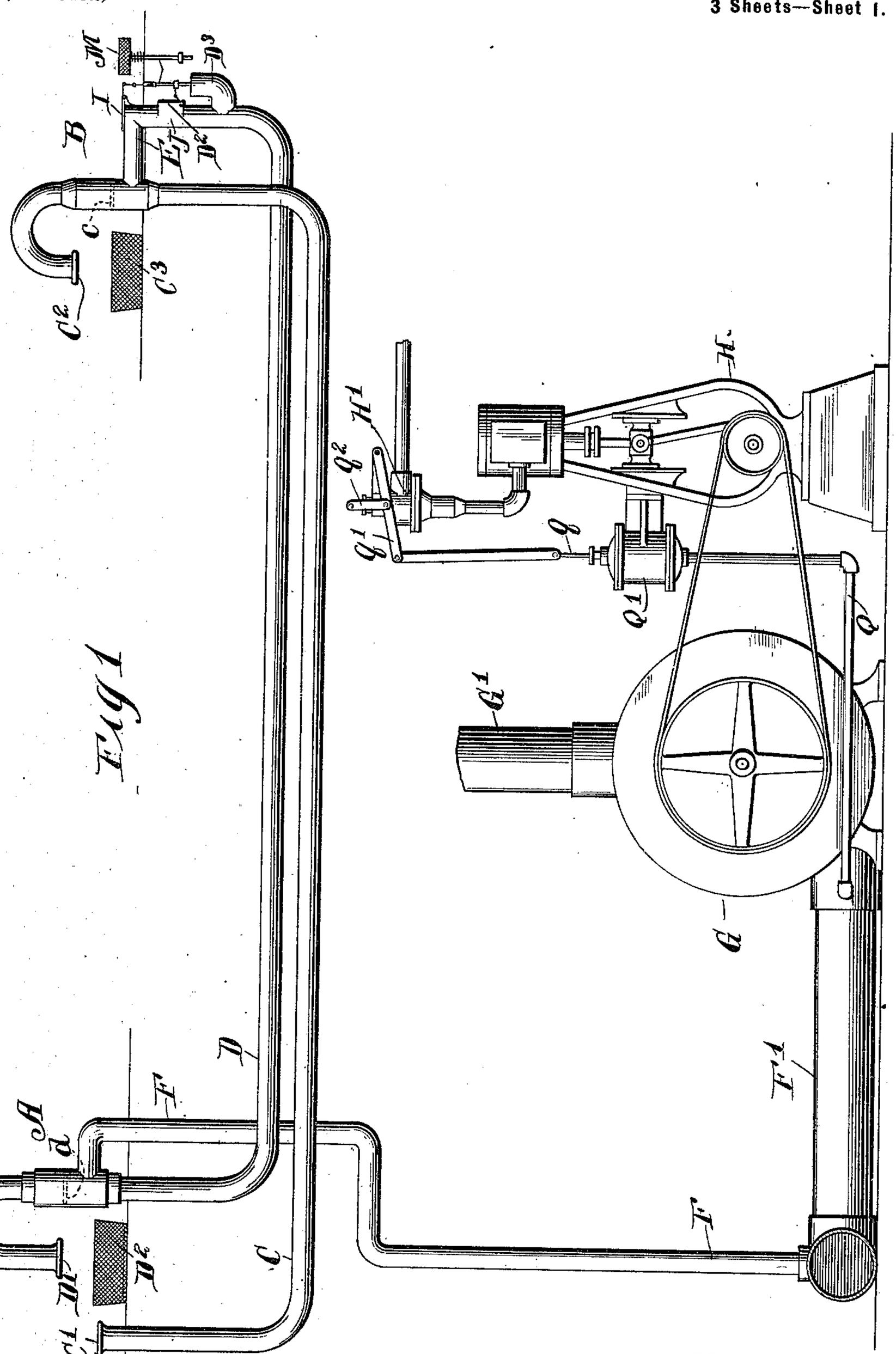
No. 669,491. Patented Mar. 5, 1901.

M. J. FOYER.

PNEUMATIC CONVEYER.

(Application filed July 5, 1900.)

(No Model.) 3 Sheets—Sheet 1.



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William H. Hall

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(No Model.) 3 Sheets—Sheet 2.

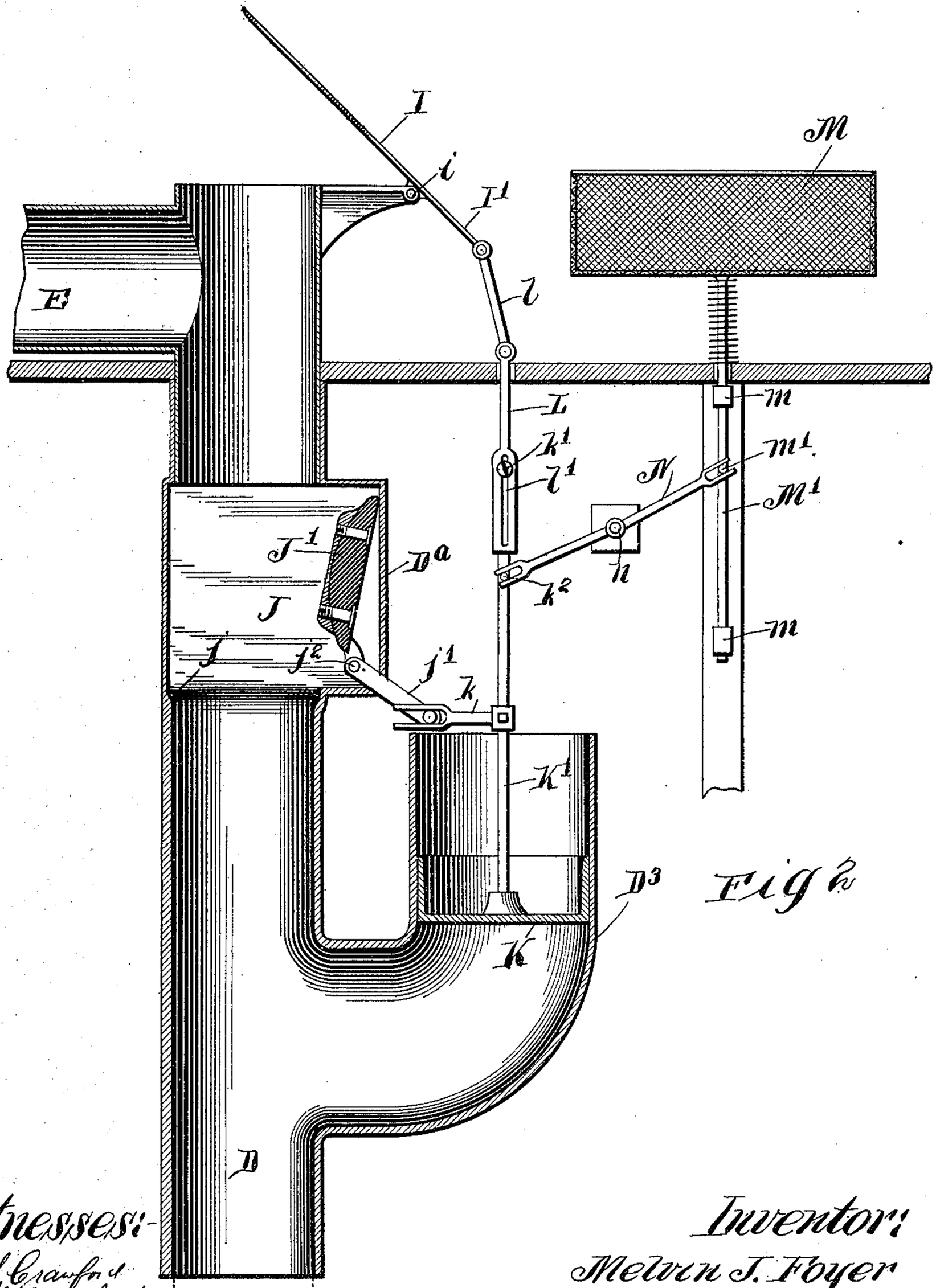

Fig 2.

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3 Sheets—Sheet 3.

Fig 4

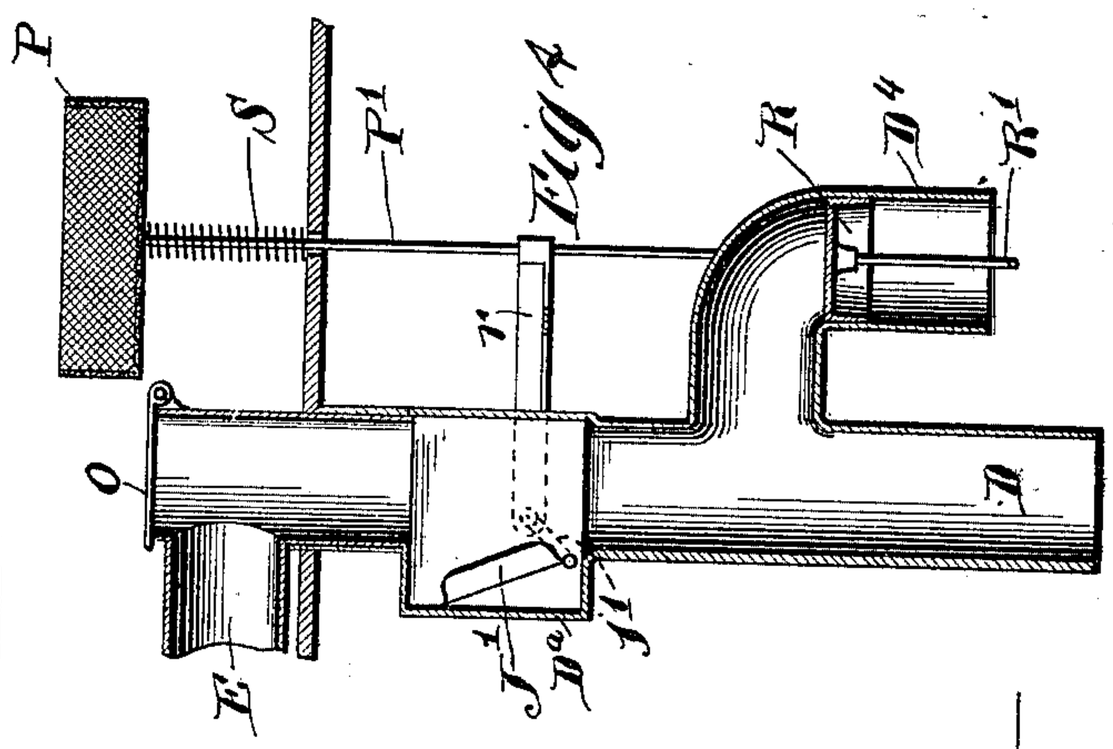


Fig 5

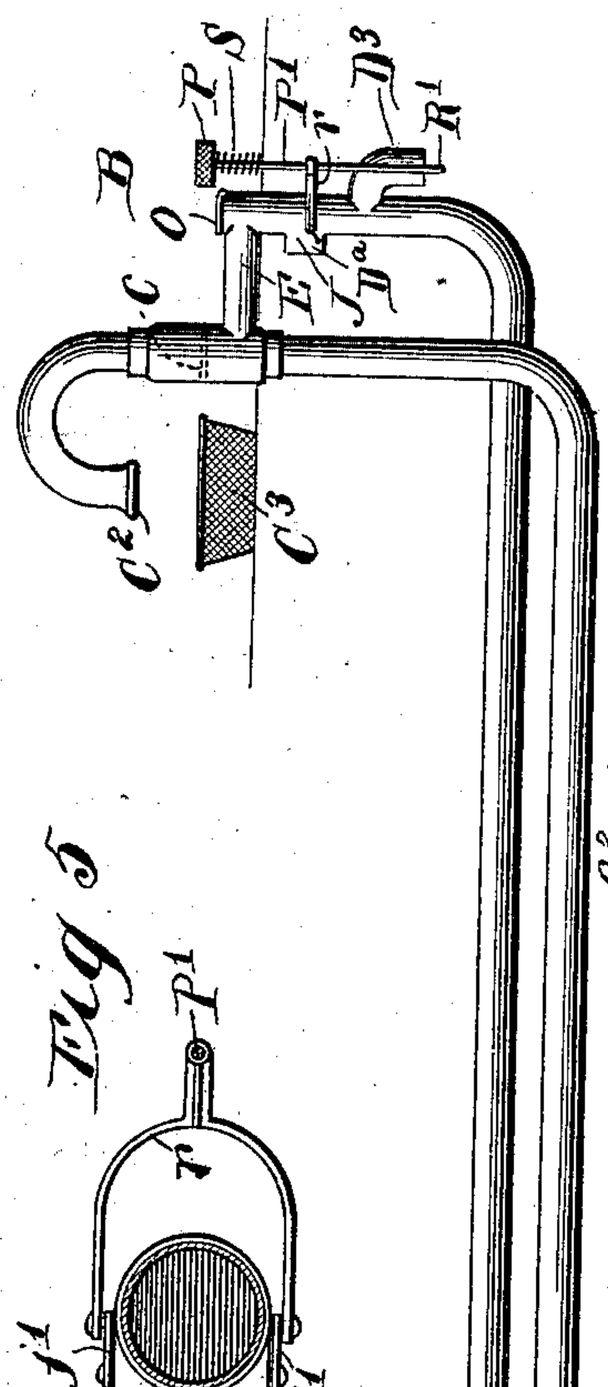


Fig 3

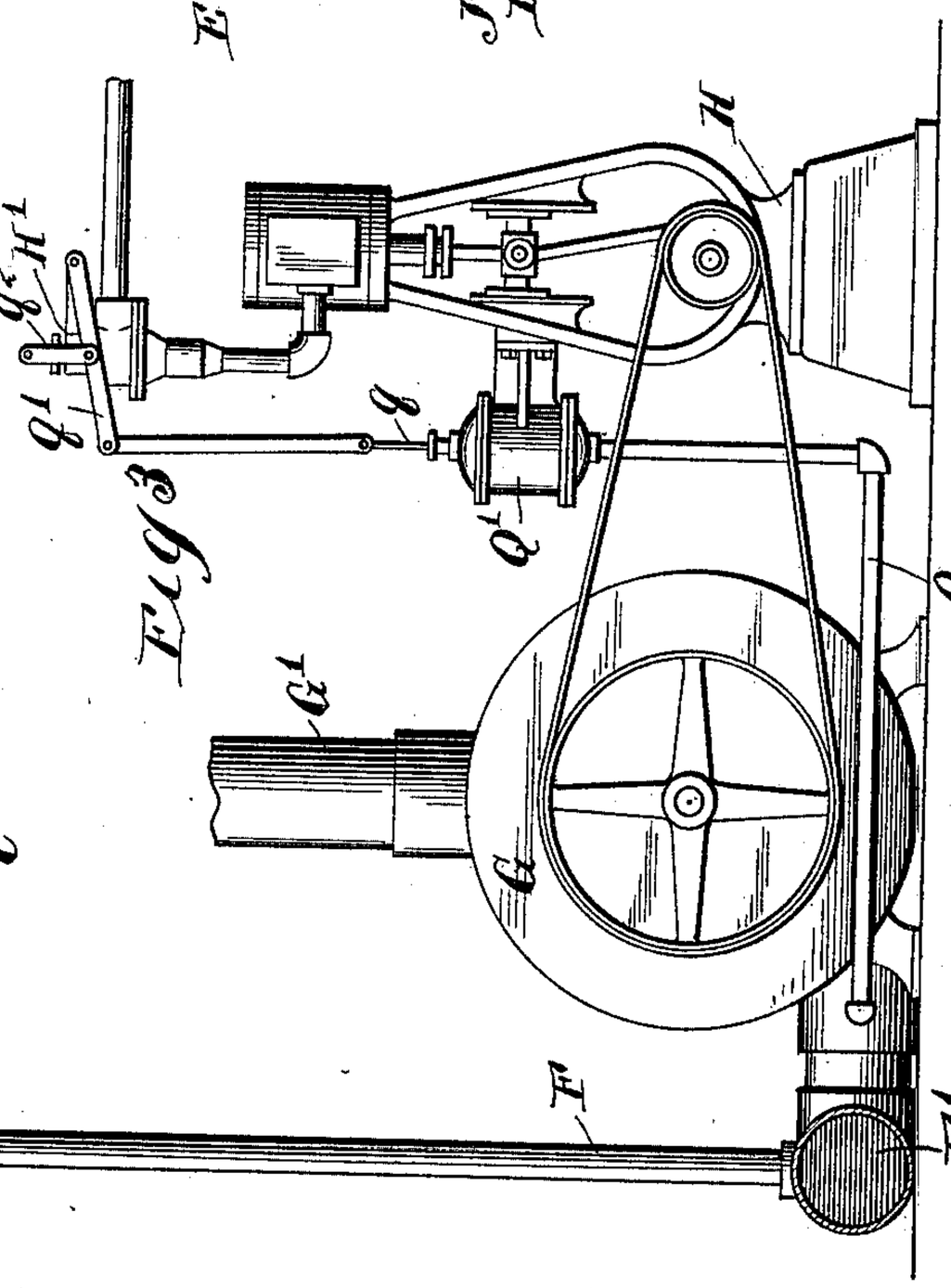
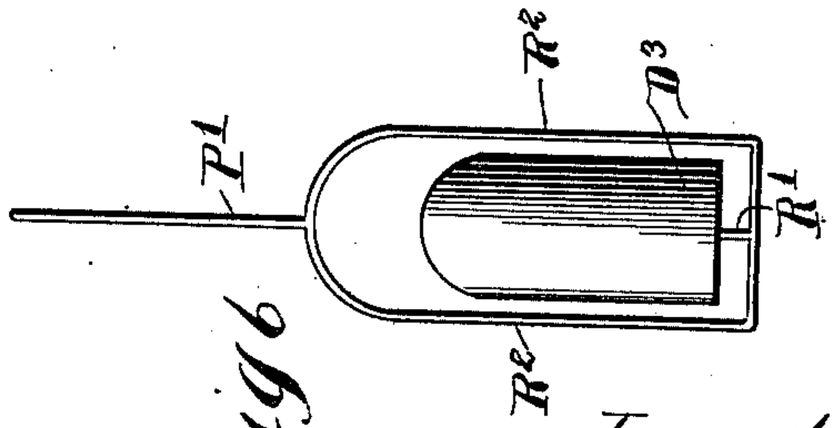


Fig 6



Witnesses
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William H. Hall

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UNITED STATES PATENT OFFICE.

MELVIN J. FOYER, OF CHICAGO, ILLINOIS.

PNEUMATIC CONVEYER.

SPECIFICATION forming part of Letters Patent No. 669,491, dated March 5, 1901.

Application filed July 5, 1900. Serial No. 22,495. (No model.)

To all whom it may concern:

Be it known that I, MELVIN J. FOYER, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Pneumatic Conveyers; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in pneumatic conveying apparatus for use in stores or similar places for conveying cash-carriers between a central cashier's desk and an outlying salesman's station. The apparatus may be used, however, for conveying parcels of any description or for other similar purposes.

The accompanying drawings illustrate one practical embodiment of the several features of my invention, embracing a single outgoing or distributing tube and a single return-tube extending between a cashier's station and an outlying salesman's station, together with an air-compressor or blower and a motor for operating the same, it being understood that in a system embracing a number of outlying or salesmen's stations a plurality of sets of such distributing and return tubes will be used.

In the said drawings, Figure 1 is a view, diagrammatic in its nature, showing a central or cashier's station, a single outlying or salesman's station, tubes connecting the same, an air-compressor, and a motor therefor. Fig. 2 is an enlarged detail view of the despatching devices at the salesman's station. Fig. 3 is a view similar to Fig. 1, showing a modified construction of the parts at the despatching end of the return-tube. Fig. 4 is a detail view of the parts shown in Fig. 3 at the despatching end of the return-tube. Figs. 5 and 6 are detail views of parts shown in Fig. 4.

As shown in said drawings, A indicates the cashier's station, and B a salesman's station.

C indicates a conveying-tube extending from the cashier's station to the salesman's station for the transmission of carriers from the cashier's station to the salesman's station. In a system having a number of outlying stations the tube C will be one of several tubes by which carriers will be transmitted to such outlying stations from the cashier's station, and said tube will therefore be herein called the "distributing-tube."

D indicates a conveying-tube for the transmission of carriers from the outlying or salesman's station B to the cashier's station A and will be herein called the "return-tube." At the outlying or salesman's station B the tubes C and D are connected by means of a tube E. At the cashier's station an exhaust-tube F is connected with the return-tube D at a point near the delivery end of said tube. Said exhaust-pipe F is connected with a main suction-pipe F', which communicates with the suction or low-pressure side of a rotary blower G. Said blower is provided with an exhaust-opening G' and is driven by means of a motor H, herein shown as having the form of a steam-engine.

At the cashier's station A the distributing-tube is provided with an open despatching end C' and the return-tube with a downwardly-directed discharge end D', beneath which is shown the usual receptacle D^2 for carriers. An outwardly-opening flap-valve *d* is located in said return-tube between the exhaust-tube F and the end of the tube, said flap-valve being adapted to permit the outward passage of the carriers past the same while preventing influx of air, as is common in similar situations in other systems. At the salesman's station the distributing-tube C is provided with a downwardly-directed discharge end C^2, beneath which is placed a receptacle C^3 for carriers, and with an outwardly-opening flap-valve *c*. At said salesman's station the return-tube is provided at its despatching end with devices, hereinafter described, to which my invention more particularly relates.

The transmission of carriers from the cashier's station to the outlying salesman's station and also the return thereof from the salesman's station to the cashier's station is effected solely by the suction from the return-pipe D at the cashier's station, and devices are provided at the salesman's station for controlling the flow of air through the conveyer-pipes, the same being shown more clearly in Fig. 2 and being constructed as follows: The despatching end of the tube D at the salesman's station is provided with a hinged door I and also with a valve J, the connecting-pipe E being arranged to commu-

nicate with the said tube D between the said door I and valve J. The valve J has a hinged valve-closure J′, pivoted in a valve-casing D^a, which is constructed with a recess at one side of the tube, so that when the said valve J is open a free passage will be afforded for the carriers past said valve-closure. The valve-closure J′ is constructed to fit upon a seat *j*, formed in the casing D^2. Said tube D is also provided adjacent to the valve J with an open-ended branch tube D^3, containing a piston K. The piston K is provided with a stem or rod K′, provided with a laterally-projecting arm *k*, which engages a rocking arm or lever *j*′, which is rigidly connected with the valve-closure J′, said lever *j*′ being attached to the end of a rock-shaft j^2, which extends through the sides of the valve-casing D^a and to which the valve-closure is rigidly attached. The door I is connected by a pivot *i* to a bracket on one side of the tube D, and said door is provided with an arm I′, extending outside of its pivot, which arm is connected with a vertically-sliding rod L by means of a connecting-bar *l*, which is pivoted to the arm I′ and to the said rod L. The rod L is arranged in alinement, or nearly so, with the piston-rod and is connected therewith by a sliding connection, affording limited movement of the rod L with respect to the rod K′. As herein shown, such connection consists of a longitudinal slot *l*′ in the rod L and a stud *k*′ on the piston-rod, which passes through and slides in said slot.

M indicates a receptacle or basket in which the carriers are placed by the salesmen after their return from the cashier's station and in which all of the carriers used by the salesmen are kept when not in use. Said basket or receptacle is supported by means affording vertical movement therein, and it is connected with the piston K and valve J in such manner that when the receptacle is depressed by the weight of a carrier or carriers therein the piston will be forced inwardly in the branch tube D^3 and said valve will be closed. As herein shown, the basket or receptacle is attached to the upper end of a vertically-arranged sliding rod M′, which is supported in guides *m m*, and the connection between the said rod M′ and the piston and valve is afforded by means of a rocking lever N, pivoted between its ends on a fulcrum-pivot *n* and engaged at one end with a pin *m*′ in the said rod M and at its opposite end with a pin k^2, which projects from the side of the piston-rod K′.

The purpose of the piston K is to counterbalance the pressure of air upon the valve-closure J′ when the valve is closed, and for this purpose the area of the piston is made the same as that of the valve. Said valve-cloure J′ and piston K, connected so as to move together, as described, constitute, in effect, a balanced valve, and so far as the general results obtained are concerned any other form of balanced valve may be used in place of such closure and piston. When the valve is closed, influx of air to the tube D will be prevented, and a partial vacuum will be maintained in the said tube D by the action of the blower. The valve will be held in its normal or closed position, as described, by the weight of a carrier or carriers deposited in the receptacle M, the weight of said carriers obviously tending to depress the receptacle, and thereby lift the piston-rod K′, with the result of holding the valve closed and the piston in its outward position. The weight of the piston K and connected parts bears such relation to the weight of the receptacle M that said receptacle will be retained in its elevated position except when all of the carriers used at such station are within the receptacle. If one carrier only be used, the receptacle M will remain elevated at all times except when depressed by the weight of such carrier. If several be used, the receptacle will remain elevated when any number of carriers less than the total number with which the salesman is furnished are therein. The door I being normally closed, if it be opened for the insertion of a carrier the downward movement of the rod L produced by the opening of the door will force downwardly the piston-rod K′, thereby opening the valve, lifting the receptacle, and moving the piston outwardly in the branch tube D′. The air-pressure on the valve and the piston due to the suction being equalized and the piston being made to move inwardly as the valve opens outwardly or upwardly, it follows that the valve can be easily opened, or, in other words, there will be substantially no air-pressure on the valve to operate against in opening the same. When the door is opened for the insertion of a carrier, and the valve is thereby opened for the passage of the carrier past it in the manner described, one of the carriers will be taken from the receptacle and inserted in the tube and the door I closed. The weight of the receptacle and the carriers which may be therein in the absence of the carrier sent to the cashier's station being insufficient to effect the closing of the valve J, said valve will remain open, and the air-current will continue to flow through both tubes C and D during the time that the carrier is passing from the salesman's station to the cashier's station and is returning from the cashier's station to the salesman's station and until said carrier has been received by the salesman and again returned to the receptacle. As soon, however, as the carrier is deposited in the receptacle its weight will overbalance the weight of the piston and its connected parts, the receptacle will descend, and the valve J will be closed.

Obviously if several carriers be sent one after the other the valve J will remain open during the sending and returning of all of the carriers and until the last carrier sent has been returned and deposited in the receptacle, it being understood, as before stated, that

the removal of one carrier only will permit the basket to rise and the valve to open and that until all of the carriers belonging to the salesman's station have been returned and deposited in the receptacle the latter will remain in its elevated position, the valve J will remain open, and the air will continue to flow through the conveyer-tube. It follows from the above that by the construction described a device is provided by which the carriers may be transmitted in both directions between the cashier's and salesman's stations by the use of exhaust only and that the flow of air through the tubes will continue only during the time the carriers are in course of transmission from the salesman's to the cashier's station, are returning therefrom, and are in use or are being handled at the salesman's and cashier's stations.

A speed-regulating device for the air compressor or blower is shown in the drawings, which is constructed as follows: Q indicates a pipe which leads from a valve-casing Q′ to the inlet or suction tube F′. In the valve-casing Q′ is located a diaphragm or piston which is connected with a piston-rod q, connected, by means of a lever q' and link q^2, with the throttle-valve H′ of the engine or motor H. As the pressure is lessened in the pipe F′ or at the lower-pressure side of the blower this mechanism operates upon the throttle-valve in such manner as to cause the motor to stop or slacken its speed; but when air is admitted to the low-pressure side of the blower, as will occur when one of the valves is opened, the motor will be started or the speed of the motor will be automatically increased, so as to give an ample supply of air to transmit the carrier to its destination.

The speed-regulator applied to the low-pressure side of the regulator, as described, has the effect of increasing the speed of the compressor to give the required supply of air through the conveying-tubes of a system proportionate to the number of stations in use at any one time, while affording a reduction of the quantity of air flowing through the conveying-tubes and a reduced speed in the motor which drives the compressor at times when no stations are in use. It is preferred that the flow of air through the conveying-tubes in the system should not entirely cease, because this would result in the entire cutting off of the supply of air to the inlet side of the blower, with the result of producing a more or less complete vacuum and through the action of the regulator a stoppage of the motor, which stoppage of the motor would be highly undesirable, because in the case of a steam or gas engine it could not be automatically again started in action, and in the case of an electric motor because of the loss of current through the stopping and starting of the same. I therefore prefer that all of the despatching-stations in a large system should not be supplied with valves like those illustrated and described, so that at one or more, but in any case a small percentage, of said despatching-stations a small quantity of air may constantly enter the system, and a sufficient supply of air will be afforded to the inlet of the blower to prevent the formation of a vacuum sufficient to completely stop the motor through the action of the speed-regulating device. It would of course be practicable to limit the movement of the speed-regulating device, so as to prevent the motor from being stopped upon the production of a more or less complete vacuum in the system through the closing of all of the air-inlets; but this would have the disadvantage that at such times—namely, when all of the air-inlets were closed and no carriers were being sent or transmitted—the blower would be working against a vacuum and an unnecessary amount of power would be required to keep it in motion. By omitting the valve at one or more of the inlet-openings in the system or by providing for a slight leakage of air past the valves when closed I am, however, enabled to secure the desired results—namely, a large reduction in the flow of air through the system and a minimum speed in the motor when all the carriers are in their proper receptacles at the salesmen's stations.

The operation of the device as a whole may be summarized as follows: Under the action of the fan a suction is produced in the pipe F′ and tube F. The tube D is normally at low pressure, owing to the suction of air at its end adjacent to the cashier's station and the fact that the valve J is closed at the salesman's station. Under these conditions the blower will be stopped or driven at its minimum speed. When, however, the valve J is opened, a current of air is induced through the pipe C, the connecting-pipe E, and the pipe D, the blower will be started in operation or its speed increased, and the air will continue to flow through said pipes as long as the valve J remains open. As soon, however, as the return of all of the carriers to the salesman's station enables the salesman to place all of them into the receptacle or basket M and the same is depressed the valve J will be closed, the air will cease to flow through the conveying-tube, a partial vacuum will be established in the tube D, and through the action of the regulator the speed of the engine will be again reduced to a minimum or the same will be stopped.

In Figs. 3, 4, 5, and 6 I have shown a somewhat different construction in the devices at the dispatching end of the return-tube, embodying the same general features of construction hereinbefore described but differing in certain details. In this instance the return-tube D is provided with a door O, which is without any connection with the other working parts of the device. A vertically-yielding receptacle P for the carriers is provided, said receptacle being mounted on a vertically-movable rod P′, which at its lower end is connected directly with a piston R, located in a branch tube D^4. In this instance, how-

ever, the branch tube D^4 is turned downwardly, so that the piston moves upward under the air-pressure tending to move it inwardly, and the rod P′ is connected with said piston R by means of a piston-rod R′ and two parallel rods R^2 R^2, Fig. 6, which extend at either side of the branch tube and are joined at their upper ends to the rod P′ and at their lower ends to the piston-rod R′. A valve J is provided, like that hereinbefore described, the same being provided with a valve-closure J′, having actuating arms or levers *j*′, which have operative connection with the piston-rod through the medium of a forked arm *r* on said rod, engaging said levers *j*′, Fig. 5. In this instance a spring S is employed to support the weight of the receptacle P, said spring being made of such strength as to hold the said receptacle elevated except when all of the carriers belonging to that salesman's station are placed therein. As shown in the drawings, said spring S is of spirally-coiled form and applied around the rod P′ between the receptacle P and the supporting-surface below the same. In this form of construction when the carriers are all in the receptacle P the latter will be depressed, the piston R will be at the outward limit of its movement, and the valve will be closed. Upon removing one of the carriers from the receptacle the latter will rise under the action of the supporting-spring, the valve will open, and the piston at the same time move upwardly or inwardly. The door O may then be opened and the carrier inserted, when it will be transmitted to the cashier's station, as before described. It is of course necessary to close the door O before the carrier is inserted in the distributing-tube C for its return to the salesman's station.

It will be observed that in the device shown in Figs. 1 and 2 the valve at the despatching end of the return-tube is opened positively by the act of opening the despatching-door there located and that the said valve will be opened in the act of opening said door when all of the carriers are in the yieldingly-supported receptacle, said receptacle being positively elevated or lifted when the valve is opened. In the construction shown in Figs. 3 and 4, however, the movement of the despatching-door has no effect upon the valve, so that it becomes necessary to remove one of the carriers from the receptacle before the valve will open and the parts are placed in condition for the transmission of a carrier.

I claim as my invention—

1. In a pneumatic conveying apparatus the combination of a conveying-tube, means connected with the delivery end of said tube for reducing the pressure thereat, a valve at the despatching end of said tube, and a movable receptacle connected with said valve by operative means so constructed that the valve will be closed when the receptacle is depressed and open when the receptacle is elevated.

2. In a pneumatic conveying apparatus, the combination of a conveying-tube, means connected with the delivery end of said tube for reducing the pressure thereat, a balanced valve at the despatching end of said tube, and a movable receptacle connected with said valve by operative means so constructed that the valve will be closed when the receptacle is depressed and open when the receptacle is elevated.

3. A pneumatic conveying apparatus comprising distributing and return tubes, a pipe connecting the despatching end of the return-tube with the delivery end of the distributing-tube, means connected with the discharge end of the return-tube for reducing the pressure thereat, a despatching-door at the despatching end of the return-tube, a valve in said return-tube inside of said door, and a receptacle for carriers at the despatching end of the return-tube, said receptacle being yieldingly supported and connected with said valve by operative means so constructed that the valve will be closed when the receptacle is depressed and open when the receptacle is elevated.

4. In a pneumatic conveying apparatus, the combination of a conveying-tube, means connected with the delivery end of said tube for reducing the pressure thereat, a valve at the despatching end of said tube, an open branch tube connected with the said conveying-tube inside of said valve, a piston in said branch tube, a connection between said piston and the said valve, whereby the piston is moved with the said valve, a yieldingly-supported receptacle for carriers, and operative connecting means between said receptacle and said valve so constructed that the valve will be closed when the receptacle is depressed and opened when the receptacle is elevated.

5. In a pneumatic conveying apparatus, the combination of distributing and return tubes, a pipe connecting the despatching end of the return-tube with the delivery end of the distributing-tube, means connected with the delivery end of said return-tube for reducing the pressure thereat, a door at the despatching end of the return-tube, a valve in said return-tube inside of the despatching-door, a yieldingly-supported receptacle for carriers, operative connections between said receptacle and said valve so constructed that the valve will be closed when the receptacle is depressed and opened when the receptacle is elevated, and a connection between said despatching-door and valve whereby the opening of the door will open the valve.

6. In a pneumatic conveying apparatus, the combination of distributing and return tubes, a pipe connecting the despatching end of the return-tube with the delivery end of the distributing-tube, means connected with the delivery end of said return-tube for reducing the pressure thereat, a despatching-door and a valve at the despatching end of said return-tube, an open branch tube connected with said return-tube, a piston in said branch tube, a connection between said piston and the said

valve, whereby the piston will be moved when the valve is opened, a yieldingly-supported receptacle for carriers, connected with said valve by operative means so constructed that the valve will be closed when the receptacle is depressed and opened when the receptacle is elevated, and a connection between said despatching-door and valve whereby the opening of the door will open the valve.

7. In a pneumatic conveying apparatus the combination of a conveying-tube, means connected with the delivery end of said tube for reducing the pressure thereat, a valve at the despatching end of said tube, having a pivoted valve-closure, an open branch tube connected with said conveying-tube inside of said valve, a piston in the branch tube, a piston-rod attached to said piston, said valve-closure having a rigidly-attached crank-arm, and a connection between said piston-rod and said crank-arm whereby the piston will move with the valve.

8. In a pneumatic conveying apparatus, the combination of a conveying-tube, means connected with the delivery end of said tube for reducing the pressure thereat, a valve at the despatching end of said tube, an open branch tube connected with said conveying-tube, a piston in said branch tube provided with a piston-rod, connections between said piston-rod and the valve whereby the piston will move with the said valve, a movable receptacle for carriers, and a vertically-movable rod supporting said receptacle and connected with said piston-rod by operative means whereby said piston will be moved, and the said valve will be closed when the receptacle is depressed and will be opened when said receptacle is elevated.

9. In a pneumatic conveying apparatus, the combination of distributing and return tubes, a pipe connecting the despatching end of the return-tube with the delivery end of the distributing-tube, means connected with the delivery end of said return-tube for reducing the pressure thereat, a door at the despatching end of the return-tube, a valve in said return-tube inside of said despatching-door, a vertically-movable receptacle for carriers, an open branch tube connected with the return-tube, a piston in said branch tube, said branch tube being arranged vertically and the piston being vertically movable, a connection between said piston and said valve whereby the piston will be moved with said valve, and operative connections between the vertically-movable receptacle, valve and piston, so constructed that the valve will be closed when the receptacle is depressed and opened when the receptacle is elevated.

10. In a pneumatic conveying apparatus, the combination of distributing and return tubes, a pipe connecting the despatching end of the return-tube with the delivery end of the distributing-tube, means connected with the delivery end of said return-tube for reducing the pressure thereat, a despatching-door at the despatching end of the return-tube, a valve in said return-tube inside of the despatching-door, a yieldingly-supported receptacle for carriers connected with said valve by operative means whereby the valve will be closed when said receptacle is depressed and open when said receptacle is elevated, and connections between the despatching-door and the valve-embracing parts having a limited sliding movement with respect to each other whereby the opening of the door will effect the opening of the valve, but the door may be closed without closing the valve.

11. In a pneumatic conveying apparatus, the combination of a conveying-tube, means for producing a vacuum at the delivery end of said tube, a motor, a valve at the despatching end of said tube, a speed-regulating device operated by the pressure in the conveying-tube and controlling the said motor, and means controlled by the weight of the carrier for closing said valve thereby operating the speed-controlling device to lessen the speed of the motor when none of such carriers is in use.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 27th day of June, A. D. 1900.

MELVIN J. FOYER.

Witnesses:
C. CLARENCE POOLE,
CLEMENT R. STICKNEY.