No. 784,440. PATENTED MAR. 7, 1905.

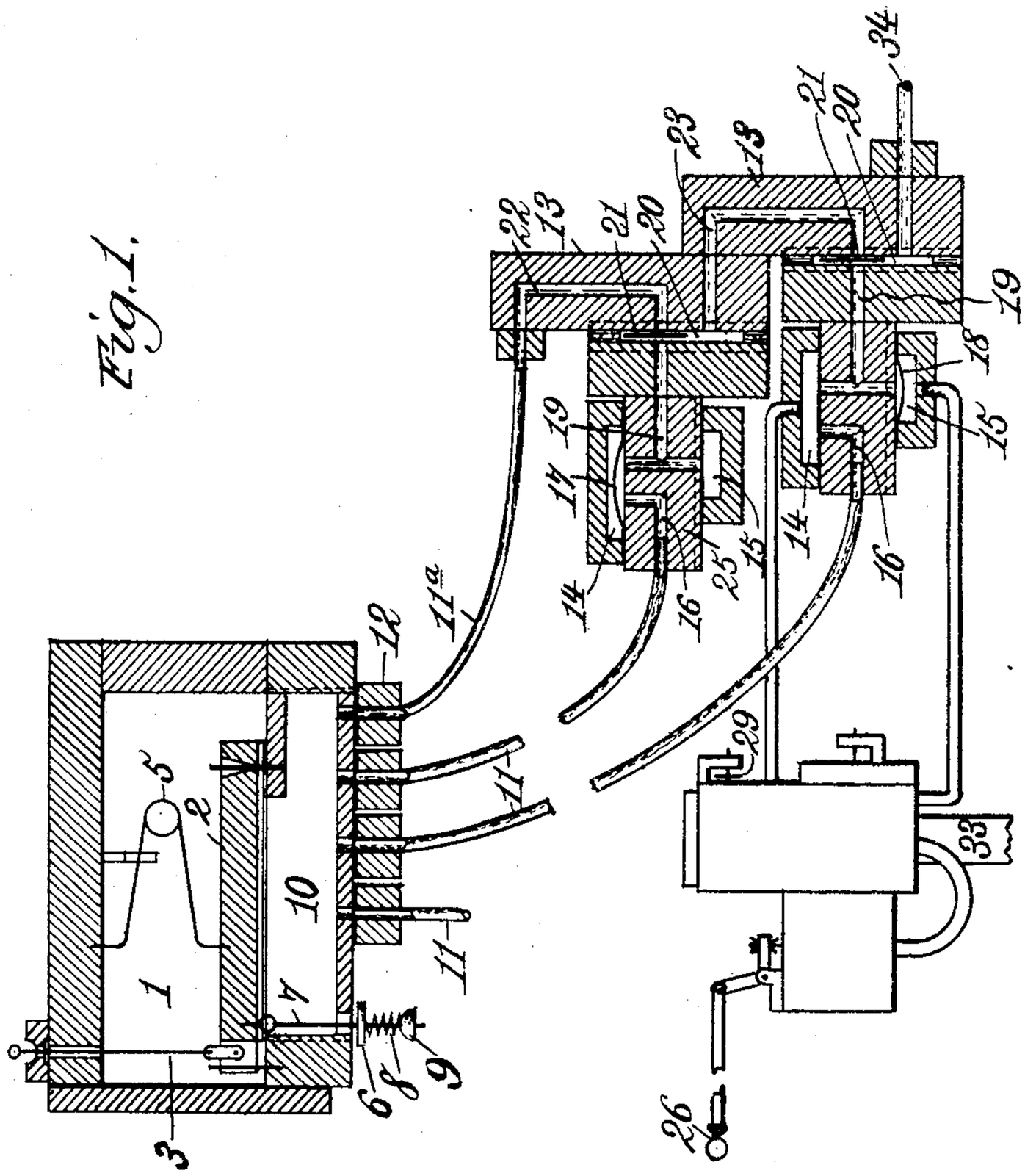
E. M. SKINNER.

ORGAN ACTION.

APPLICATION FILED JULY 31, 1903.

8 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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8 SHEETS—SHEET 2.

Fig. 2.

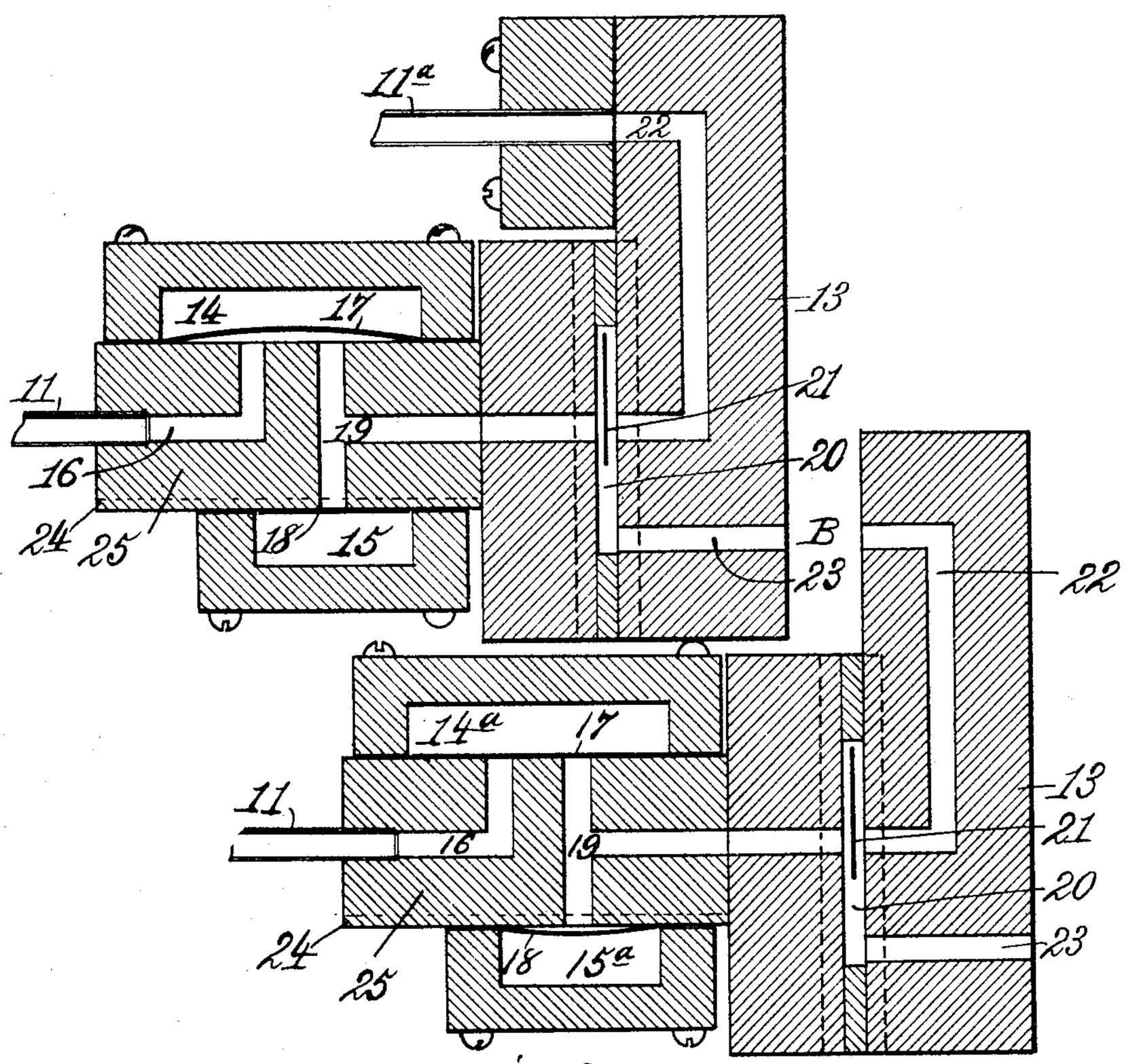
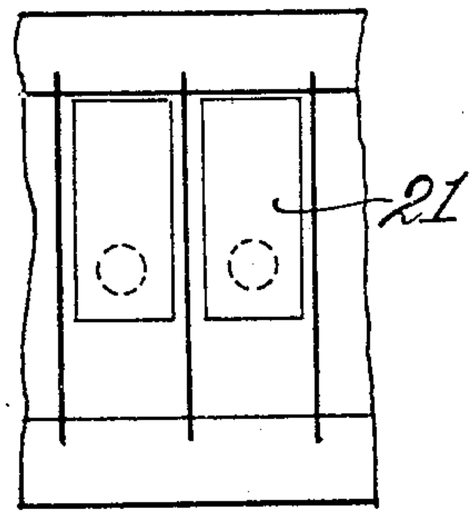


Fig. 3.



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8 SHEETS—SHEET 3.

Fig. 4.

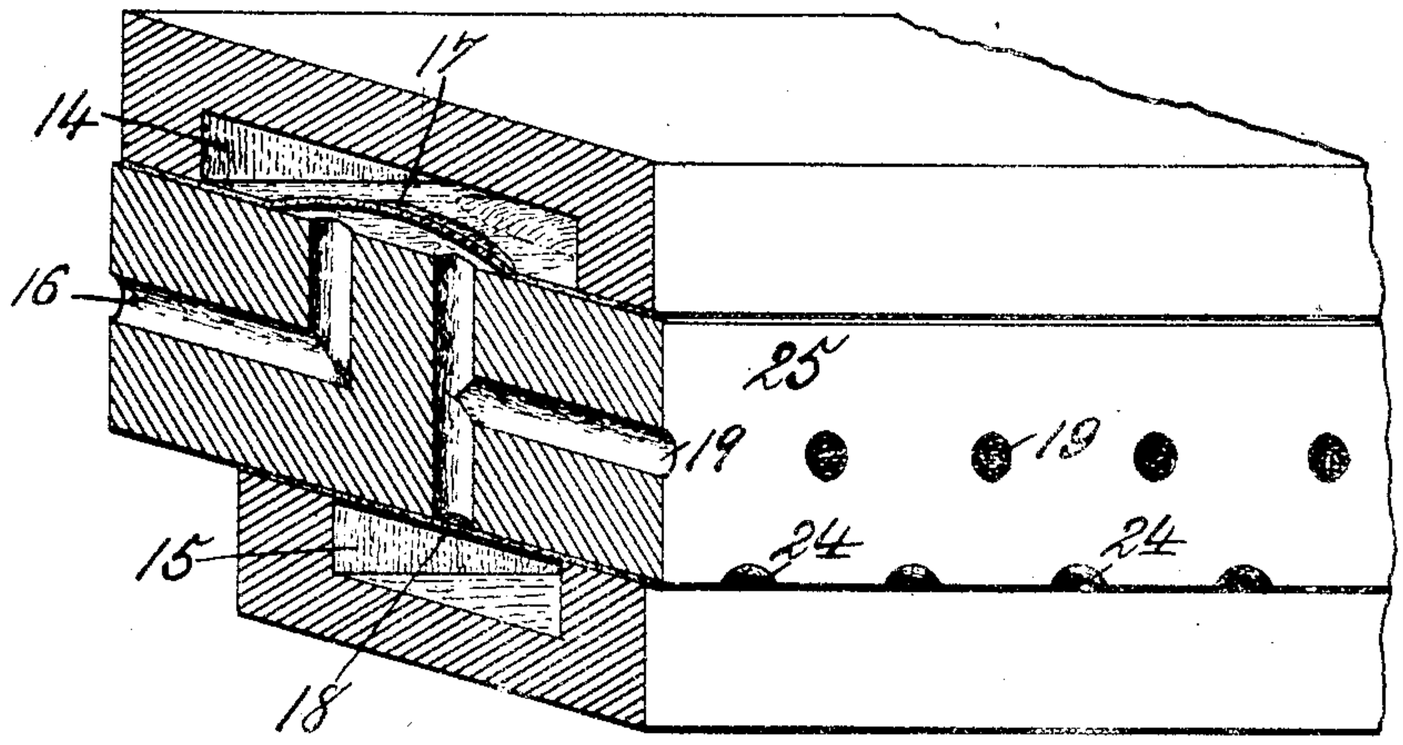
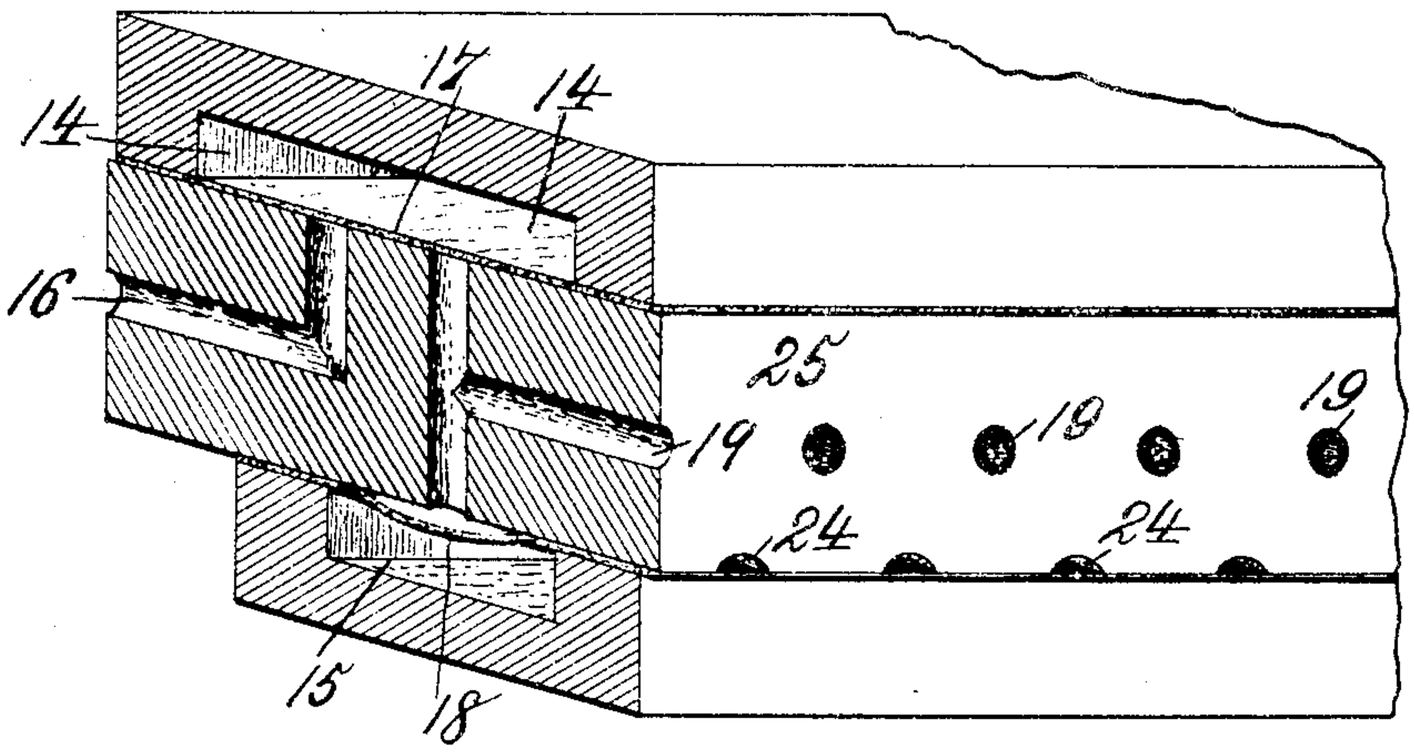


Fig. 5



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8 SHEETS—SHEET 4.

Fig. 6

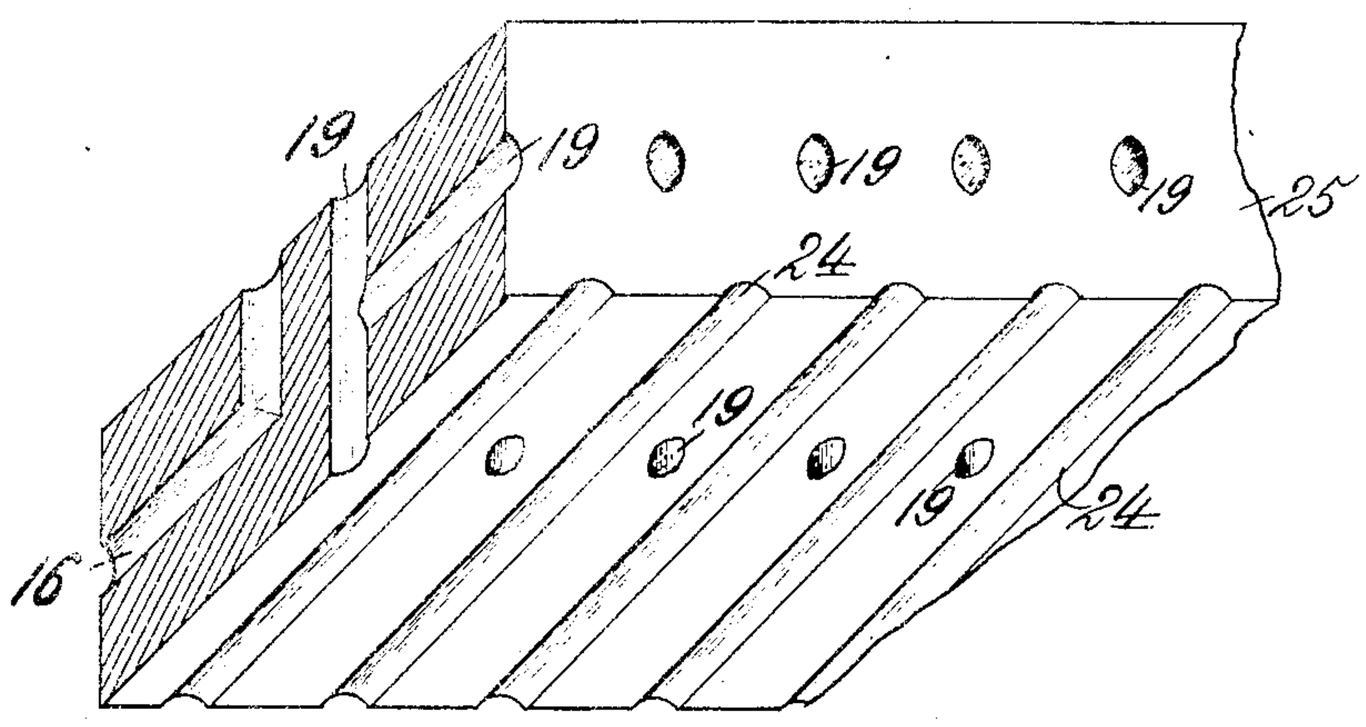


Fig. 7

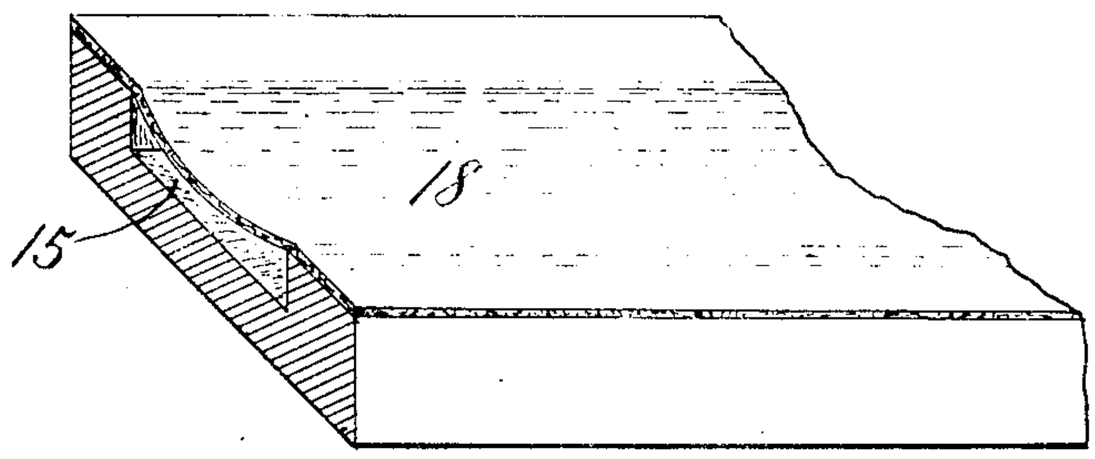


Fig. 8.

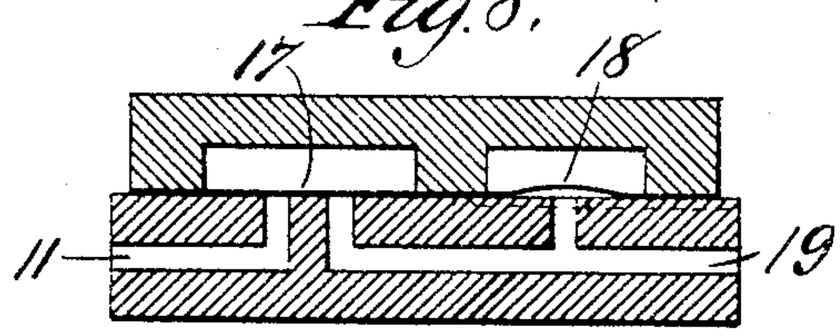
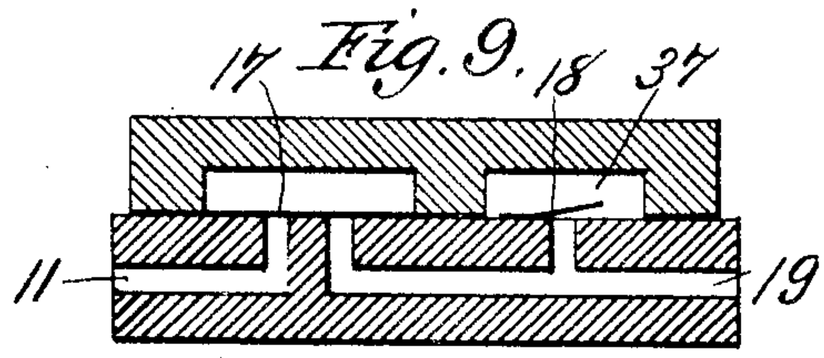


Fig. 9.



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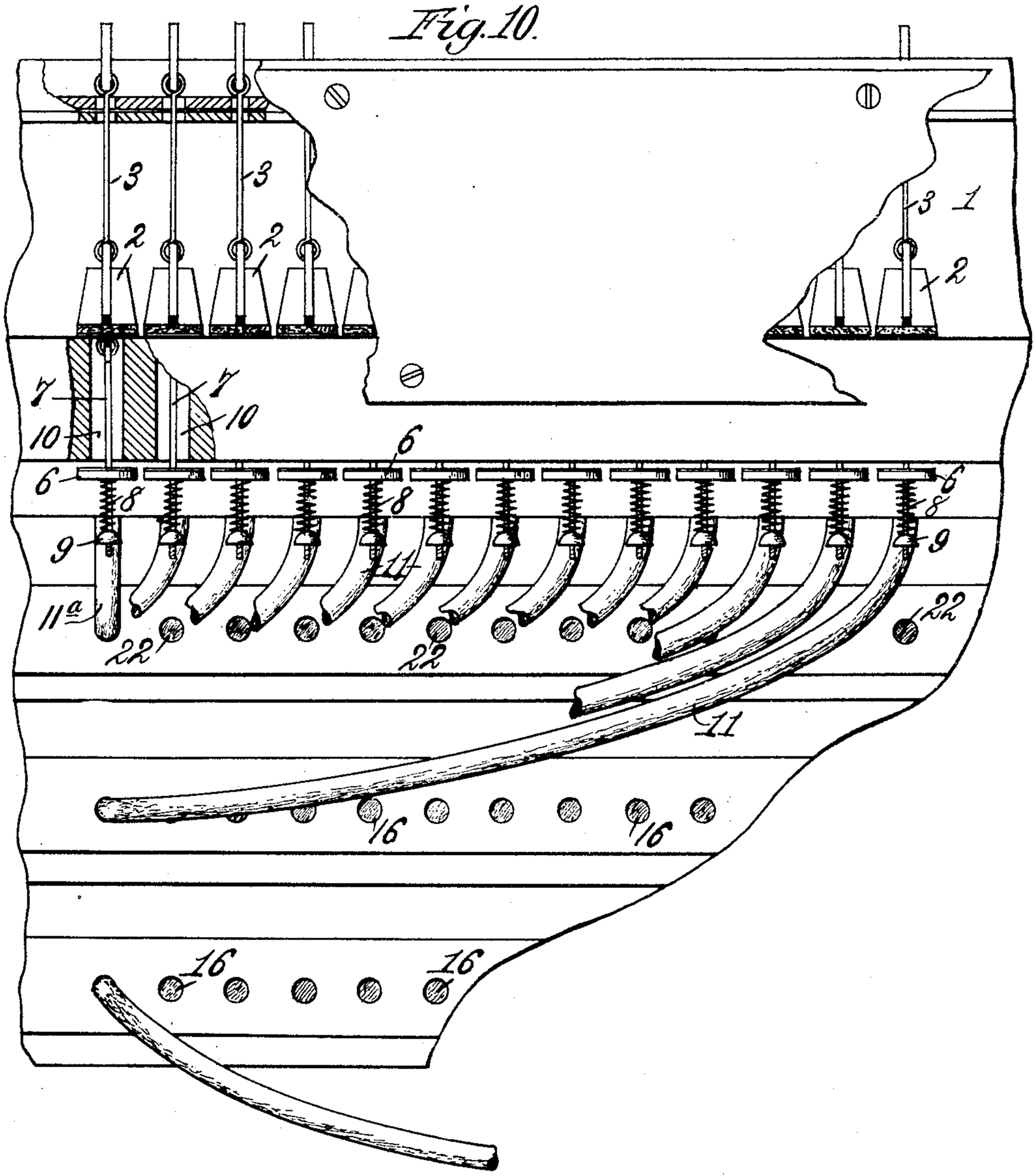
8 SHEETS—SHEET 5.

Fig. 10.



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8 SHEETS—SHEET 6.

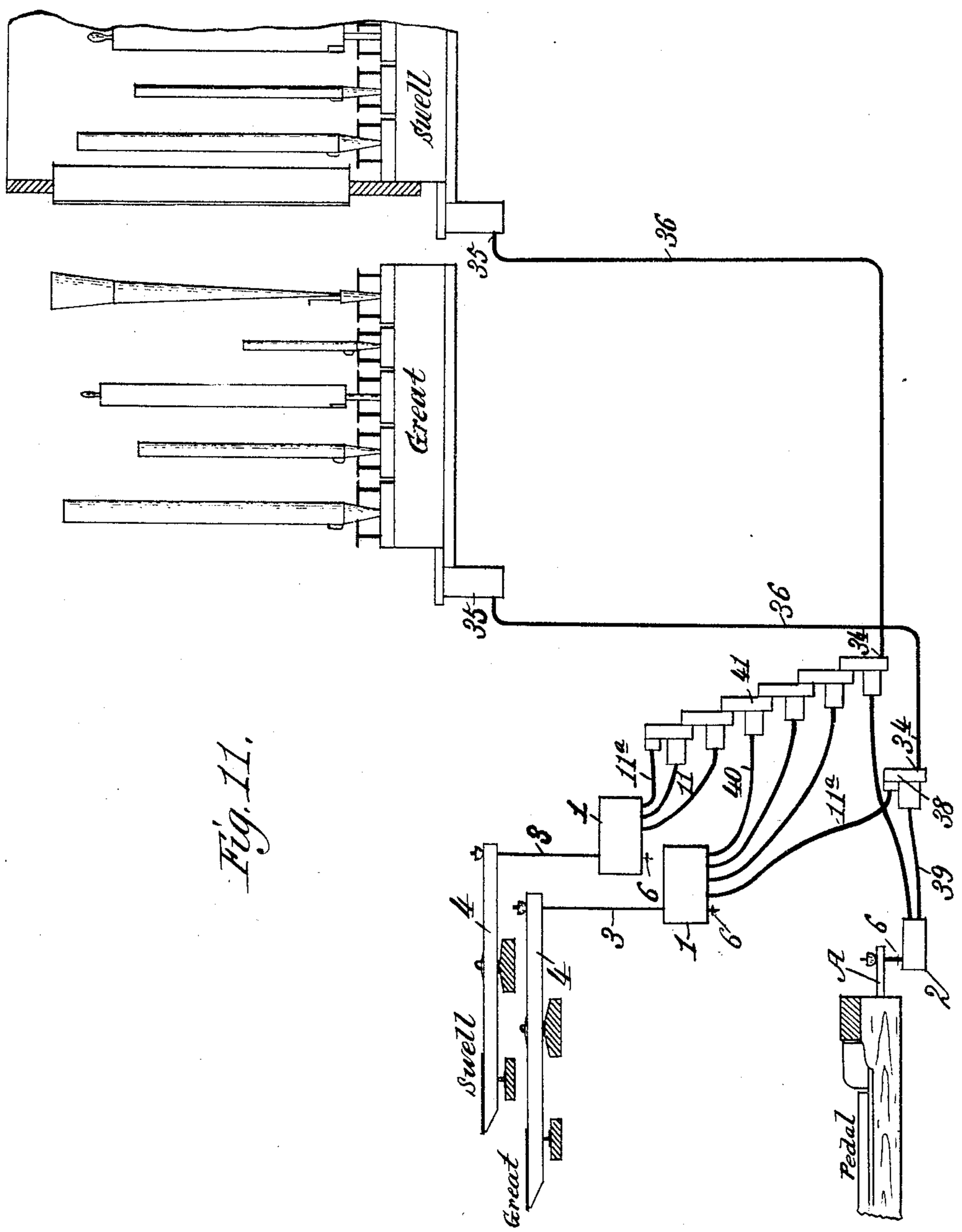

Fig. 11.

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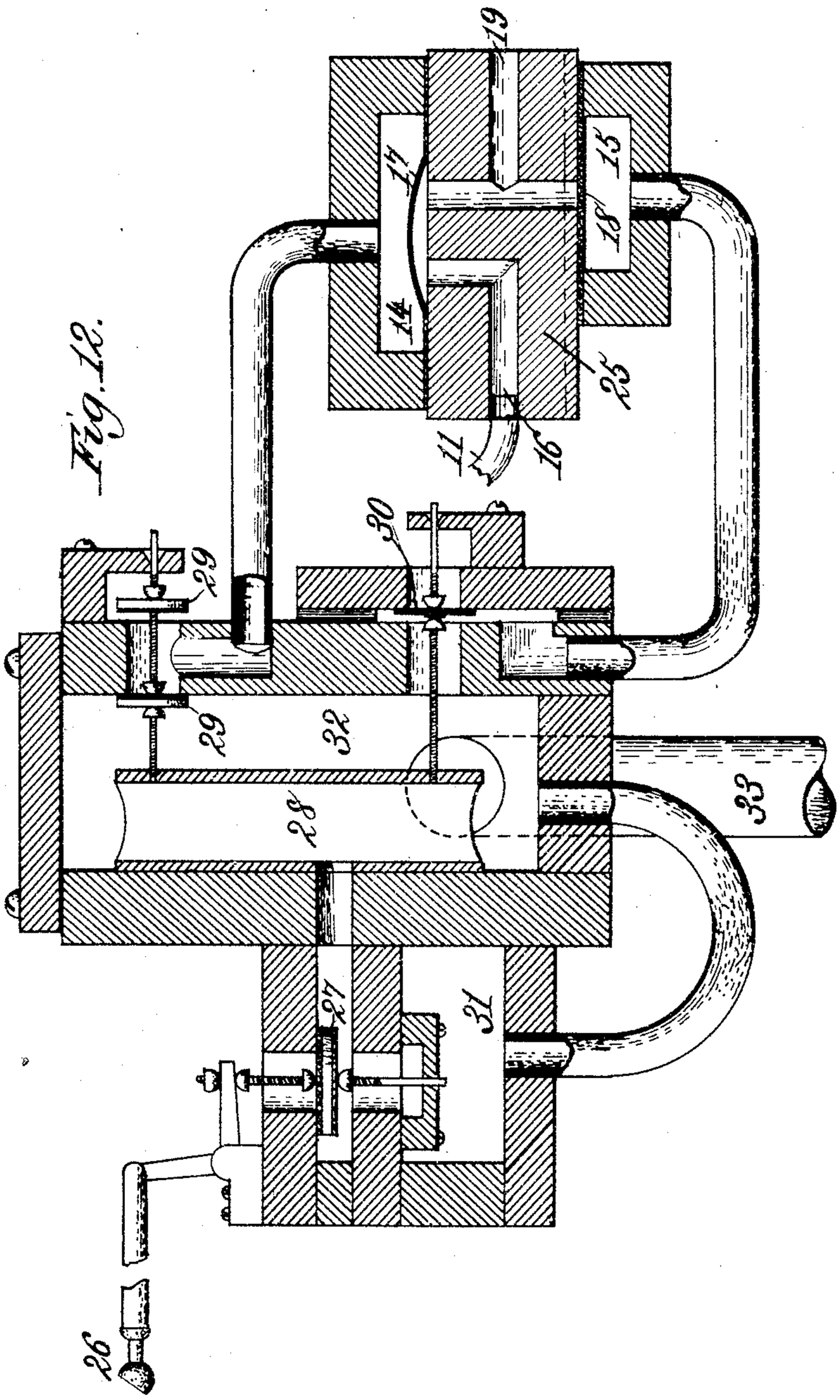
8 SHEETS—SHEET 7.

Fig. 12.



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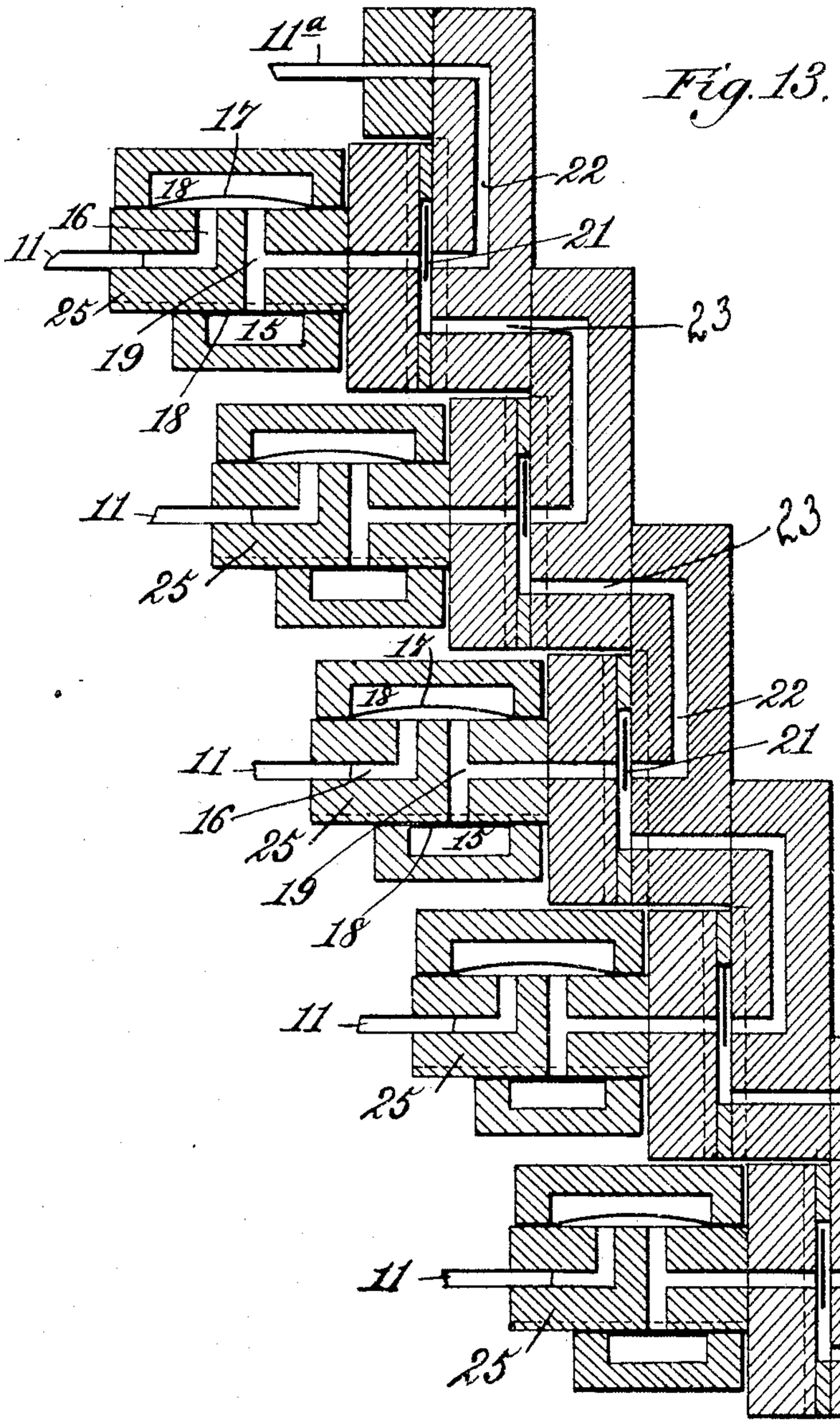
APPLICATION FILED JULY 31, 1903.

8 SHEETS—SHEET 8.

Fig. 13.



WITNESSES:

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No. 784,440. Patented March 7, 1905.

UNITED STATES PATENT OFFICE.

ERNEST M. SKINNER, OF BOSTON, MASSACHUSETTS.

ORGAN-ACTION.

SPECIFICATION forming part of Letters Patent No. 784,440, dated March 7, 1905.

Application filed July 31, 1903. Serial No. 167,746.

To all whom it may concern:

Be it known that I, ERNEST M. SKINNER, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Organ-Actions, of which the following is a specification.

This invention relates to an improvement in organ-actions, and particularly to a tubular pneumatic type.

The objects of the invention are in a ready, simple, thoroughly feasible, and practical manner to effect exhaust and supply for the tube directly from the keys, thereby obviating necessity of venting or puncturing the tubes, as usual; to prevent climatic conditions from interfering with the operation of the instrument; to adapt the blocks employed to be attached in succession one to the other, thereby to facilitate their manufacture; to present an exhaust of the tube which shall at all times afford an outlet to the atmosphere when the note is not speaking, regardless of the position of the couplers, and, finally, to improve and simplify the construction of the parts of an organ constituting the present invention.

With the above and other objects in view, as will appear as the nature of the invention is better understood, the same consists in the novel construction of parts of an organ, as will hereinafter be fully described and claimed.

In the accompanying drawings, forming a part of this specification, and in which like characters of reference indicate corresponding parts, there is illustrated a form of embodiment of the invention capable of carrying the same into practical operation, it being understood that the elements therein exhibited may be varied as to shape, proportion, detail, and exact manner of assemblage without departing from the spirit thereof.

In the drawings, Figure 1 is a view in section of a key-valve chest and two coupler-blocks, with their connecting-tubes. Fig. 2 is an enlarged sectional view of the coupler-blocks shown in Fig. 1. Fig. 3 is a view in plan of two of the check-valves shown in Figs. 1 and 2. Figs. 4 and 5 are perspective views of a portion of Fig. 2. Figs. 6 and 7 are perspective views in section, further illustrating what is shown in Figs. 4 and 5. Figs. 8 and 9 are sectional views of a modified arrangement of parts of the apparatus shown in Figs. 4 and 5, inclusive. Fig. 10 is a detail view, partly in section, showing the construction of the key-valve chest exhibited in Fig. 1. Fig. 11 is a diagrammatic view showing the connection of the present invention with the organ-pipes. Fig. 12 is a diagrammatic view, partly in section, showing an arrangement of valves for operating one of the coupler-blocks. Fig. 13 is a sectional view of five of the coupler-blocks attached in succession, the outlet of one block terminating in the inlet of the block next below.

Referring to the drawings and to Fig. 1 thereof, 1 designates a key-valve chest containing a valve 2 for each key of the manual to which the chest belongs, a wire 3 serving to connect the valve with its appropriate key 4, as shown in Fig. 11. The valve is normally held closed or seated through the medium of a spring 5. (Clearly shown in Fig. 1.) Arranged on the under side of the valve-chest is a valve 6, which is connected with the valve 2 through the medium of a stem 7, there being a spring 8 disposed beneath the valve 6, which is adapted to compress to a degree equal to the movement of the valve 2 in excess of the movement of the valve 6. Upon the stem 7 is an adjusting-nut 9, which serves to hold the valve 6 and spring 8 in their proper position on the stem. In the lower portion of the key-valve chest is a cell or chamber 10, into which compressed air is admitted and liberated by the valves 2 and 6 and in which the various action and coupler tubes terminate. The coupler-tubes 11 terminate in the cell 10, said tubes being held in proper operative position with relation to the cell through the medium of cleats or strips 12. In addition to the tubes 11, which communicate with the cell 10, there is an action-tube 11^a, the function of which will presently be described. The coupler-blocks 13 are shown in Fig. 1 as two in number, while in Fig. 13 five are shown, connected in succession.

Referring to Fig. 2, 14 designates a chamber containing a diaphragm 17 for each tube 11 entering the coupler-block 13, and 15 is a

chamber containing one diaphragm 18 for all of the tubes 11 entering the coupler-block 13. In Fig. 2 the coupler-blocks 13 are shown as slightly separated in order to facilitate an understanding of the construction of this part of the apparatus. Under the diaphragm 17 is a duct 16, with which the tube 11 communicates, and 19 is a duct constituting a continuation of the duct 16 through the diaphragm 17, said duct 19 terminating in a cell 20 under the valve 21, said duct having a terminus and an alternative outlet under the diaphragm 18, as indicated by dotted lines at 24 in Fig. 2 and in Figs. 4, 5, and 6. The tube 11^a forms a duct for the normal action of the keyboard, a duct 22 constituting a continuation of the tube 11^a, having an outlet in the cell 20 under the valve 21 and exactly opposite the duct 19. The valve 21 is adapted to close either of the ducts 19 or 22 when the compressed air is entering the cell 20 through the other. A duct 23 is provided which leads from the cell 20 to the next coupler-block or to the tube connecting the duct 23 with its pneumatic, as shown at 34 in Fig 11.

Referring to Fig. 12, 26 designates a register operating a valve 27, and 28 designates a pneumatic bellows or diaphragm for controlling valves 29 and 30, compressed air being admitted to and liberated from the bellows by a valve 27. As stated, the valves 29 and 30 are operated by the bellows 28, and when the register 26 is drawn the valve 29 liberates the compressed air from the chamber 14, and valve 30 admits air to the chamber 15 simultaneously, the object of the operation above described being to bring into or take out of action one of the coupler-blocks, as will presently appear. The chamber 31, Fig. 12, is preferably charged with compressed air from the bellows, as is also the chamber 32 through the duct 33. Tubular action as generally constructed consists of a key-valve, a tube, and a pneumatic with union-blocks for the coupler-tubes. The key-valve admits air under pressure to the tube, which energizes the key-pneumatic and causes the note to speak. When the key-valve is closed, the compressed air finds outlet through a small vent or puncture in the tube provided for the purpose. As the compressed air admitted to the valve by the key-valve has to overcome the leakage caused by the vent before the note will speak, it becomes necessary to make the vents as small as possible, and the result is that when the action is extended and the tubes are of great length the vents will not allow the amount of air contained by a long tube to escape quickly, and response therefore becomes slow. In addition the vents are also liable to become clogged with dust, which will be detrimental to their effective action.

The elements of the present invention consist of a double key-valve in combination with a system of oppositely-working diaphragms in lieu of the slides usually employed and an arrangement of the valve 21 by which the compressed air can escape to the atmosphere when the key is in silent position without regard to the position of valve 21 or the diaphragms 17 and 18. This mechanism acts as follows: When a key is depressed, the valve 2 opens and the valve 6 closes, the chamber 1 being charged with compressed air from the bellows. The cell or air-chamber 10 now becomes charged with compressed air, admitting it to the various tubes 11 and the action-tube 11^a. For the purposes of this description it is assumed that the couplers are not operative—that is to say, the diaphragms 17 are closed by compressed air and diaphragms 18 are open, as shown in Fig. 5, the compressed air being ineffective on tubes 11 for this reason. The compressed air now passes through tube 11^a and duct 22 to cell 20, closing valve 21 against duct 19 and passing out duct 23. Should there be one or more blocks in series, the operation above described in each will be repeated, the compressed air in each acting in the same way—that is to say, entering at 22, passing to cell 20, closing valve 21 against duct 19, and making its final exit into a tube 34 and operating a pneumatic 35, as shown in Fig. 11, thereby causing the note to speak. It will be seen by reference to Fig. 13 that the air entering the tube 11^a in its passage to the tube 34 closes all of the valves 21 against the ducts 19, thus forming a perfectly continuous and air-tight windway from the key-valves 2 and 6 to the pneumatic 35. If the key now be allowed to return to its silent or normal position, the valve 2 will close and the valve 6 will open, liberating the compressed air from the cell 10. The compressed air contained in tube 36, Fig. 11, may now be liberated in a variety of ways. It may escape through valve 6 and through exactly the same system of channels or ducts as it entered, or it may pass through any one of the ducts 19, provided the escaping air has caused any of the valves 21 to move from their position when covering the ducts 19. For instance, let it be supposed that the valve 21 in the block nearest the tube 36, Fig. 13, has, owing to the removal of compressed air, left its position against the duct 19 and passed over against the duct 22. The escaping air in the tube 36 now passes into the duct 19. Referring now to Fig. 2 and bearing in mind that the couplers are not in operation, it will be seen that diaphragm 17 is closed and diaphragm 18 is open, the latter diaphragm being common to all the notes of the keyboard. The upper outlet of the duct 19 being closed, the escaping air passes from said duct 19 to diaphragm 18 and thence to the atmosphere through the grooves 24. (Shown in dotted lines in Fig. 2 and in perspective in Figs. 6 and 7.) In Fig. 6 the diaphragm 18 is removed in order clearly to exhibit the grooves 24, the latter forming an outlet for the trench

formed by the diaphragm 18 when compressed air is removed from beneath it.

As shown in Fig. 12, the air is always exhausted from beneath the diaphragm 18 when the diaphragms 17 are closed, and vice versa, as the valves 29 30 operate to exhaust and inflate the diaphragms 17 and 18 for an opposite effect, move simultaneously, and are controlled by the same agency—that is, the pneumatic 28. In the event of the coupler being in operation the diaphragm 18 will be closed, as shown in the upper part of Fig. 2, and the chamber 15 will be charged with compressed air. The pressure being now removed from the chamber 14, the diaphragms 17 will rise, and the compressed air in duct 19 instead of passing out through the diaphragm 18 passes through diaphragm 17 to duct 16, to tube 11, and out through one of the valves 6 an octave above or below, as the case may be.

The operation above described may take place in any one of the blocks in the system, as shown in Fig. 13, or by reference to Fig. 11 it will be seen that if a swell-key be depressed and its note be caused to speak the return air may find vent through the valves 6 of the great or pedal keyboard; but in no case can the compressed air fail to find an outlet, as the valves 21 cannot close both ducts 19 and 22 at the same time.

An inspection of Fig. 11 with reference to the arrangement of the couplers and of Fig. 1 with reference to their construction will make clear that while when under pressure the system of tubes, ducts, and valves is absolutely air-tight, when the valve 2 is closed the compressed air has on the swell-organ thirteen possible points of egress—that is, the outlet through its own valve, or the outlets through the diaphragms 18, with the couplers off, or through the diaphragms 17, ducts 16, tubes 11, and valves 6, with the couplers on, but always at least seven at one time. The operation of a coupler is identical with that of an ordinary note, with the exception that the compressed air enters the system through the tubes 11, ducts 16, diaphragms 17, and ducts 19, and closing the valves 21 against the ducts 22 instead of entering through the action-tube 11^a and duct 22. The compressed air enters the cell 20 from the normal note or the coupler, each closing the outlet or escape supplied by the other by acting on the valve 21. From the cell 20 the compressed air acts as hereinbefore described.

As heretofore constructed the coupler mechanism is large and cumbersome and subject to irregularities from swelling and shrinking. When made up in blocks, as described, the swelling and shrinkage is local to each block and is immaterial, the aggregate swelling and shrinkage being rendered non-objectionable, as the tubes (see Fig. 11) will readily yield sufficiently to compensate for any change in a total distance between the extreme upper and lower block.

The operation of a coupler is as follows: If the coupler-registers 26 be drawn out, the valve 27 is raised and pneumatic 28 is neutralized. The compressed air in the chamber 32 forces the valves 29 and 30 outwardly, and valve 29 exhausts the chamber 14, and valve 30 permits compressed air to enter the chamber 15, causing the diaphragm 18 to close all of the ducts 19. (See Figs. 6 and 7.) The diagrams 17, one for each note, now being liberated, the compressed air when key is depressed enters at the coupler-tubes 11 and raises the diaphragms and enters cell 20. If coupler-register 26 be now pushed in, pneumatic 28 will be exhausted through valve 27 to the atmosphere and valves 29 and 30 will be drawn in. The pressure entering the cell 14 through the valve 29 forces the diaphragm 17 to close the ducts 16 and 19, and the pressure being removed from the cell 15 allows the diaphragm 18 to sag, thereby opening a clear passage-way from the ducts 19 to the atmosphere. If now the compressed air in any of the tubes 36 seeks an outlet and a check-valve 21 is closed against the duct 22, the outlet will be established through the duct 19, diaphragm 18, and grooves 24 to the atmosphere.

The operation of the apparatus is as follows, special reference being had to Figs. 1 and 11: A great organ-key 4 is depressed, thereby opening valve 2 and closing valve 6, and the compressed air in the chamber 1 passes into the action-tube 11^a of the great organ and to blocks 38, Fig. 11. In passing to the block 38 the air traverses the cell 20 and closes in its passage the check-valve 21 against the entrance of air through the pedal-coupler tube 39, and after passing through the cell 20 the compressed air enters tubes 34 and 36 and after traversing these two tubes operates the usual system of pneumatics, causing the pipes to speak. The great organ-key now being allowed to assume its normal or raised position, the valve 2 closes and valve 6 opens, and the compressed air in the system contained in the cell or air-chamber 10, action-tube 11^a, block 38, tubes 34 and 36, escapes through the outlet-valve 6, causing the pipes to become silent. It will be seen that if it were not for the check-valves 21 the air entering the tube 11^a (great) when a key is depressed would escape or waste itself through the pedal-coupler tube 39 and pedal escape-valve 6 in the event that the pedal-coupler is drawn or through the exhaust-port 19 if the pedal-coupler be not drawn, and would thus have no effect. If the great pedal-coupler now be drawn, the system of diaphragms 17 and 18 in block 38 will allow the compressed air to pass from the tube 39 to block 38 when the pedal-key is depressed, the said key having closed

its exhaust-valve 6 and opened its supply-valve 2. The check-valve 21 now closes the outlet to the action-tube 11ª (through which air enters from the great key) and enters the tube 34, causing the pipes to speak. The compressed air from pedal-key is prevented from wasting itself through the great key-outlet 6 by the check-valve 21, which, as previously described in connection with the operation of the great key, prevents escape through the pedal-tube 39. The check-valve 21 serves to prevent escape of compressed air through either of the inlets when it is entering at the other. It will be clear that compressed air in the tube 34 can always find escape when either a great or a pedal key assumes its normal position, as the valve 21 cannot possibly close both outlets at once, or, in other words, if it closes either one the air cannot escape through the other.

The operation described above with reference to the great key is that of the normal action of the great organ, and a similar description would serve for the normal action of the swell-organ, except that the compressed air from the swell-key passes successively through several of the blocks, of which Fig. 2 is a complete illustration, the lower portion being a duplicate of the upper portion.

The several blocks are placed in series for the purpose of admitting branch or coupler inlets into the normal action of a manual, as will now be described. As shown in Fig. 11, if a swell-key be depressed compressed air passes through the action-tube 11ª and the system of blocks to the swell-tube 34 and thence to the swell-pneumatics 35, causing the pipes to speak, the air being liberated through the valve 6 when the swell-key assumes its normal position. Each of the blocks 13 is a complete system of cells, check-valves, and coupler-diaphragms. If the coupler-register 26, Fig. 12, which operates the block 41, Fig. 11, be drawn out and a great key depressed, the compressed air from the great key will pass through the tube 40 into block 41, close the check-valve 21 against outlet leading upward to the swell-key, and will then pass down the regular normal swell-action channels to the swell wind-chest, causing the swell-pipes to speak from the great key. These tubes 40 leading from the great-key box may leave the great on a given note and lead to a note-octave above or below in the swell-action. Every new block added to a group of blocks connected as shown in Fig. 13 affords a separate entrance for a coupler-tube, and said coupler-tube may cause, for example, the swell middle C to speak from the swell or great manual an octave above or below it, from the pedal-key, or from the unison-note on a different manual.

It is to be understood that the elements illustrated in Figs. 4, 5, 6, and 7 are adapted for use in connection with other parts of an organ-action than the key-action, and for this reason it is to be understood that the invention is not to be limited to the use of these parts simply in connection with the key-action.

Having thus described the invention, what I claim is—

1. In an organ-action, a pair of coupler-blocks provided with communicating passages forming a continuous windway for the normal action, each of said blocks having a branch passage for the coupler-action communicating with said continuous passage, and valves controlling said branch and continuous passages.

2. In an organ-action, a system of coupler-blocks provided with communicating passages to form a continuous channel constituting the normal windway, each of said blocks having a branch channel for the coupler-action in communication with said normal windway, and a valve controlling such communication.

3. In an organ-action, a block having a normal and a branch channel, diaphragms operating to close the branch channel, and controlled by air-pressure, and valves for controlling the admission of air to said diaphragms.

4. In an organ-action, a block having a normal and a branch channel, oppositely-acting diaphragms operating to close the branch channel and controlled by air-pressure, and valves for controlling the admission of air to said diaphragms.

5. In an organ-action, a block having a normal and a branch channel, diaphragms operating to close the branch channel, and means for controlling said diaphragms operating to subject one to air-pressure while simultaneously removing the air-pressure from the other.

6. In an organ-action, a block having one system of outlet-ducts and two systems of air-supply ducts, and means whereby said supply-ducts may be closed to the compressed-air supply and simultaneously be placed in communication with the atmosphere, comprising a separate diaphragm for closing one end of each duct of one system and a single diaphragm for closing the opposite end of all of said ducts.

7. In an organ-action, a block having one system of outlet-ducts and two systems of air-supply ducts, means whereby said supply-ducts may be closed to the compressed-air supply and simultaneously be placed in communication with the atmosphere, comprising a separate diaphragm for closing one end of each duct of one system and a single diaphragm for closing the opposite end of all of said ducts, and means for operating said diaphragms by air-pressure.

8. In an organ-action, a block having one system of outlet-ducts and two systems of air-supply ducts, means whereby said supply-ducts may be closed to the compressed-air supply and simultaneously be placed in communication with the atmosphere, comprising a separate diaphragm for closing one end of each duct of one system and a single diaphragm for closing the opposite end of all of said ducts,

and means for simultaneously supplying air-pressure to said individual diaphragms while permitting air to exhaust from said single diaphragm, or the reverse.

9. In an organ-action, a block having a cell entered by an outlet-duct and two inlet-ducts, one of said inlet-ducts having three orifices, one of which terminates in the cell, a diaphragm under which another of the orifices terminates and which is adapted to place the orifice in communication with the atmosphere, a second diaphragm under which the remaining orifice terminates, and a valve in said cell interposed between said inlet-ducts and common to the orifices of both.

10. In an organ-action, a key-chest having a cell for each key, valves for controlling the admission and exhaust of compressed air to and from said cells, respectively, and a plurality of coupler-blocks each of which has a normal windway communicating with one of said cells, and a windway for the coupler-action communicating with a different cell.

11. In an organ-action, a coupler-block having a cell therein and having ducts for the normal and coupler action entering said cell and an outlet-duct leading therefrom to a pneumatic, a valve interposed between said normal and coupler ducts, chambers provided in said block and communicating with said coupler-duct, a diaphragm in each of said chambers controlling said duct, means for admitting compressed air to and exhausting it from said chambers to operate said diaphragms, a key-valve chest provided with a cell for each key, a conduit connecting the normal duct with one of said cells, and a conduit connecting the coupler-duct with a different cell.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ERNEST M. SKINNER.

Witnesses:
N. L. SHELDON,
WM. B. GOODWIN.