(No Model.)

2 Sheets—Sheet 1.

A. C. ROWE.

FIRE EXTINGUISHER.

No. 596,623. Patented Jan. 4, 1898.

Fig. 1.

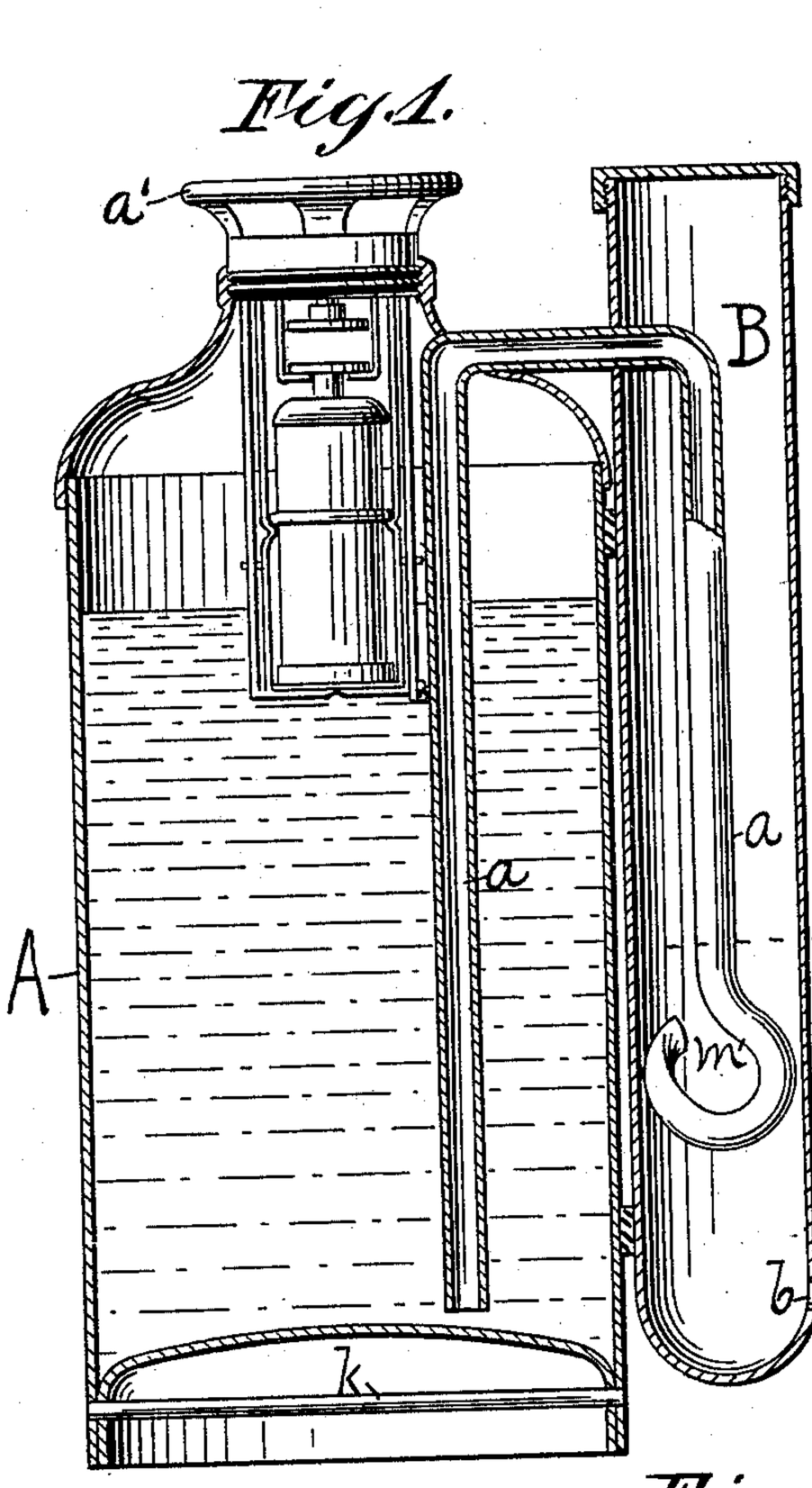


Fig. 2.

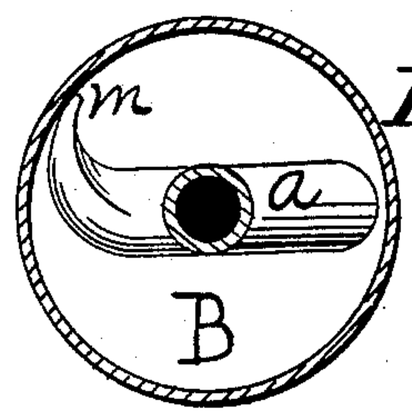


Fig. 3.

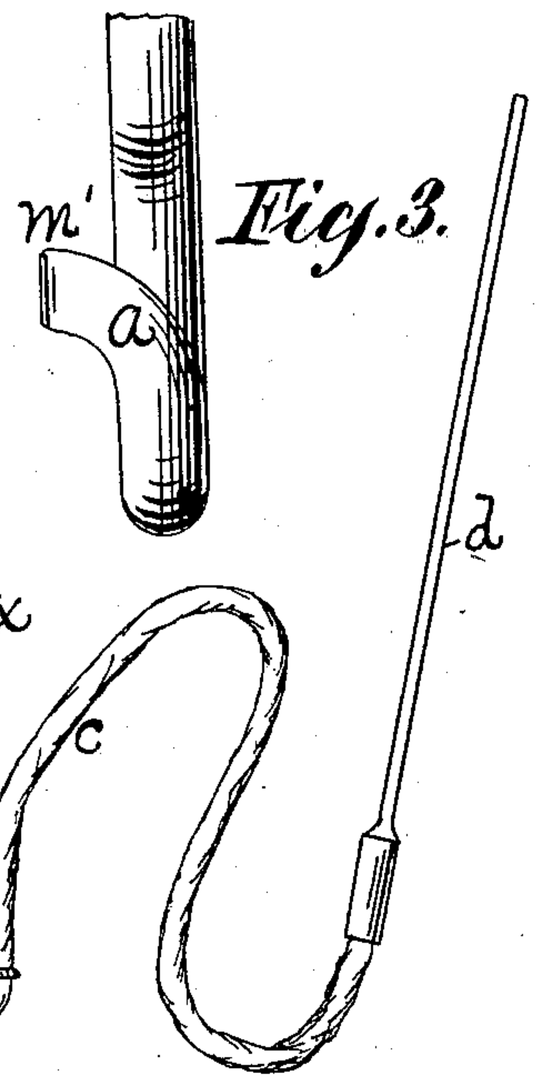


Fig. 4.

Fig. 5.

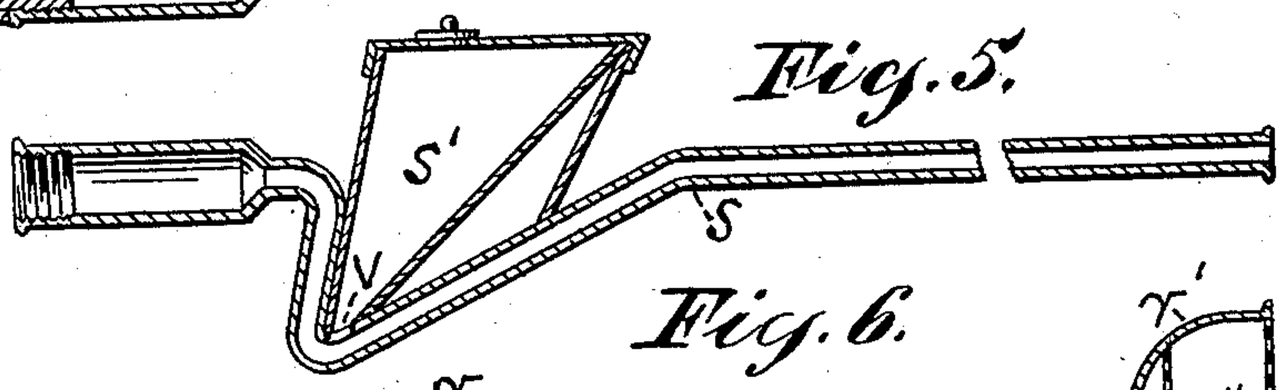
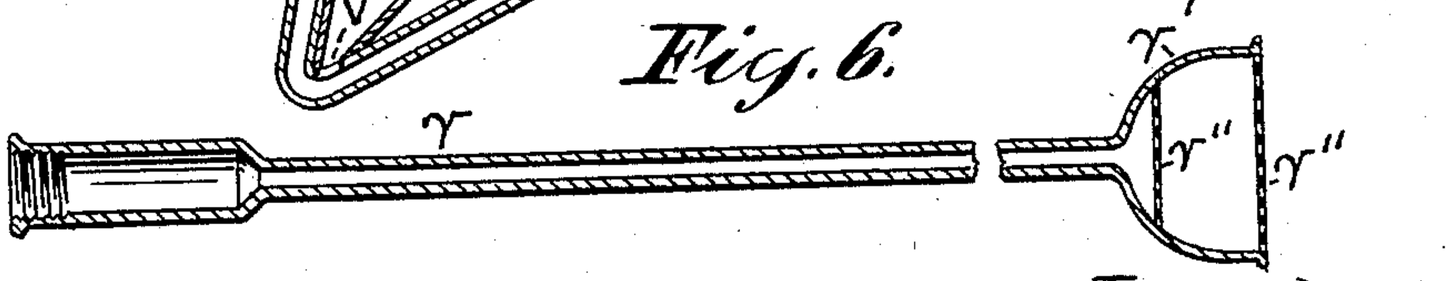


Fig. 6.



Witnesses:
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Inventor:
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(No Model.) 2 Sheets—Sheet 2.

A. C. ROWE.

FIRE EXTINGUISHER.

No. 596,623. Patented Jan. 4, 1898.

Fig. 7.

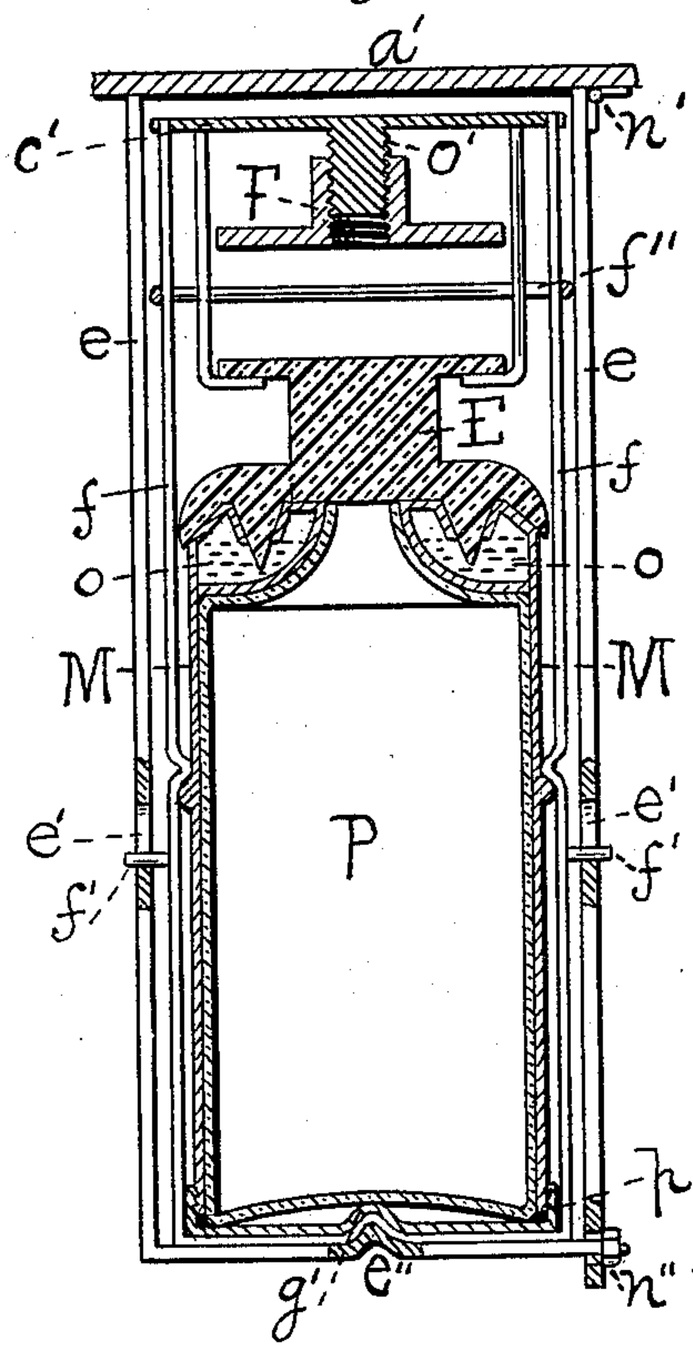


Fig. 8.

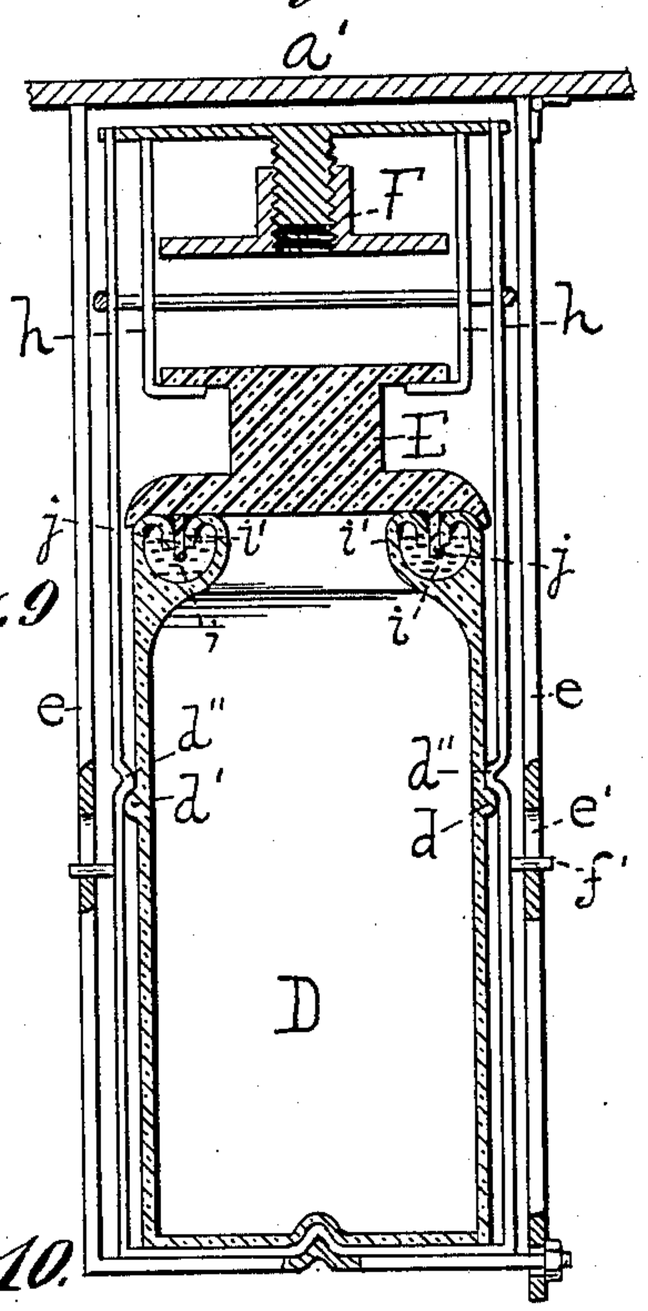


Fig. 9

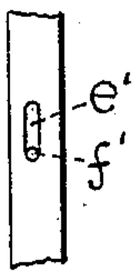
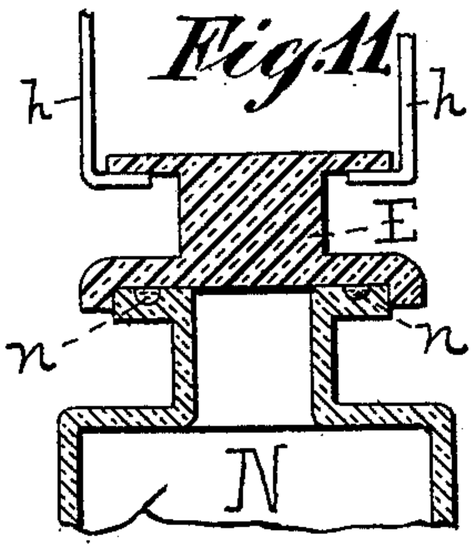
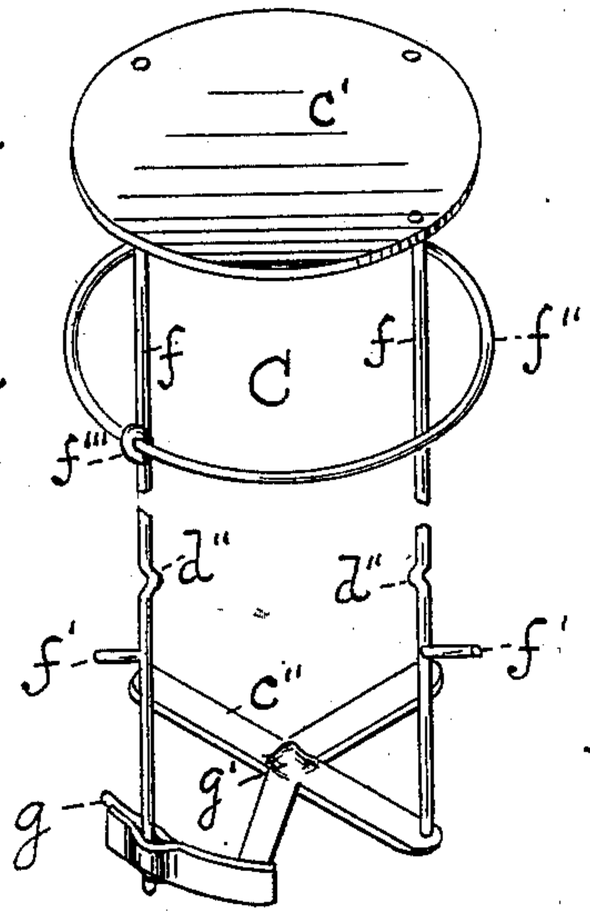


Fig. 10.

Fig. 11.





Witnesses:
D. W. Gardner.
M. F. M. Gallagher.
Elizabeth A. H. Towner.

Inventor:
Arthur C. Rowe
by Dallett D. Clark
his attorney

UNITED STATES PATENT OFFICE.

ARTHUR C. ROWE, OF NEW YORK, N. Y.

FIRE-EXTINGUISHER.

SPECIFICATION forming part of Letters Patent No. 596,623, dated January 4, 1898.

Application filed June 25, 1897. Serial No. 642,353. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR C. ROWE, of the city, county, and State of New York, have invented certain new and useful Improvements in Fire-Extinguishers, of which the following, taken in connection with the accompanying drawings, is a description.

My invention relates to chemical fire-extinguishers, in which an alkaline solution and an acid are made to mingle at the moment of use to form a flame-extinguishing gas under pressure. Its objects are to provide a tight seal for the acid-receptacle, which shall protect the same completely from the air and the liquid in the main receptacle, but shall automatically release the acid on reversal of the machine; to provide, in a machine throwing liquid or dry gas interchangeably, means for continuing the regulated issue of the acid from the bottle no matter how many times the machine is re-reversed; to provide means by which the dry gas may be formed under pressure, but be applied to the flames not under pressure, and a means for throwing a combination of dry gas and sand or other cooling substance upon the fire.

It consists, substantially, of the following devices, viz: a liquid seal of oil or like substance in a groove around the top of the acid-receptacle, in combination with a gravity valve or closure, such valve extending entirely over both the mouth of the bottle and its oil-trough, so as to form a cover for both, and having on its bottom an annular projection dipping into the oil-trough while the machine is upright and forming a distributing-cup on reversal of the machine; a cage to contain both the acid-bottle and the gravity-valve, hung upon pivots in such way as to be automatically released on the reversal of the machine and to hang mouth downward thereafter, though the machine be re-reversed; a metal delivery-tube to be attached to the nozzle, having a much greater diameter than the nozzle and forming both a conveying-channel and an expanding-chamber for the dry gas, and a delivery-tube having are ceptacle for sand or other cooling material to be mingled with the gas and thrown with it upon the fire.

In the accompanying drawings, which show a machine capable of being used either as a dry-gas machine or one throwing a stream of mingled gas and water, Figure 1 is a sectional perpendicular view of the entire machine. Figs. 7 and 8 are enlarged sectional views of two alternative forms of the acid-receptacle with its liquid seal and reversing-cage to hold it. Fig. 10 is a perspective of the reversing-cage. Fig. 9 is a detail showing how the cage is supported. Fig. 2 is a sectional view, on line X, of the secondary chamber, looking downward. Fig. 3 is a perspective view of the pipe *a* from the left-hand side. Fig. 4 is an enlarged sectional view of the delivery-tube. Fig. 5 is a sectional view of the delivery-tube furnished with a receptacle for sand to throw sand and gas combined; and Fig. 6, a sectional view of the delivery-tube, having a large opening at its end with gauze diaphragms. Fig. 11 is a varied form of the liquid seal.

A, Fig. 1, is a closed cylinder having an open exit-pipe *a*, leading from a point near the bottom into a second cylinder B. The exit *b* from the cylinder B is also at a point near the bottom thereof and leads through a flexible tube *c* and a metal delivery-tube *d* into the air, these passages being at all times open, without valves or stop-cocks.

To the head *a'* of the cylinder A are attached two depending rods *e*, having slots *e'* to receive the two pivots *f'*, which form part of the cage C, Figs. 7 and 10. The cage C is the part into which is put the bottle or other receptacle containing the acid. It consists of a head *c'*, a base *c''*, and four rods *f*, connecting them. One of the rods (see *f'''*) swings on the circular strengthening-strip *f''* and engages with the base *c''* by means of a spring *g*. This rod can thus be swung up for the insertion of the acid-receptacle. Upon two opposite rods are the two pivots *f'*. The cage C hangs by its pivots *f'* from the rods *e*. The pivots *f'* are so placed that with the acid-receptacle inside the center of gravity is above the pivots *f'*, and until the machine is reversed the cage and acid-receptacle are held in their upright position by means of a projection *e''* in the base-bar connecting the rods *e*, which projection engages with a similar one *g'* in the base of the cage C. Fig. 8 shows the simpler construction, as it has fewer parts than Fig. 7. It consists of a bot-

tle D, to be inserted within the cage C, removable for filling. It has a circular flange d', which, with corresponding projections d'' just above it in the rods f of the cage, prevents its falling down on the reversal of the machine.

E is the valve or closure, made of lead or other material not acted upon by the acid, covering the mouth of the bottle until it is necessary to use the machine. Upon reversal of the machine it falls between the guides h until it meets the stop F. The stop F and guides h (of which there are three or four) are attached to the cage C. The valve E is therefore always in position for use and cannot get lost.

A serious trouble heretofore had with machines using a gravity-closure for the acid-receptacle has been that the acid absorbs water from the air in the machine. This in time surely leads to its overflowing, and frequently leads to the freezing of the mingled acid and water, if the machine is kept in a cold spot, and so to its uselessness when needed. No gravity-closure alone can prevent this absorption of moisture by the acid. To obviate this difficulty entirely and at the same time preserve the gravity-valve, I provide a liquid seal. In the top of the bottle D is formed a shallow annular trough i to contain a little oil, and into this oil dips an annular projection j, formed on the bottom of the valve E. Only enough oil is put in to cover well the bottom of the projection j. By bending over the lips i' of the acid-receptacle two annular chambers are formed, and into these the oil runs when the machine is reversed, so that little or none issues from the machine.

The gravity-valve E not only closes the mouth of the bottle D, but it also forms a cover for the seal. In extinguishers of this class the liquid in the main receptacle frequently rises nearly to the mouth of the bottle, and in the necessary handling it is almost sure to splash into the oil-trough i. This might destroy the seal by its freezing or by its changing the character of the liquid used for the seal. The automatic valve E also has another function. It will be noted that on the reversal of the machine the projection j of the valve E, being of annular form, makes a sort of cup into which the acid pours. A very important feature in a chemical extinguisher is the proper mixing of the chemicals. In forms where this is not done acid is thrown out, goods are damaged, and the power is wasted; but the cup-shaped gravity-closure, properly adjusted, receives the acid, it being heavier than the surrounding water, and distributes it, insuring gradual and complete mixing. In the forms shown in Figs. 7 and 8 there is also a secondary trough formed upon the bottom of the gravity-valve E, which serves to further distribute the acid.

The operation of the machine as a whole is as follows: Having been charged, for example, with a saturated solution of bicarbonate of soda in the cylinder A and sulfuric acid in the bottle D, it can remain that way until needed, even in a cold place and through severe freezing weather, without danger of the acid overflowing or freezing. When to be used, the whole machine is reversed, being grasped by the bar k. On reversal the valve E drops down upon the stop F and the acid mingles with the soda solution, making carbonic-acid gas, which passes out through the pipe a into the chamber B, where the moisture is removed and dry gas issues from the delivery-tube d. Upon reversal the pivots f' drop down through the slots e' and release the projection g' from the projection e'', so that upon re-reversal of the machine the cage C will swing upon the pivots f' with its mouth downward to allow the rest of the acid to issue. When first used, the machine throws dry gas. Upon re-reversal it throws mingled gas and water.

The construction of the pipe a where it opens into the chamber B is a peculiarity of my invention in connection with its use as a dry-gas machine. Almost perfect dryness in the gas is necessary for such use. When the gas comes from the chamber A it is mingled with spray. The especial features of this device are that it is delivered against the side of the compartment at an acute angle, not at right angles, where it can run down without rebounding into the air of the compartment again; that it is delivered in a flattened stream, so that all particles of the moisture come in contact with the moisture on the side of the chamber and unite with them, and that it is delivered in a downward spiral direction, while the gas is forced upward. The flattened orifice of the pipe a delivering directly against the side of the chamber and at an acute angle is shown at m, Fig. 2, and the downward spiral direction is shown at m', Figs. 1 and 3.

Variations of the oil seal are shown in Figs. 7 and 11. In Fig. 11 it consists simply of a shallow annular groove n cut in the top of the bottle N. The under surface of the valve E (if of glass) is ground, and the upper surface of the bottle N is ground, so as to secure an accurate fit. If then a few drops of oil or such substance not acted upon by the acid are inserted in the groove n, it adheres to the surface of the valve E and closes the mouth of the bottle effectually. Thus an exceedingly small quantity of oil can be used.

In Fig. 7 is shown the annular trough o, like that of Fig. 8, but instead of being formed in the acid-bottle itself it is formed in the top of a cylinder M, inclosing the bottle P. The cage C and its supporting-rods e are the same as in Fig. 8. The bottle P may be made removable from its containing-cylinder M by a screw-bottom, (shown at p, the joint there being made air-tight.)

The cage C may be made removable from its supporting-rods e by giving one of such rods e a hinge n' at the top and a hole-and-nut connection at the bottom n''.

In both Figs. 7 and 11 the valve E is shown

as covering not only the mouth of the bottle, but the oil-trough as well, for the purpose described above. In such a form as that shown in Fig. 11, where an exceedingly small quantity of oil can be used—just a few drops—this covering of the oil-trough is especially essential, as a very small quantity of water added to it would destroy it as a seal.

The stop F consists of a thimble screwing upon a post o', affixed to the top c' of the cage C. The purpose of this is as follows: It is desirable for different purposes to vary the speed at which the acid is allowed to mingle with the soda solution. Thus a machine may be set up in a place where the likelihood is that in case of a fire a machine will be needed which will need a strong stream and quick action. In such case the stop F is adjusted at the time the machine is set up so as to allow the valve E to fall away completely from the mouth of the acid-receptacle. If a slow mingling of the acid and soda is likely to be needed, the stop F is adjusted, when the machine is set up, as near as desired to the valve E. A further purpose is to allow of proper adjustment of the stop F in case of acid-bottles differing in size.

The metal delivery-tube d acts as follows, Fig. 4: The opening z at the end of the flexible tube c serves as a nozzle—*i. e.*, its diameter regulates the time of the delivery of the gas. In a machine of the proportions shown in the drawings, acting under a pressure of, say, ninety pounds to the square inch, with all the communications uncontracted—say, *e. g.*, half an inch in diameter—the entire charge of gas would be spent in a quarter to a half a minute. This would be insufficient time to enable the operator to direct it upon the fire effectively. Therefore the opening z must be contracted to, say, one thirty-second of an inch, thus gaining the necessary time to do the most effective work. (In the drawings, Fig. 4, the relative sizes of z and t cannot be shown without reducing z so much as to destroy clearness. The nozzle z should be imagined as about one-sixteenth the diameter of t. The opening t, as shown, is about in proportion with the rest of the machine.) But if the opening of such a nozzle is placed as near the fire as may be—say even only an inch or two away—the effect is that the stream of gas issuing therefrom with great velocity sets in motion and carries with it a stream of air, which tends to feed the flame, thus neutralizing in a great measure the effect of the gas. The added tube d remedies this, owing not to its length but to the increased diameter of its bore t, which may be half an inch or more. The stream of gas issuing with velocity from the nozzle z expands many diameters and loses its velocity while passing through the tube d and is at the same time prevented from mingling with the air. The narrow opening z could not be placed at t, for then we would have the same strong current of gas carrying a current of oxygen no matter how near to the fire t was placed. On the other hand, the opening z could not be enlarged to the size of t, for then the machine would discharge too quickly to be of practical use; but with z controlling the time of discharge and t the velocity of the stream both objects are accomplished. The function of keeping the hand of the operator away from the fire is entirely secondary. To act on the idea of the invention, the tube d need not be more than a foot or two long, though ordinarily I would make it of any necessary length—say four or five feet long.

To make a practicable merchantable machine, especially of the reversible type, the gas must be formed under pressure. The delivery-tube d, in combination with such a machine, is therefore a device to form the gas under pressure and at the same time deliver it upon the flame without pressure—breathing it out, as it were. This feature—*i. e.*, delivery in volume without pressure—is of especial use on surface fires, where the smothering effect of the gas has the freest scope, as is the usual kind on electrical switchboards, where water cannot be used nor any draft created without fanning the flames.

Fig. 6 shows a variation of the conveying-tube and expanding-chamber d of Fig. 4. In this r is a metal tube four or five feet long, having a semiglobular end r', and across the mouth are arranged one or more gauze partitions r''. The gas, which issues at great velocity from the narrow opening in the nozzle, expands in the larger opening of the tube, and upon reaching the large globular end r' is expanded several hundred diameters in filling the larger space, thus reducing the velocity of the stream in corresponding measure. By this means the whole body of gas is delivered in a smothering volume upon the flame and covering a large area of the burning surface.

Fig. 5 shows another attachment to be used with the dry gas, consisting of a metal tube s, upon which is arranged a receptacle s' to contain sand or other mineral substance, the effect of which is to cover and cool the burning parts. The sand runs down through the opening v into the tube s and is carried along by the stream of gas mingled with it to the fire. The receptacle s' is of such form that the sand will run in any position in which the tube s is likely to be held.

I claim as my invention—

1. In a reversible chemical fire-extinguisher the combination of a main receptacle for the alkaline solution, an acid-receptacle within the main receptacle, a trough or space formed about the mouth of the acid-receptacle and containing a liquid not acted upon by the acid, and a gravity-valve completely covering and closing the top of both the acid-receptacle and the trough; such valve touching the liquid in the trough to form a liquid seal when the machine is upright, and falling away by gravity when the machine is reversed.

2. In a reversible fire-extinguisher, to throw liquid or dry gas interchangeably, the combination of an acid-receptacle, a gravity-closure therefor, pivots attached to the acid-receptacle below the center of gravity, supporting-rods attached to the machine having longitudinal slots to receive the pivots of the acid-receptacle, and a corresponding upright projection and socket upon the acid-receptacle and its support respectively; such projection and socket holding the acid-receptacle upright while the machine is upright, and disengaging by gravity when the machine is reversed.

3. The combination of a dry-gas fire-extinguisher having a contracted nozzle, to form the gas under pressure, and an additional delivery-tube, having its diameter greatly increased over the diameter of the nozzle, to form both a closed conveying-channel and an expanding-chamber, and delivering the gas upon the fire under reduced pressure.

4. In combination with a dry-gas fire-extinguisher a metal delivery-tube, having upon the top thereof a receptacle for sand opening into such tube.

In witness whereof I have hereunto set my hand this 22d day of June, 1897.

ARTHUR C. ROWE.

Witnesses:
SALTER STORRS CLARK,
HERBERT H. KELLOGG.