(No Model.) 2 Sheets—Sheet 1.

A. E. A. RUAULT.

SURGICAL ASPIRATOR, &c.

No. 350,895. Patented Oct. 12, 1886.

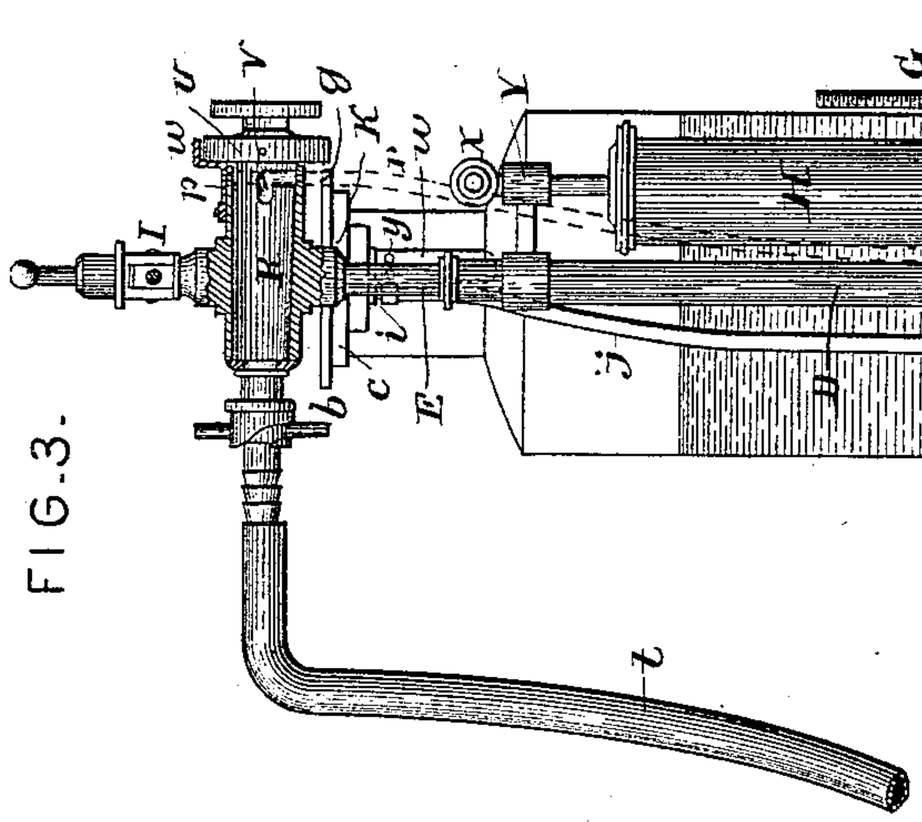

FIG. 3.

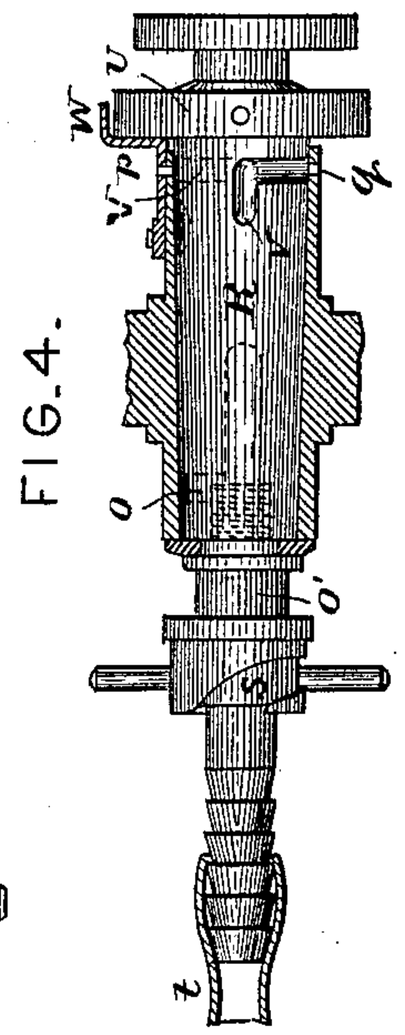

FIG. 4.

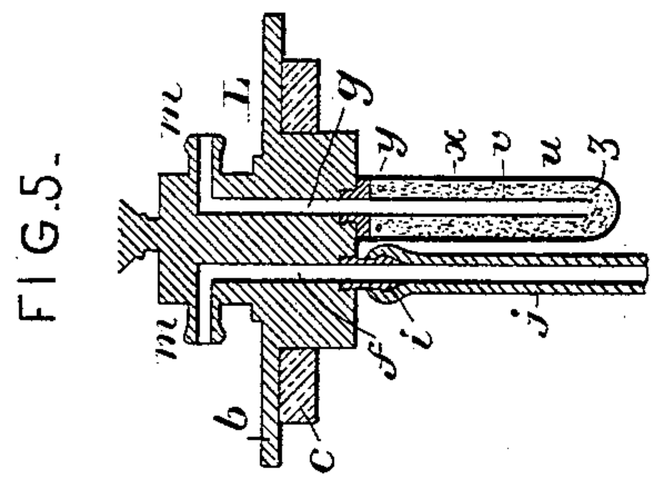

FIG. 5.

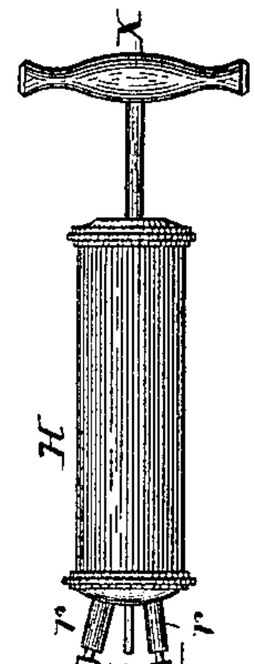

FIG. 1.

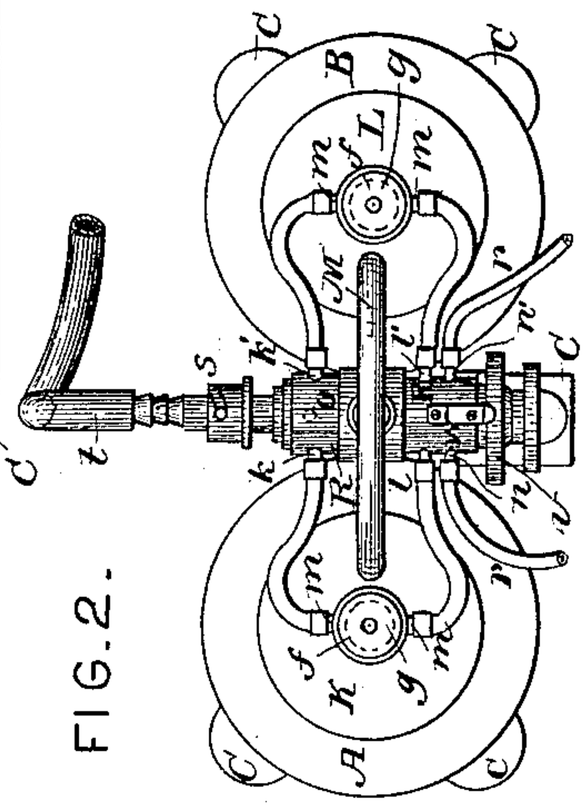

FIG. 2.

ATTEST-

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 6.

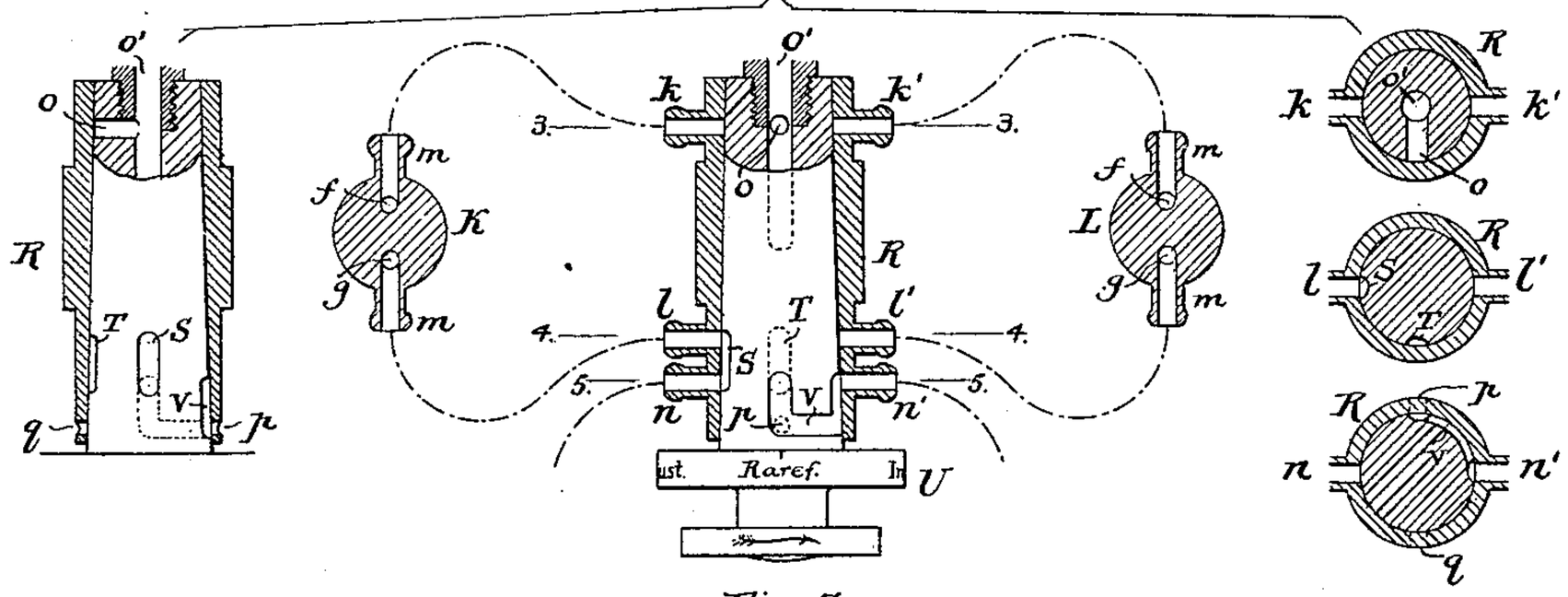


Fig. 7.

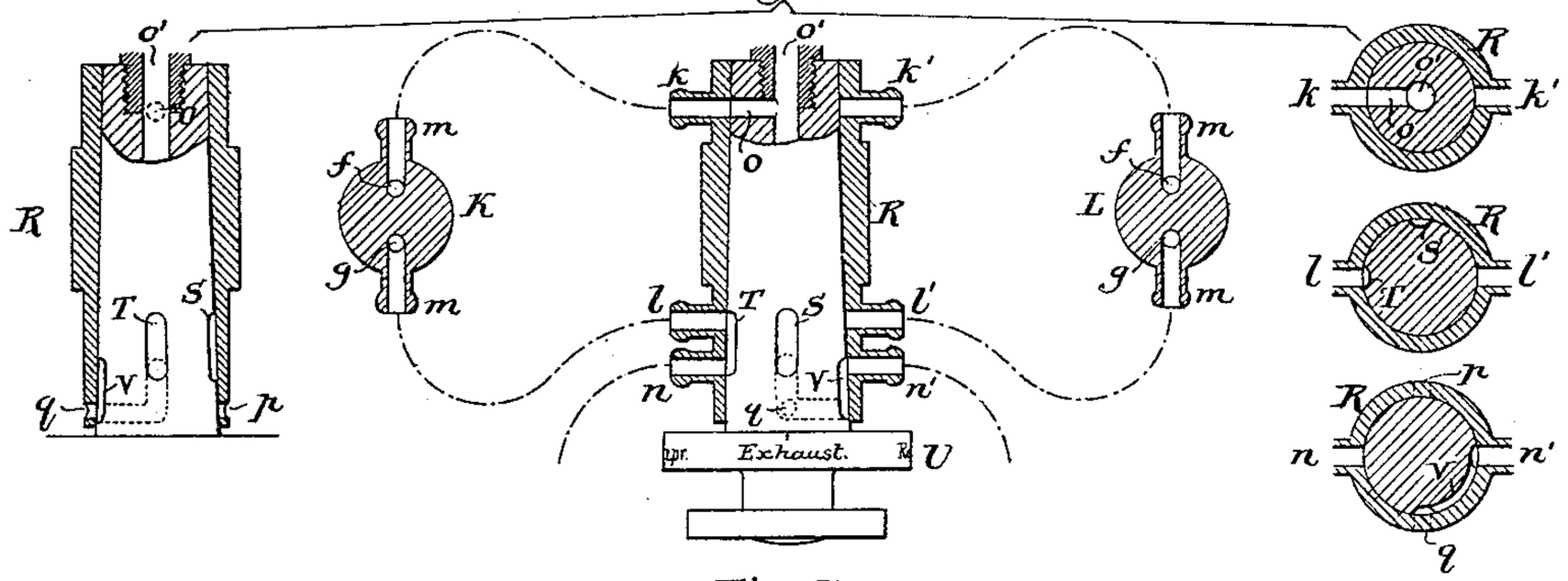


Fig. 8.

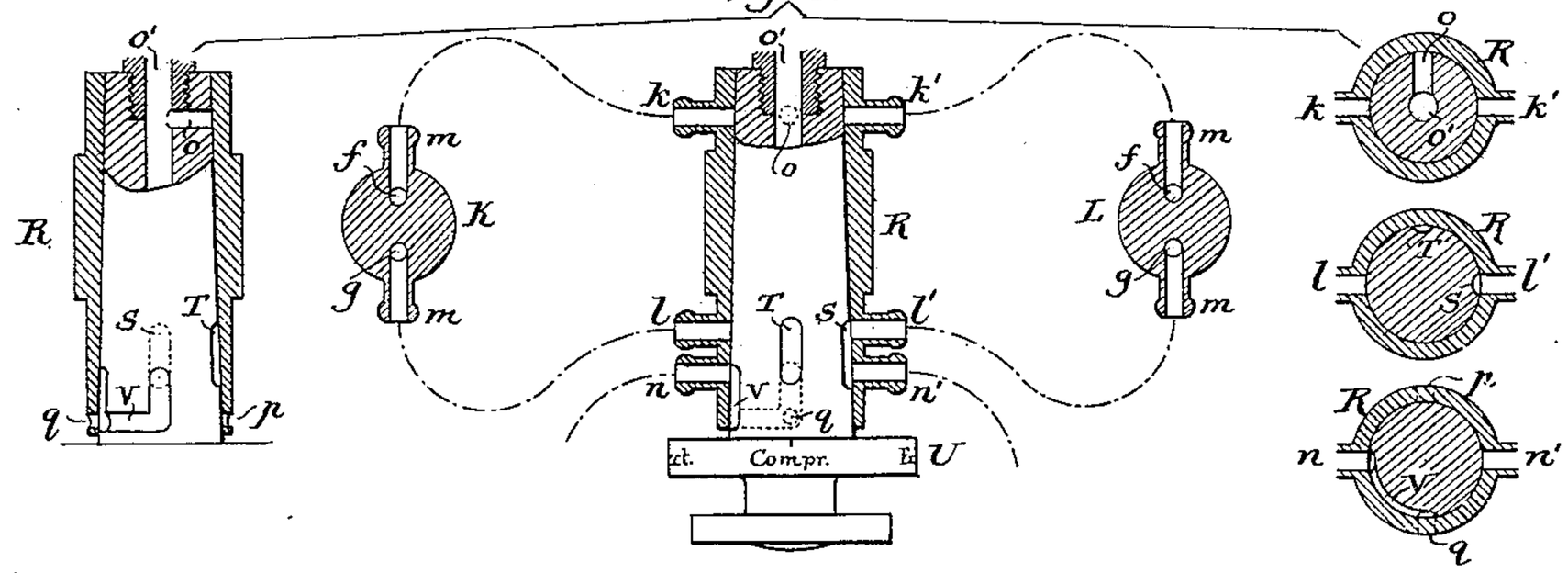
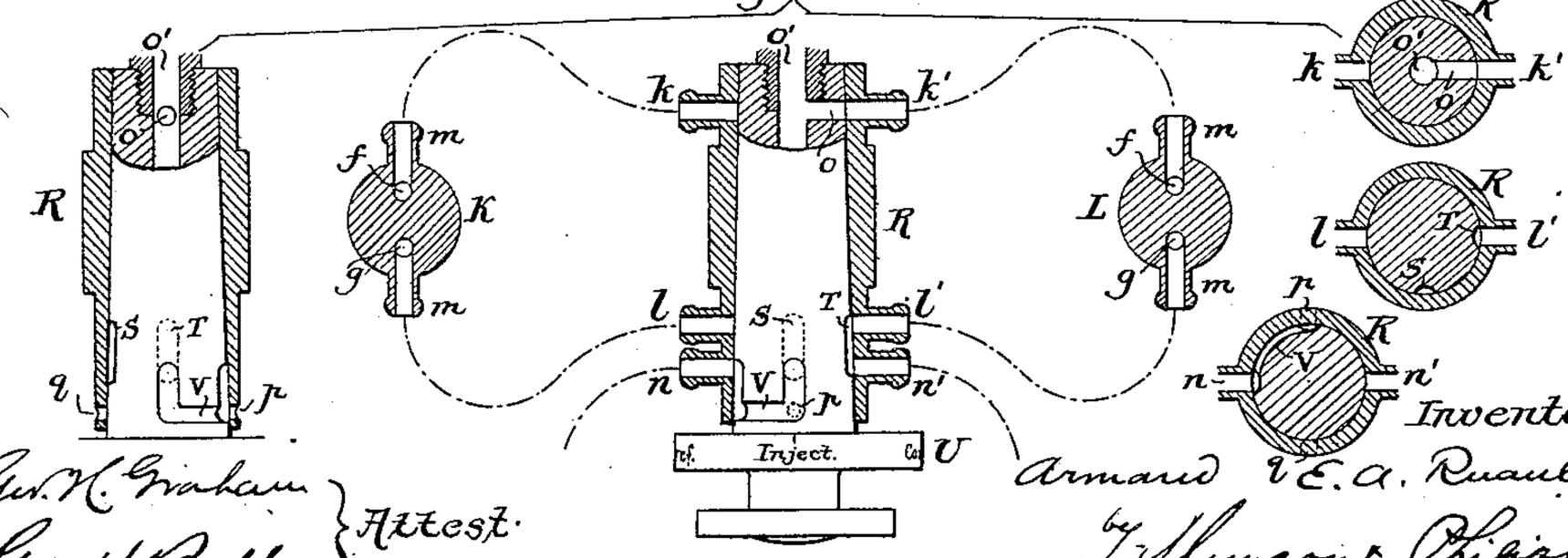


Fig. 9.



Witnesses:
Geo. H. Graham
Geo. H. Bott
} Attest.

Inventor.
Armand E. A. Ruault
by Munson & Philipp
Attys

UNITED STATES PATENT OFFICE.

ARMAND EDOUARD ALBERT RUAULT, OF PARIS, FRANCE.

SURGICAL ASPIRATOR, &c.

SPECIFICATION forming part of Letters Patent No. 350,895, dated October 12, 1886.

Application filed January 20, 1886. Serial No. 189,151. (No model.) Patented in France December 18, 1885, No. 160,362.

To all whom it may concern:

Be it known that I, ARMAND EDOUARD ALBERT RUAULT, a citizen of the Republic of France, residing at the city of Paris, France, have invented certain new and useful Improvements in Surgical Aspirators, &c., fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

Surgical instruments commonly known as "exhausters," have proved in practice to be defective in many respects, the chief of which is the use of a great number of cocks, which require caution and preciseness in their manipulation, and which are with difficulty kept in order. Double-acting apparatuses employing a combined exhausting and injecting pump have also been used by which a medicinal fluid can be injected into a cavity directly it has been exhausted by the apparatus of its morbid liquid, by connecting the apparatus with a second channel of the pump, which will then act as a force-pump, instead of by suction, a single bottle being employed. Such apparatus, while acting efficiently during the exhausting operation, is more or less inefficient when operating as an injector by reason of the danger of expelling the stopper with which the bottle employed in the apparatus is provided, and which in practice is guarded against by an assistant holding it in place. This apparatus, moreover, consists of many independent parts requiring time to fit together and caution in manipulation.

The object of the present invention is to provide a combined exhausting and injecting instrument, which shall overcome the objections to those heretofore employed, and which shall be simple in its structure, easy of manipulation, and efficient in its operation.

In the drawings, Figure 1 is a front elevation, partly in section, of the improved instrument; Fig. 2, a plan view of the same, the pivoted beam for clamping the stoppers in place being removed for perspecuity's sake; Fig. 3, a sectional side elevation of the same, the pump being shown in its position on the apparatus while not in use. Fig. 4 is an enlarged side elevation of the controlling-valve, its case being shown in section. Fig. 5 is a vertical sectional elevation of a plug or stopper of one of the bottles, and Figs. 6, 7, 8, and 9 are diagrams illustrating by two longitudinal sections and three cross-sectional views each, taken, respectively, on the lines 3, 4, and 5, Fig. 6, the four different positions of the controlling valve or cock.

Referring particularly to Figs. 1 to 5, inclusive, it is to be understood that the apparatus as therein illustrated consists of two bottles, A B, one the suction and the other the injecting bottle, resting side by side upon a bed-piece, C, from which projects a hollow vertical post, D, that rises between the bottles to a height slightly lower than their mouths. Within this vertical post is arranged a vertically-adjustable rod, E, that is provided near its upper end with a horizontally-arranged beam, I, pivoted thereto, and also with a controlling valve or cock, R, and a handle, M, for lifting and carrying the instrument. The horizontal beam I projects from opposite sides of the rod E over the mouths of the bottles A B, and is there provided with plugs or stoppers K and L, respectively connected thereto through ball-and-socket joints *a*, and arranged so as to enter and rest upon the mouths of the bottles, as is clearly shown. The vertical rod E is connected at its lower end with a lever, F, fulcrumed at one end upon a stud projecting from the bed-piece of the instrument, its opposite end being engaged by a nut, N, on a screw-threaded rod, G, by which nut the lever and through it the rod E and beam I may be adjusted and forced downward, so as to securely confine the plugs or stoppers onto the mouths of the bottles, and thus they may be simultaneously closed or opened, according as the lever F is adjusted, and enabling the bottles to be rapidly removed and replaced as occasion may require. The ball-and-socket joints *a* permit the stoppers to adjust themselves to that of the mouths of the bottles, while, should the bottles vary slightly in height, the pivoted beam I will accommodate itself thereto.

The stoppers K and L are of like construction. They consist of a cylinder, *d*, provided with a flange, *b*, the under side of which is lined with an india-rubber washer, *c*, to rest upon the mouth of the bottle. The stoppers are each provided with orifices *f g*, communi-

cating with the interior of the bottle, and by suitable nozzles, *m m*, upon opposite sides of the stopper, with tubes connecting said orifices with the shell of the controlling-valve. The orifice *f* of the stopper for the injecting-bottle will preferably have a nozzle, *i*, to which is attached an india-rubber tube, *j*, projecting into the bottle, as shown. The distributing cock or valve R is of cylindrical partly tapering shape, and is arranged at right angles to the length of the beam I and to the plane of the bottles A B. It is held in a shell or seat on the vertical rod E, which shell is provided with six orifices, *k k'*, *l l'*, and *n n'*, three each on opposite sides thereof and in the plane of the axis of the valve. The orifices *k k'* and *l l'* are each connected by suitable pipes or tubes with the nozzles *m* of the orifices *f g* of each stopper, as seen in Figs. 2, 6 to 9, while the orifices *n n'* are each connected by suitables tubes, *r*, to nozzles of a pump, H. The valve-shell is also provided with two air-orifices, *p q*, arranged near the head of the valve upon opposite sides of the shell and at right angles to the horizontal axis of the valve. The plug of the valve R has a longitudinal opening, *o'*, extending a short distance in its stem, connected by a "bayonet" or other tight joint, *s*, with an india-rubber tube, the end of which is adapted to receive the instrument, (catheter, trochar, &c.,) which is to be inserted into the cavity to be acted upon by aspiration or injection. With this longitudinal opening connects an orifice, *o*, extending at right angles therefrom and in line, when the valve is rotated therefor, to coincide with either of the openings *k k'* of the shell, and thus either of the orifices *f* of the stoppers K L may be put into communication with the tube *t* by turning the plug so as to present the orifice *o* in line with either one of the openings *k k'*. The valve-plug is provided with a channel, V, which is of such form that either one of the orifices *n n'* may communicate with one of the air-orifices *p q*, and the plug is also provided with two short longitudinal channels, S T, that serve at stated times to connect the orifices *n* and *l* together, and likewise the orifices *n'* and *l'* together, so that the bottles may each be placed independently into communication with the pump. This shell of the valve R preferably carries a stationary pawl or index, W, that engages with notches on the disk U, carried by the valve-plug, and which disk is provided with designating words or abreviations, as "Raref," "Exhaust," "Compr.," "Inject.," so that the plug may be instantly turned to a position to effect the proper connections with the channels and orifices for the operations in which the instrument is to be employed. The pump H is a single-acting one, its nozzles being provided with the ordinary valves, one opening inward and one outward, and its piston actuated by a handle, X, which, when the pump is not in use, may be hooked on a support, Y, its bottom projecting stud, Z, fitting in a recess (not shown) in the top of the lever F, completing the means for holding said pump and preventing it from swinging about when moved from place to place.

Referring to Figs. 6, 7, 8, and 9, it will be seen that the valve-plug R may occupy four different positions. In the first position—that shown in Fig. 6—the air within the left-hand suction-bottle, A, may be rarified upon actuating the pump in one direction, in which case the air will be drawn from the bottle through the stopper-orifice *g*, tube connecting it with orifice *l*, and by channel S of the valve-plug by tube-connecting orifices *n* and pump-nozzle *r* to the pump, and on the reverse action of the pump-piston the air thus withdrawn from the bottle A will be expelled through pipe connecting the pump-nozzle *r* with orifice *n'*, and the recess V in the valve-plug to the open air by the air orifice *p*, communication between both the bottles and the tube *t* by the axial orifice *o'* being cut off as well as between the pump H and the injecting-bottle B, as is clearly seen. In the second position—that shown in Fig. 7—the valve-plug having been turned in the direction of the arrow, (see Fig. 6,) the pathological cavity into which the instrument at the end of the tube is projected will undergo a direct exhaustion upon actuating the pump, in which case the axial orifice *o'* and tube *t* will be brought into communication with the suction-bottle A through its radial orifice *o* and orifices *k* and *f*, and the tube connecting the two, while the other stopper-orifice, *g*, will still be in communication with the pump, but by means of the channel T, (the channel S having been moved to an idle position,) and the pump also in communication with the open air by means of the recess V, which in this position communicates with the air-orifice *q*. In the third position—that shown in Fig. 8—air may be compressed in the right-hand or injecting bottle, B, by the action of the pump, in which case the axial orifice *o'* is cut off from both bottles, while the pump is, through its connections with the orifice *n*, in communication with the open air through recess V and air-orifice *q*, the pump being also in communication with the injecting-bottle B through its connections with the orifice *n'*, channel S, orifices *l'* and *g*, (the channel T, which has communicating orifices *l* and *n*, having been moved to an idle position.) In the fourth position—that shown in Fig. 9—the liquid contained in the injecting-bottle B may be injected directly into the cavity operated upon, in which case the axial orifice *o'*, through its radial orifice *o* and the orifices *k'* and *f*, and the connection between the two, is in communication with the injecting-bottle B, while the pump, through its connections with the orifice *n'*, channel T, orifices *l'* and *g*, and connections, is in communication with said bottle, and the pump being also in communication with the open air through its connections with the orifice *n*, recess V, and air-orifice *p*.

The arrangement of the orifices, channels, recess, and connections being as described,

the practical operation of the instrument is as follows:

The instrument is prepared for use by filling or partially filling the injecting-bottle B with the liquid to be injected while the suction-bottle A is empty, and they are both carefully stoppered. The instrument attached to the tube *t* of the axial orifice *o'* of the valve (say, for instance, the cannula of a trochar) is placed within the pathological cavity to be acted upon by either suction or injection.

First. Let it be assumed that a vacuum is first to be produced within the suction-bottle A, and that the latter is then to be connected with the pathological cavity, so that it may exhaust the morbid liquid contained therein, that immediately after this exhaustion an antiseptic or modifying liquid is to be injected into the said cavity, and, on having remained therein for a variable space of time, is to be removed therefrom again by suction. (Example: a thoracocentesis; a pleuritical effusion to be evacuated or a purulent collection to be removed; an antiseptic injection to be made into the pleural cavity, the liquid to be subsequently drawn out again.) To effect this I first bring the valve-plug R to the position shown in Fig. 6. Then by setting pump H into operation I draw in air from the suction-bottle and discharge it into the atmosphere by the air-orifice T. The orifices *o* and *o'* connecting with tube *t*, which leads to the cannula of the trochar, thus remains closed. When the rarefaction of the air within bottle A is found to be sufficient, I turn the controlling-valve to the position shown in Fig. 7, thus opening communication between the tube *t* and the suction-bottle. The liquid from the pathological cavity will, by reason of the partial vacuum produced in said bottle, run into the same. After a space of time deemed sufficient for the whole of the liquid to be evacuated, aided, may be, by a suction-stroke of the pump, the controlling-valve will be brought to the position shown in Fig. 9. In the meantime the operation of the pump undergoes no change whatever. External air is thus drawn in through the air-orifice *p*, and caused to pass into the injecting-bottle B, and force the liquid from the latter into the pathological cavity. When the amount of liquid thus injected is deemed sufficient, the injection is stopped by bringing the controlling-valve into the position shown in Fig. 8, and the same will be returned to the position shown in Fig. 7 when it is required to remove the liquid again from the cavity.

Second. Suppose that the apparatus is to act successively by injection and suction. (Example: the pleura to be washed after the foregoing operation, this washing to be continued until the liquid used leaves the cavity in a perfectly pure state.) For this purpose the assistant actuating the pump may continue his work as before, without the slightest alteration, and the controlling-valve is only carried from the position shown in Fig. 7 to that shown in Fig. 9.

Third. In the course of the operation, before it is completed it happens that one of the bottles is to be displaced—either the suction-bottle, in order to be emptied, or the injecting-bottle, to be filled anew. To this end it will suffice to bring the controlling-valve to one of the two positions shown in Figs. 6 or 8, which correspond to the closing of the orifice *o*, communicating with the tube *t* carrying the cannula. Thus the interior of the cavity is no longer in communication with the atmosphere. Then by disengaging lever F from the central rod, D, of the apparatus, all the upper part of the latter is lifted, the bottles are emptied, filled, cleaned, &c., and finally put in place again. Now, lever F, which had been lowered, is lifted and tightened, as before, and the whole of the apparatus assumes the same position as in the beginning of the operation, without its having been necessary to touch any one of the parts in contact with the patient. This operation can be repeated as many times as may be desirable. It is accomplished quickly and safely, and no inconvenience whatever results therefrom for the patient.

Fourth. Suppose, now, that an injection is to be very powerful. (Example: an injection into a fistulous course; an anfractuous wound with seats of purulent collections to be washed.) The controlling-valve R is first placed in the position shown in Fig. 8. Then pump H is set in operation, and when the pressure is judged high enough in the injecting-bottle B the controlling-valve is brought to position shown in Fig. 9.

Fifth. When it is desired that the liquid to be injected should be absolutely aseptic, so as to convey no germ whatever into the morbid cavity. (Example: an intra-venal injection.) Orifices *o'* of the controlling-valve, the one of tube *t* leading to the cannula, the tube *j*, as well as the vessel, are first of all carefully washed by means of an antiseptic liquid. Then before commencing the operation, a filter of wadding, hereinafter described, is screwed into the air-channel *g* of stopper L of the injecting-bottle. The apparatus is now set in operation, and the injection is sure to be absolutely aseptic, as no germ can be carried into the distributer by the circulating air, since the latter only reaches the surface of the liquid on having been filtered through the wadding. In this case the apparatus should be charged with liquid down to the very cannula before the insertion of the latter into the vein, so as to exclude therefrom even the smallest bubble of air. The wadding-filter *u*, before referred to, consists of a tube, *v*, (see Fig. 5,) depending from the channel *g* into and near the bottom of a closed tube, *x*, which, like the tube *v*, is also attached at its upper end to a piece of metal adapted to be screwed to the under side of the stopper. The closed tube *x* at or near its top is provided with small orifices *y* for the exit of air, and the space *z*, between the two tubes, is filled with wadding, through which the air is to be filtered. It will be understood that one of the bottles may be provided with a press-

ure-gage, and the other with a vacuum-indicator, or both may be connected with an apparatus recording the two. In a word, the apparatus, arranged as herein described, enables, by simply operating pump H and turning the controlling-valve R to the proper position, a preparatory vacuum to be produced in suction-bottle A, or a direct exhaustion to be effected without a preparatory vacuum, or a direct injection to be performed from the injecting-bottle B, or, lastly, a suitable amount of air to be compressed within said bottle B before the injection is commenced, and the positions of the controlling-valve to obtain these various effects will be facilitated by the index pawl or hand *w*, before described. It will therefore be seen that the handling of the apparatus is exceedingly simple, and that by its use no mistake is possible. The cases in which it may be successfully employed are of course very numerous, viz: first, various tappings, pleurisy, pericarditis, ascites, abcesses, hydrocele, tappings of the bladder, &c.; second, medicinal washings or injections directly after a tapping; third, intra venal injections, (artificial serum,) blood freed from fibrin, &c.; fourth, intestinal enemas with varying pressures; fifth, irrigations and washing of wounds, nasal and ocular douches, &c.; sixth, washings of the vagina, the uterine cavity, the bladder, &c.; seventh, artificial feeding, washing, and cleansing of the stomach, &c. In fact, by means of the perfectly-tight joint *s* and the india-rubber tube *t*, the apparatus may readily be connected with a variety of instruments, such as trochars, cannulae, sounds, &c.

What I claim is—

1. A combined exhausting and injecting apparatus consisting of a pair of bottles, a single conveying-tube, a pump, and a controlling-valve common to said bottles, tube, and pump, substantially as described.

2. A surgical apparatus capacitated to act as an exhauster and an injector, the same consisting of a suction and an injecting bottle, a single controlling-valve, as R, carrying a conveying-tube, as *t*, and a pump, as H, and connections between said tube and the bottles and between the bottles and the pump, all controlled by said valve, substantially as described.

3. The combination, with a suction and an injecting bottle, each having a stopper provided with channels, a conveying-tube, as *t*, and a pump and connections between said channels and the conveying-tube and pump, of a controlling-valve interposed between the channels of the stoppers, conveying-tube, and the pump, whereby either bottle is put into communication with the pump, either bottle is put into communication with the conveying-tube, and either bottle is put into communication with both the conveying-tube and the pump, substantially as described.

4. The combination, with a pair of bottles having stoppers, of a rod, E, provided with a beam, I, that is connected with both stoppers, whereby the said rod will simultaneously raise or lower said stoppers to close or open the mouths of said bottles, substantially as described.

5. The combination, with a pair of bottles having stoppers provided with channels *f g*, of a rod, E, provided with a beam, I, that is connected with both stoppers, and a controlling-valve, also carried by said rod and having connections with said channels, whereby the said rod will simultaneously raise or lower said stoppers to close or open the mouths of said bottles without disconnecting the valve from the channels, substantially as described.

6. The combination, with a pair of bottles having stoppers connected together by a beam, as I, of a rod, as E, connected to said beam and provided with a hold-down lever, F, engaged by a nut of screw-threaded rod G, substantially as described.

7. The combination, with a single conveying-tube, *t*, and a pair of stoppers for closing the mouths of a pair of bottles, and having channels therein, of a controlling-valve having an orifice for the tube and an orifice for each channel of the stoppers, and for a pump and a valve-plug having orifices, channels, and recess controlling communication between said conveying-tube, channels in the stoppers, and the pump, substantially as described.

8. The combination, with the induction-channel of the stopper L, of a filter consisting of the open tube *v* and closed tube *x*, having air-orifices near its upper end and filled with antiseptic wadding, substantially as described.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

ARMAND EDOUARD ALBERT RUAULT.

Witnesses:
DAVID T. S. FULLER,
ALBERT CAHEN.