensible effort.

When the air is supplied for respiration at a pressure considerably above that of the atmosphere the valve which opens for inhalation is governed by flexible diaphragms applied to a compartment of the tube between the supply valve and the mouth of the inhaler, and connected to the valve stem.

When this compartment is supplied with air exceeding that of the external medium these diaphragms are distended and close the supply valve. When, on the other hand, the pressure in this compartment is reduced below that of the external medium the diaphragms are collapsed and open the supply valve.

The portable air reservoir is in form like a bellows which can be carried on the back, it is fitted with several nozzles to which can be joined by screwed unions pipes for supplying the reservoir, and pipes for supply of air for respiration and to support combustion of lamps. Each of these nozzles is fitted with a valve opening inwards, which is always kept closed by a spring unless when a pipe is joined to it, in which case the valve is forced from its seat by the screw union bearing on its stem. The reservoir is filled by expanding it in a pure atmosphere, in which case a supply of air enters it by one of the nozzles. As the valves of the nozzles close this air cannot escape except when the pipes for respiration or light are screwed to the nozzles. The weight of the expanded leaf of the bellows reservoir or a light spring applied to it serves to give its contents a pressure slightly exceeding that of the surrounding medium.

The improved lamp used in connection with this apparatus in suffocating atmospheres has its wick enclosed by a glass, the interior of which is supplied with air from the reservoir, for the purpose of supporting the combustion. As the pressure in the reservoir somewhat exceeds that of the surrounding medium the lamp is always supplied with air, the products of combustion escaping by a chimney above the flame. The lamp for use under water has this chimney covered by a valve opening outwards, which prevents access of water to the interior of

the lamp, but which opens to allow products of combustion to escape when the pressure within the lamp becomes sufficient to raise the valve.

The improved air pumps for supplying either fixed or portable reservoirs are of two kinds, one for supply of air at pressure little exceeding that of the atmosphere, the other for supplying air at considerable pressure, such as is required for diving operations. The former is made like a bellows the lower leaf of which is fixed in a framing, and the upper leaf is caused to reciprocate vertically by a crank on a shaft above, worked by hand or other convenient power. This bellows pump is provided with inlet and outlet valves, the latter being in a nozzle to which the supply pipes can be joined and which may also be provided with a gauge to indicate the pressure. Besides these two valves a third valve on the outlet nozzle is made to open inwards so that air can enter the supply pipes or reservoirs connected to them when their contents are partly exhausted by inhalation or by the distention of a portable reservoir even when the pump is not at work.

The improved pump for supplying air at considerable pressure, as for use in diving, consists of two pistons or plungers fixed on the same rod and working in two cylinders placed so as to face each other, the one cylinder being of smaller diameter than the other. The rod which unites the two pistons or plungers is tubular and fitted with the discharge valve from the larger cylinder, which cylinder has also a supply valve, the smaller cylinder having a discharge valve in the pipe for supplying air to reservoirs or diving hoods. At each stroke in the one direction the contents of the larger cylinder are forced into the smaller cylinder, the air being thus to a certain extent compressed. At the return stroke while the larger cylinder draws in a fresh supply the air previously forced into the smaller cylinder is farther compressed into the supply pipes, reservoirs, hoods, or other vessels with which they communicate.

The two pistons or plungers above described may conveniently be worked vertically by a lever passing through a slot in the rod which unites them.

The improved diving dress for use under water in connection with this apparatus consists of three parts, the metallic hood having two glazed apertures for vision and an aperture to which is united the respirating tube, the jacket of waterproof texture which covers the bust

and arms, and the trousers of waterproof texture which cover the lower part of the body and the legs. The hood is connected to a stiff collar on the neck of the jacket by caoutchouc flaps which are crossed over corresponding flaps on the jacket. The jacket is tightened on the wrists by elastic bands, leaving the hands exposed, and it is united to the waist band of the trousers by caoutchouc bands in a manner similar to that by which the hood is united to the jacket.

The diver may at pleasure breathe into the hood, he may expand his volume of displacement so as to render himself light and rise to the surface.

It is obvious that the apparatus for air supply described above may be employed with any known diving dress, the mouth piece being provided with the governing diaphragms and valve above described so as to adjust the pressure of the air supplied to that of the surrounding medium.

The pipes employed for supply of air are of two kinds, the one set of considerable size for the supply of local reservoirs, and the other of smaller size for the respiration or lamps of individual workmen, made light and flexible preferably of air-tight fabric, covering externally and internally a helical wire. These pipes made in lengths are united by short pieces of metal tube each of which may have a side branch fitted with a light valve opening inwards kept to its seat by a light spring. Should the supply of air by the pump fail the act of inhaling by reducing the pressure in the pipe will permit a supply to enter by these valves.

In employing the apparatus above described, as for example for penetrating workings of mines charged with foul air, the following method of procedure might be adopted. The low pressure pump is worked in a pure atmosphere, one workman carries on his back a reservoir having several nozzles to which the breathing tubes and lamps of other workmen are connected. These workmen carry rolled round their arms lengths of flexible pipe which they lay and connect as they proceed along the workings. The several workmen may either receive their supply of air continuously from the pipes thus laid in connection with the pump, or when any one has to detach himself he can charge from these pipes the reservoir on his back which will supply him for a certain time independently. Even should the supply from the pump fail although the lights would become extinguished the workmen could still

breathe, drawing in air by the inlet valve on the discharge nozzle of the pump. In laying air pipes in mines they should be suspended by hooks or holdfasts driven into the roof or sides of the workings, as they are thus less liable to be trod upon and crushed.

Men accustomed to the use of the respiratory apparatus breathe solely through the mouth piece, but until they become used to it they should be provided with an instrument for closing the nostrils. This instrument consists of a spring bent to a horse-shoe shape with elastic pads inside each end, being placed on the nose, the pads bearing on each side close the nostrils. In certain gaseous atmospheres which injure the eyes spectacles should be used, these consist of an elastic band which passes round the head, its front part being widened out and formed with two conical openings which are fitted with glasses opposite the eyes of the wearer.

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