No. 635,434. Patented Oct. 24, 1899.

E. A. FORDYCE.

TERMINAL FOR PNEUMATIC DESPATCH TUBE SYSTEMS.

(Application filed Aug. 3, 1899.)

(No Model.) 2 Sheets—Sheet 1.

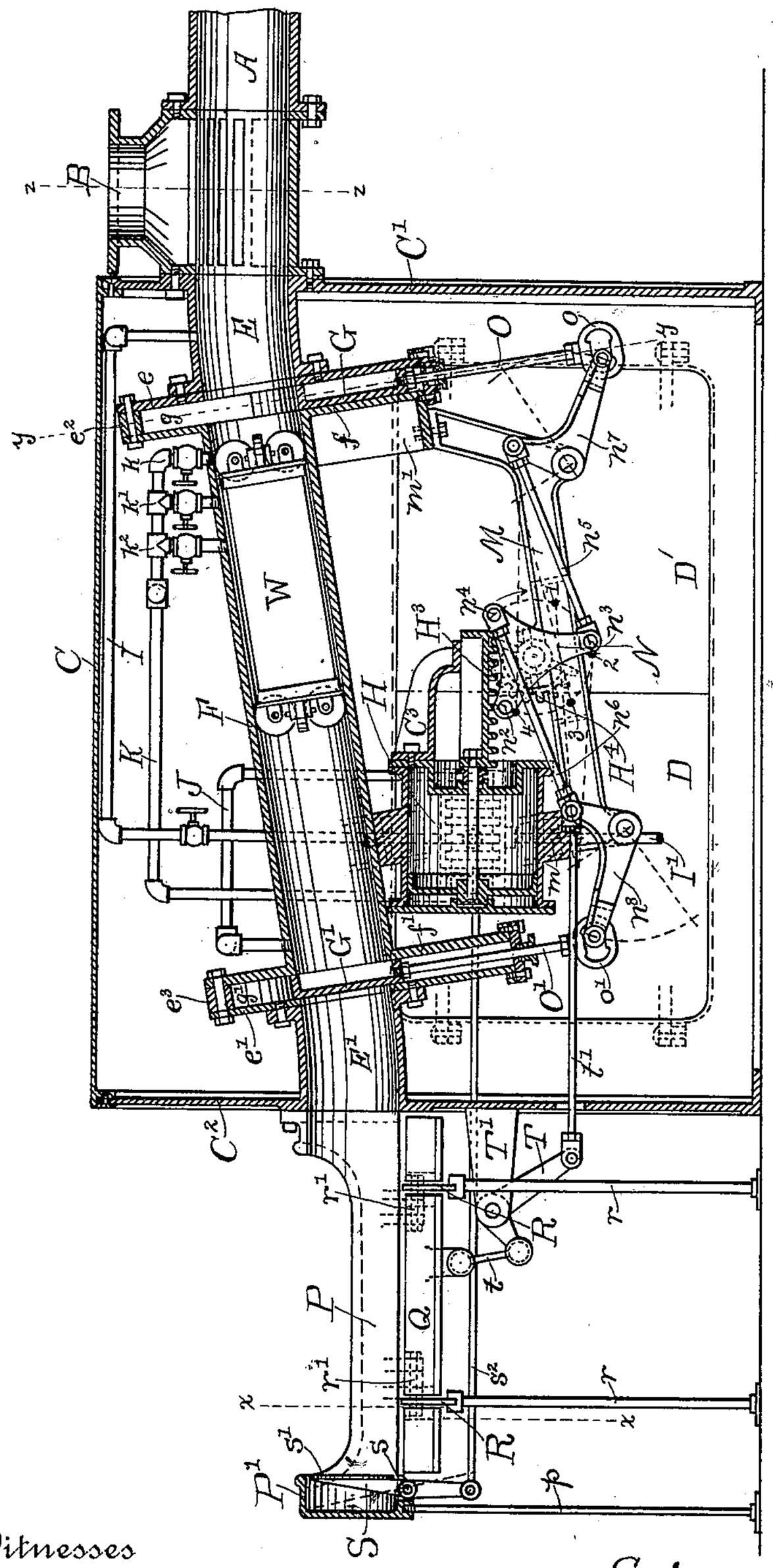

Fig. 1.

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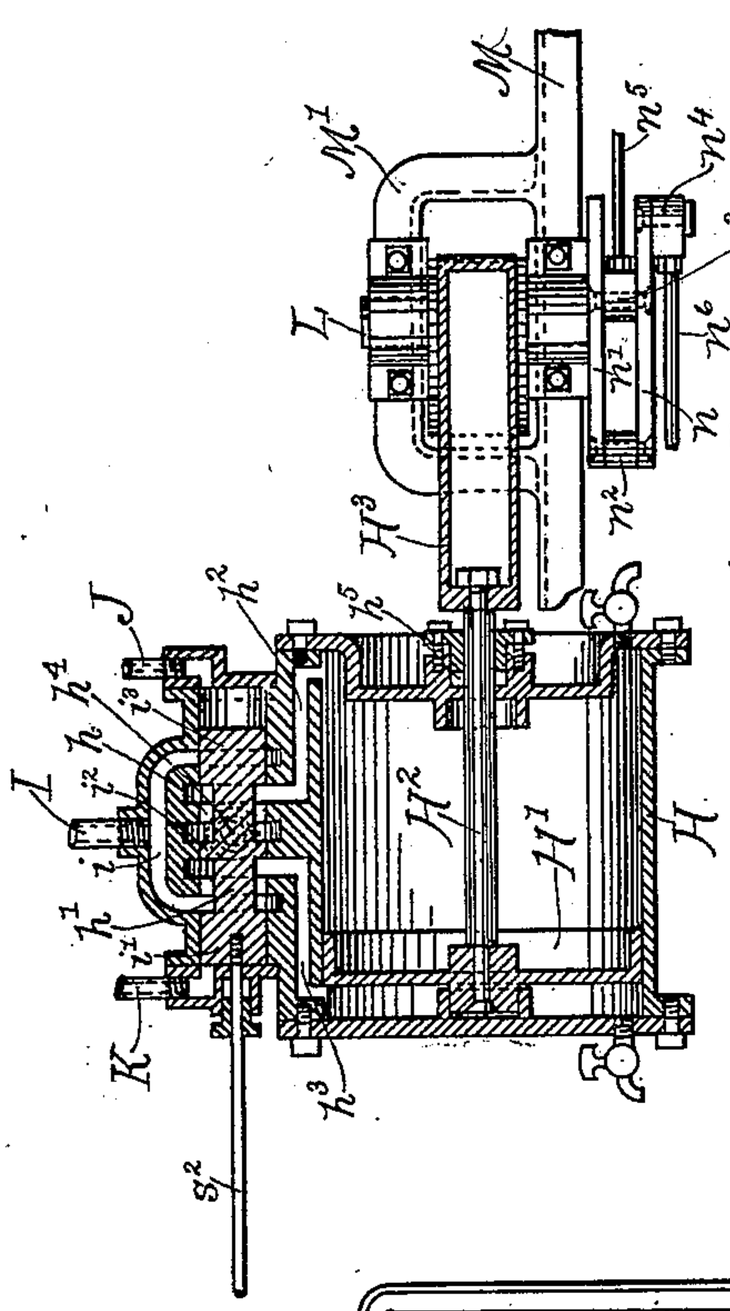

Fig. 5.

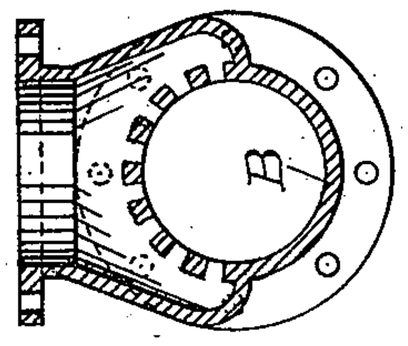

Fig. 4.

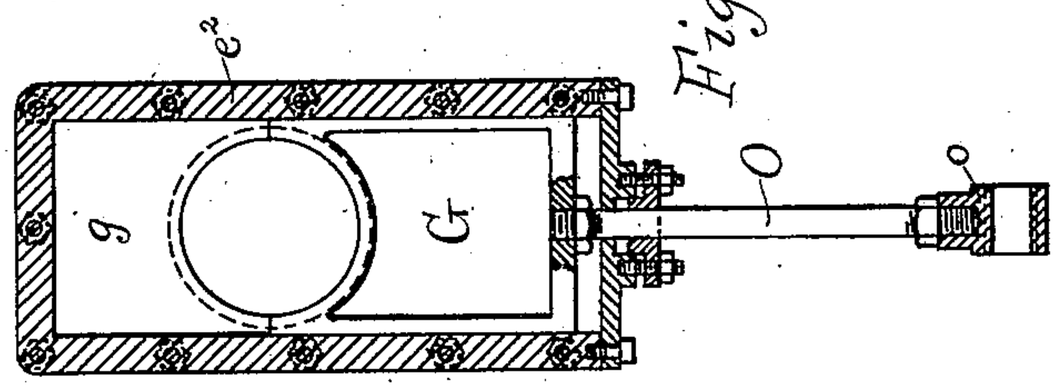

Fig. 3.

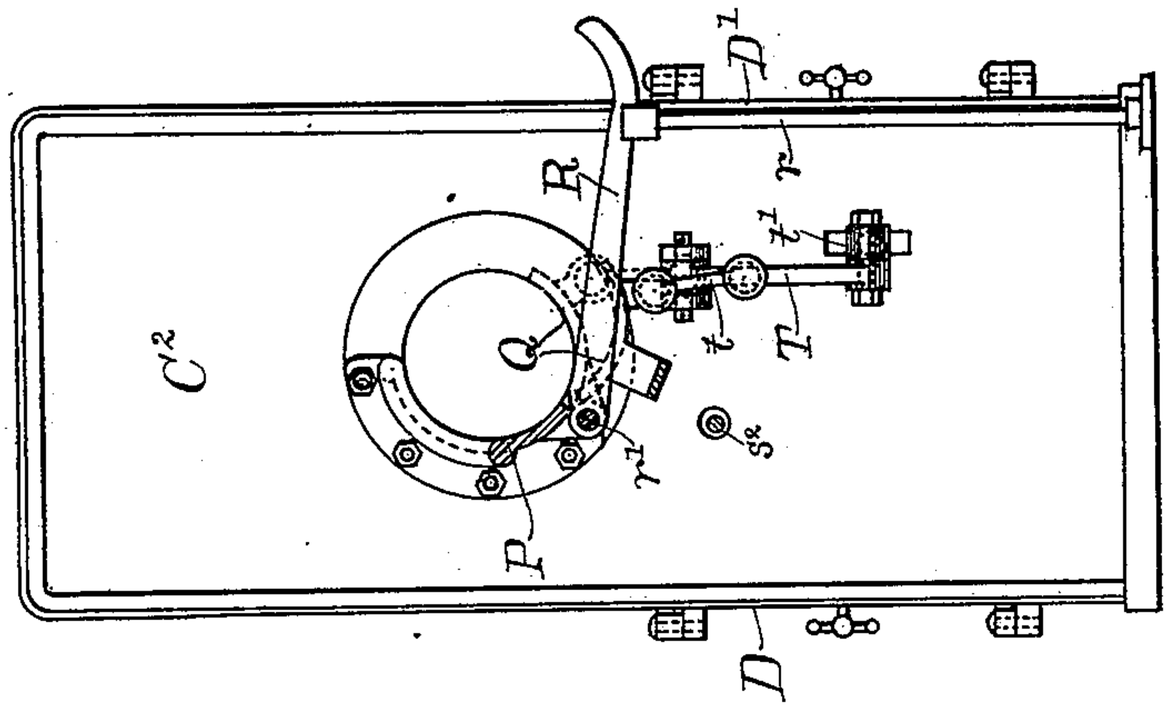

Fig. 2.

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UNITED STATES PATENT OFFICE.

EDMOND A. FORDYCE, OF CHICAGO, ILLINOIS.

TERMINAL FOR PNEUMATIC-DESPATCH-TUBE SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 635,434, dated October 24, 1899.

Application filed August 3, 1899. Serial No. 725,941. (No model.)

To all whom it may concern:

Be it known that I, EDMOND A. FORDYCE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Terminals for Pneumatic-Despatch-Tube Systems, of which the following is a specification.

My invention relates to pneumatic-despatch-tube apparatus in which a carrier is caused to travel through a tube through the agency of an air-current created therein by an air-compressor, blower, or similar device; and it resides more particularly in what is known in the art as a "discharge-terminal," in which the carrier having completed its travel and reached its destination is automatically brought to rest and discharged from the system.

The improvements forming the subject-matter of my present invention are applicable to discharge-terminals on either the main line or any of its branches and are adapted more particularly to systems which are intended for transporting bulky parcels in large-sized carriers through considerable distances.

My improvements are directed to that type of terminal in which the discharging carrier is made to enter a short section of tube, in the nature of an air-lock, controlled at each end by a sliding gate or valve, and wherein the moving carrier is made to control the gates both before and behind it, so that the carrier may be discharged from the tube without permitting the escape of air and consequent reduction of pressure in the system.

My invention has for its general object to provide an improved and simplified terminal in which the proper discharge of the carrier shall be rendered certain and entirely automatic; and this object is attained by the employment of certain specific features of construction, the principal of which are: (*a*) a single motor connected to both of the gates and adapted by a continuous operation in one direction to actuate said gates successively; (*b*) a balanced valve for controlling the admission of motive fluid to the said motor, which valve is operated by the carrier in both directions, through adjustable pneumatic means in one direction and through mechanical connections in the other; (*c*) a downwardly-inclined receiving-tube section between the discharge-gates, whereby the action of gravity assists the momentum of the carrier in effecting the actuation of the gates and insuring the delivery of the carrier, and (*d*) a discharge-table having a horizontally-hinged discharge-plate which is connected to the gate-operating mechanism and automatically coöperates therewith to effect the withdrawal of carriers from the system and their lateral discharge to a position convenient for unloading, all as will be fully hereinafter explained.

To these ends my invention consists in the parts and combinations of parts embodying in coöperative form the features of construction above specified, substantially as hereinafter described and claimed.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a central vertical section of a discharge-terminal constructed in accordance with my invention. Figs. 2, 3, and 4 are transverse sections thereof on lines *x x*, *y y*, and *z z*, respectively, of Fig. 1; and Fig. 5 is a horizontal central section through the cylinder and valve-chest of the motor which operates the discharge-gates and discharge-table.

Similar letters and figures refer to similar parts throughout the several views.

A designates a despatch-tube which may represent the terminus of a main or branch line of a pneumatic-despatch system and which is in communication with the receiving side of an air-compressor, blower, or other air-forcing device (not shown) through a short perforated section B, Figs. 1 and 4.

C is a rectangular casing to one end of which the perforated section B is bolted and inclosing the air-lock and its actuating mechanism, which casing may be provided with suitable hinged doors D and D′ for permitting convenient access to the interior. Within the casing C and between two stub-sections E E′ of tubing secured on or formed integral with the inner sides of the opposite end plates C′ C² of the casing C is a downwardly-inclined tube-section F for receiving the carriers from the system and subsequently discharging them without leakage of air past the

carrier in the discharging operation. This tube F has wide flanges $f f'$ formed on its ends, which flanges are securely bolted to corresponding flanges or annular plates $e e'$, secured to or formed on the stub-sections E E', respectively. The abutting flanges are bolted a slight distance apart by intervening rectangular frames $e^2 e^3$, as shown in Figs. 1 and 3, and in this way the tube F is securely held in place, and at the same time two parallel guideways $g g'$ are formed for the reception of a pair of transversely-reciprocating gates or valves G G'. These gates coöperate with the tube-section F to form a chamber in the nature of an air-lock, into which the carrier may be received from the tube A and from which it may be discharged onto the discharge-table without any leakage or loss of air in the tube A.

Referring now to the mechanism for actuating the gates G G', the letter H designates a cylinder located beneath the tube F and supported in any convenient way, as by said tube and a bracket C^3 on the inner wall of casing C, and having on one side thereof a valve-chest h, containing a sliding piston-valve h'. Ports h^2 h^3 lead from the interior of valve-chest h to the opposite ends of the cylinder H, while a centrally-located discharge-port h^4 may communicate with the atmosphere through a discharge-pipe I'.

I is a pipe for introducing motive fluid to cylinder H from any convenient source, it being shown as tapping the pressure in the system slightly in advance of the gate G, its other end entering the valve-chest h centrally of its ends and communicating through an inverted-U-shaped port i with the interior of valve-chest h near its opposite ends. The piston-valve h' is so formed with three piston-bodies i' i^2 i^3 that at one end of its throw it opens communication between ports i and h^3 for the admission of motive fluid from pipe I to the left-hand end of the cylinder, at the same time placing the right-hand end of the cylinder in communication with the atmosphere through ports h^2 h^4 and pipe I', as shown in Fig. 5, and at the end of its throw in the opposite direction it establishes communication between ports i and h^2 for the admission of motive fluid from pipe I to the right-hand end of the cylinder, at the same time placing the left-hand end of the cylinder in communication with the atmosphere through ports h^3 h^4 and pipe I'. The valve-chest h is also tapped at its extreme ends by two pipes J and K, the former of which communicates at its other end with tube F at a point just in advance of gate G', while the latter also communicates with the tube F through a series of short branch pipes k k' k^2 just in the rear of gate G, each of the latter branch pipes being provided with a suitable cut-off cock or valve, as shown.

The functions of the various parts above recited will be disclosed later in the description of the operation.

Within cylinder H is a piston H', whose rod H^2 extends through a stuffing-box h^5 in one of the cylinder-heads and is secured to a toothed rack H^3. This rack engages a pinion H^4, fast on a short shaft L, the latter being journaled in a bracket M', formed on a suitable frame or yoke M, which is secured at one end to a depending lug m on the cylinder II and at its other end to a depending bracket m' on the tube F. On one end of shaft L is keyed a star, shaped wrist-plate, (designated as a whole by N,) formed, as best shown in Fig. 5, of two star-shaped plates n n', bolted together in parallel relation at two of its three points n^2 and n^3, so that the connecting-rod n^5 may have free play for a limited distance between them.

O and O' designate a pair of rods secured to and actuating the gates G and G', respectively, each passing through a suitable stuffing-box in the lower edge of guideways $g g'$. These rods are connected with wrist-plate N, so as to be actuated thereby through the agency of connecting-rods n^5 n^6, bell-crank levers n^7 n^8, pivoted to the frame M, and the slotted heads o o' of the rods O O', respectively, all as plainly shown in Fig. 1.

In the rear of casing C and in alinement with the path of the carrier's travel therethrough is placed the discharge-table on which the carrier is finally brought to rest and from which it is discharged laterally to be unloaded. This comprises a short cut-away section of tube P, slightly longer than a carrier and bolted at one end to the end plate C^2 and supported at its other end by a standard p, which screws into a cap P', closing the outer end of tube P. The bottom of tube P is cut away and hinged at one of its horizontal edges to the upper part of the tube-section, as shown, thus forming a downwardly-swinging discharge-plate Q. This plate in its elevated position (shown by dotted lines in Fig. 2) receives the carrier as the latter emerges from casing C and on being depressed, as shown by full lines in Fig. 2, rolls the carrier off laterally onto a pair of parallel downwardly-inclined rails R R, pivoted at their inner ends on the hinge-bolts r' r' of the plate Q and supported at their outer upwardly-curved ends on suitable posts or standards r r.

S is a short lever fulcrumed at s in the lower edge of cap P', its upper arm carrying a disk s', loosely fitting the cap P' and adapted to be struck and rocked by a carrier, and its lower arm being pivotally secured to the actuating-rod s^2 of the piston-valve h'.

The discharge-plate Q is actuated in both its upward and downward movements by the same motor mechanism that actuates the gates G and G' through the connections shown in Figs. 1 and 2. These connections comprise a bell-crank lever T, pivoted to a bracket T' on the end plate C^2, a connecting-rod t between the short arm of the bell-crank lever T and a lug on the under face of discharge-plate Q, and another connecting-rod t' between the

long arm of bell-crank lever T and the short arm of bell-crank lever n^8.

Having thus described the various parts and elements comprising the present embodiment of my invention, I will now show how they coöperate to effect the automatic discharge of a carrier without any loss of air and consequent reduction of pressure in the system.

When the terminal is ready for the reception of a carrier to be discharged, all the parts will be in the positions shown in the several figures of the drawings except the piston-valve h', which will be at the right-hand end of its throw, Fig. 5, and the lever S connected thereto, which will occupy the slanting position indicated by dotted line, Fig. 1. The cut-off cock in all of the branch pipes k k' k^2 but one will be closed. At that time the pressure in the system, acting through pipes J and K equally on opposite ends of the valve h', will hold said valve balanced. The carrier W then enters the terminal from tube A, as shown in Fig. 1. As it travels through the downwardly-inclined tube-section F it compresses the air in advance of it through the pipe J and destroys the balanced condition of valve h', causing said valve to begin a shifting movement toward the left. As soon as that movement has progressed far enough to open communication between pressure-pipe I and the left-hand end of cylinder H and between exhaust-pipe I' and the right-hand end of the cylinder the piston H' will begin to move to the right and through rack H^3 and pinion H^4 will rotate the wrist-plate N in the direction indicated by the arrow, Fig. 1. The travel of piston H' through the first half of the cylinder length will carry point n^4 of the wrist-plate around to the position indicated at 1 and will carry point n^3 around to the position indicated at 3. This movement of wrist-plate N will close gate G behind the carrier, but will have no effect on gate G'. As now the carrier proceeds through tube F by gravity and its own momentum, (both the gates G and G' being closed,) air will be further compressed in advance of the carrier through pipe J and will be rarefied in rear of the carrier through pipe K. Valve h' is then forced hard to the left-hand limit of its throw by the combined effect of pressure on one end and suction on the other, and this movement also, through valve-actuating rod s^2, will restore lever S to the vertical position shown in full lines in Fig. 1. As piston H' now completes the remainder of its travel to the right through the cylinder the continued rotation of wrist-plate N will carry point n^4 from 1 to 2 and point n^3 from 3 to 4. This will open gate G' in front of the carrier, but will have no effect on the previously-closed gate G. Simultaneously with the opening of gate G' the hinged discharge-plate Q will, through its described connections to bell-crank lever n^8, be thrown up into receiving position in line with tube-section P, as shown in dotted lines, Fig. 2. The carrier W will then slide out onto the discharge-table, and simultaneously with its emergence from the casing C equilibrium of pressures (atmospheric) will occur on the opposite ends of valve h' and said valve will be again balanced. As the carrier comes to rest on the hinged discharge-plate Q its forward end abuts the disk s' on lever S, rocks this lever, and through the valve-actuating rod s^2 resets valve h', so as to admit pressure to the right-hand end of cylinder H. This reverses the rotation of wrist-plate N and resets all the parts in the following order: First, the gate G' is closed, this action simultaneously drawing down into discharging position the plate Q and causing the carrier to roll laterally down onto the rails R R or other receptacle, and then, by the continued rotation of the wrist-plate, the gate G is opened, the atmospheric pressure balancing the valve h' gives place to the pressure of the system acting equally through pipes J and K, and the parts are all in readiness for the reception and discharge of the next carrier.

With continued use the carrier becomes slightly worn, so that it does not fit the interior of the tube so snugly, and consequently after the carrier has entered tube F and gate G has been closed behind it a vacuum or partial vacuum does not so quickly form in its rear. For this reason I connect pipe K with tube F through the series of short branch pipes k k' k^2. While the mechanism is comparatively new little or no air leaks past the carrier, and consequently a very short travel of the carrier from the closed gate G produces an effective vacuum on valve h'. I then shut off pipes k^2 and k' and open pipe k. As the carrier wears and leakage of air past the carrier increases a longer travel of the carrier from the closed gate G is necessary to produce an effective vacuum on valve h'. I then close pipes k^2 and k and open pipe k'. For the same reason when the wear and leakage have still further increased I close pipes k and k' and open pipe k^2. As many of these branch pipes may be used as are found necessary or expedient.

In view of the fact that the carrier travels nearly the entire length of the receiving tube-section F (which in practice may be considerably longer relatively to the carrier length than as indicated in the drawings) not only without a propelling current, but against pressure in front and a partial vacuum behind I have found it expedient to supplement the carrier's momentum by the effect of gravity by arranging the tube F in a downwardly-inclined position, as shown,

In carrying out my invention I do not limit myself to the precise structural details hereinabove shown and described. So long as the essential features enumerated hereinabove under the statement of the general ob-

ject of the invention are preserved their mechanical embodiment may vary widely within the field of mechanical skill and expediency.

What I claim, therefore, and desire to secure by Letters Patent, is—

1. A discharge-terminal for pneumatic-despatch-tube systems, comprising a receiving tube-section at the end of and communicating with a main or branch line of the system, two transversely-sliding gates in said tube-section adapted to receive a carrier between them, the first of said gates being normally open and the second closed, and a single motor connected to both of said gates and actuating them successively, whereby, on the arrival of a carrier to be discharged, the first gate is first closed in rear of the carrier and then the second gate is opened to permit the carrier's discharge, substantially as described.

2. A discharge-terminal for pneumatic-despatch-tube systems, comprising a receiving tube-section at the end of and communicating with a main or branch line of the system, two transversely-sliding gates in said tube-section adapted to receive a carrier between them, the first of said gates being normally open and the second closed, and a single motor, set in operation by the carrier, connected to both of said gates and actuating them successively, whereby, on the arrival of the carrier to be discharged, the first gate is first closed in rear of the carrier and then the second gate is opened to permit the carrier's discharge, substantially as described.

3. A discharge-terminal for pneumatic-despatch-tube systems, comprising a receiving tube-section at the end of and communicating with a main or branch line of the system, two transversely-sliding gates in said tube-section adapted to receive a carrier between them, the first of said gates being normally open and the second closed, a single motor, set in operation by the carrier, connected to both of said gates and actuating them successively, whereby, on the arrival of the carrier to be discharged, the first gate is first closed in rear of the carrier and then the second gate is opened to permit the carrier's discharge, and mechanism actuated by the carrier after its discharge for resetting the gates into position for the reception of the next carrier, substantially as described.

4. A discharge-terminal for pneumatic-despatch-tube systems, comprising a receiving tube-section at the end of and communicating with a main or branch line of the system, two transversely-sliding gates in said tube-section adapted to receive a carrier between them, a motor for actuating said gates, and pneumatic means operated by the carrier for causing said motor to actuate the gates in a direction to effect the discharge of the carrier, substantially as described.

5. A discharge-terminal for pneumatic-despatch-tube systems, comprising a receiving tube-section at the end of and communicating with a main or branch line of the system, two transversely-sliding gates in said tube-section adapted to receive a carrier between them, a motor for actuating said gates, pneumatic means operated by the carrier for causing said motor to actuate the gates in one direction to effect the discharge of the carrier, and mechanical devices operated by the discharged carrier to cause the motor to actuate the gates in the opposite direction, and thus reset the latter in a position to receive the next carrier, substantially as described.

6. In a discharge-terminal for pneumatic-despatch-tube systems, the combination with the downwardly-inclined receiving tube-section, provided with a transversely-sliding gate at each end thereof, of motor mechanism for actuating said gates, and pneumatic means operated by the carrier after the latter has entered the tube-section, whereby said motor mechanism is caused to first close the gate in rear of the carrier, and subsequently open the other gate in advance of the carrier, whereby the carrier may slide out by gravity and be discharged, substantially as described.

7. In a discharge-terminal for pneumatic-despatch-tube systems, the combination with the downwardly-inclined receiving tube-section, and the transversely-sliding gates for closing the ends thereof, of a motor for actuating said gates, and means for setting said motor in operation to effect the discharge of the carrier, said means being controlled from the carrier while the latter is in the receiving-section through the joint agency of air compressed in advance of the carrier and a vacuum or partial vacuum created in its rear, substantially as described.

8. In a discharge-terminal for pneumatic-despatch-tube systems, the combination with the receiving tube-section, and the transversely-sliding gates for closing the ends thereof, of a motor for actuating said gates provided with a valve controlling the admission of motive fluid to said motor, said valve being normally balanced by equal air-pressures on its opposite ends, and means whereby, on the entrance of a carrier in the receiving tube-section, the balanced condition of said valve is destroyed, and the latter is actuated in a direction to admit motive fluid to the motor and thereby effect the discharge of the carrier, as and for the purpose described.

9. In a discharge-terminal for pneumatic-despatch-tube systems, the combination with the receiving tube-section, and the transversely-sliding gates for closing the ends thereof, of a motor for actuating said gates provided with a sliding piston-valve for controlling the admission of motive fluid to said motor, and pipes tapping said receiving tube-section between and closely adjacent to said gates and leading to opposite ends of said valve, whereby said valve is normally balanced when the tube-section is empty, but on the entrance of a carrier the balanced condition of the valve is destroyed and the valve actuated by the joint agency of air com-

pressed through one of said pipes in advance of the carrier and a vacuum or partial vacuum created through the other pipe in rear of the carrier, substantially as and for the purpose described.

10. In a discharge-terminal for pneumatic-despatch-tube systems, the combination with the receiving tube-section, and the transversely-sliding gates for closing the ends thereof, of a motor for actuating said gates provided with a sliding piston-valve for controlling the admission of motive fluid to said motor, a pipe communicating with the receiving-tube and arranged to transmit air compressed in front of the carrier to one end of said valve, and a second pipe arranged to make effective upon the other end of said valve a vacuum created in rear of the carrier, and communicating with the receiving-tube through any one of a series of short branch pipes set at varying distances from the end of the receiving-tube, whereby wear on the carrier and consequent impairment of the vacuum created in its rear may be compensated for, in the manner and for the purpose described.

11. In a discharge-terminal for pneumatic-despatch-tube systems, the combination with the receiving tube-section, and the transversely-sliding gates for closing the ends thereof, of a motor comprising a cylinder and piston for actuating said gates, and connections intermediate said piston and both of said gates, said connections being so constructed and arranged that during the first half of a piston-stroke in one direction the first gate will be closed and the second gate unmoved, and during the last half the second gate will be opened and the first gate unmoved, while on the reverse stroke of the piston during the first half the second gate will be closed and the first gate unmoved, and during the last half the first gate will be opened and the second gate unmoved, as and for the purpose described.

12. In a discharge-terminal for pneumatic-despatch-tube systems, the combination with the receiving tube-section having the transversely-sliding gates, and a motor mechanism for actuating said gates set in operation by the carrier passing through said receiving tube-section to effect the discharge of the carrier therefrom, of a discharge-table on which the carrier is received and brought to rest, said discharge-table having a hinged discharge-plate from which, on its downwardly-swinging movement the carrier is discharged laterally, connections intermediate said discharge-plate and the motor mechanism which actuates the gates, and a lever pivoted on said discharge-table in the path of the carrier, and connected to the controlling device of the motor, whereby the impact of the carrier on said lever reverses the motor mechanism, simultaneously effecting the depression of the discharge-plate and the lateral discharge of the carrier therefrom and the resetting of the gates to a position for receiving the next carrier, in the manner and for the purpose described.

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