(No Model.) 3 Sheets—Sheet 1.

R. M. CURTISS.

MEANS FOR AUTOMATICALLY OPERATING THE GATES OF PNEUMATIC TUBES AND SIMILAR WAYS.

No. 376,862. Patented Jan. 24, 1888.

Fig. 1.

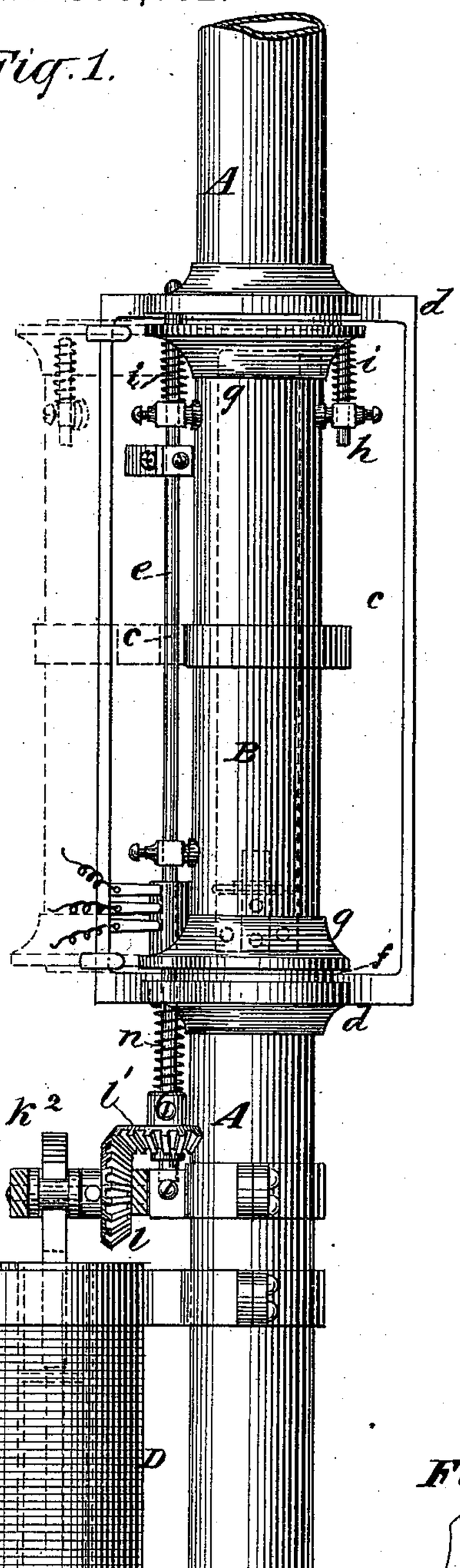


Fig. 2.

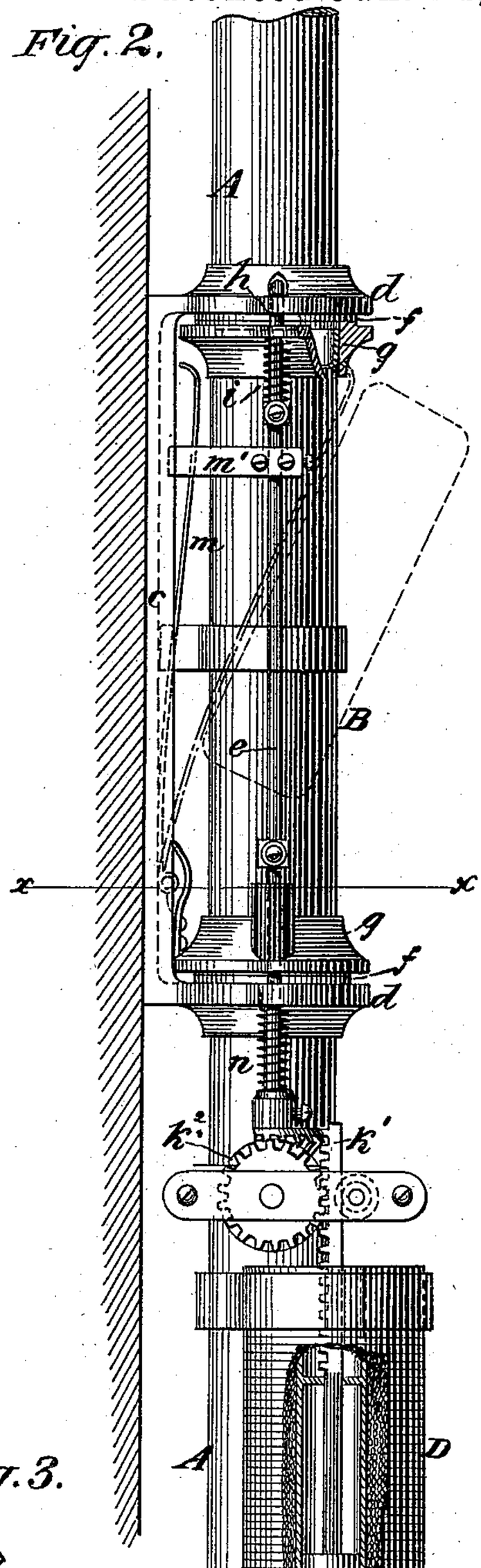
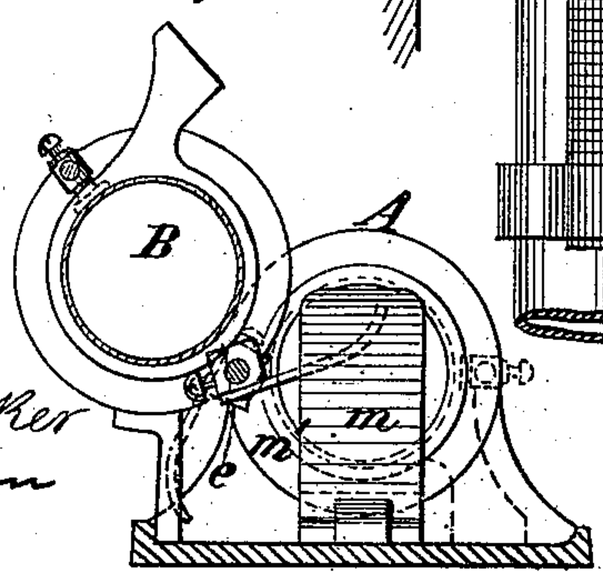


Fig. 3.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 6.

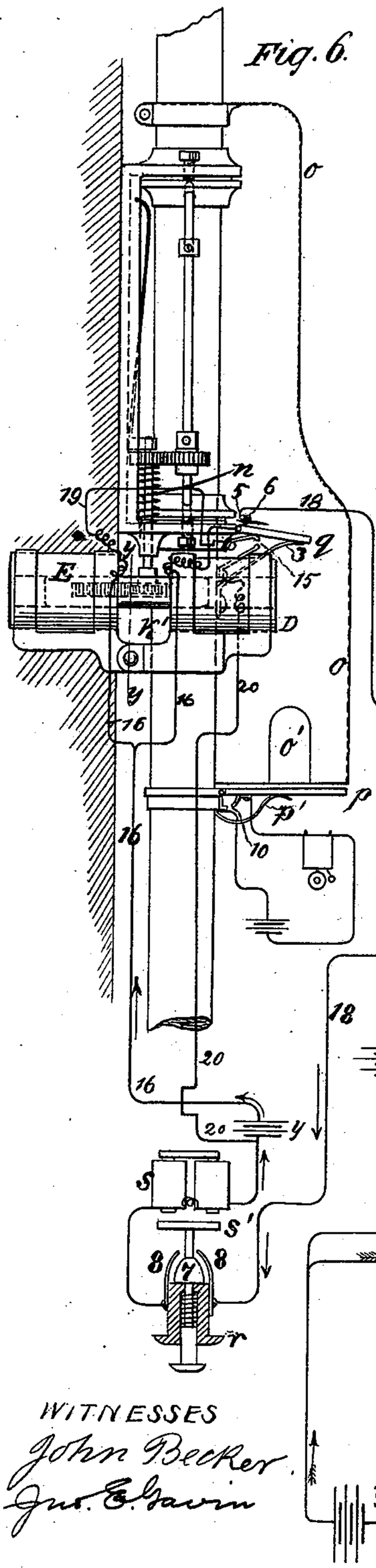

Fig. 7.

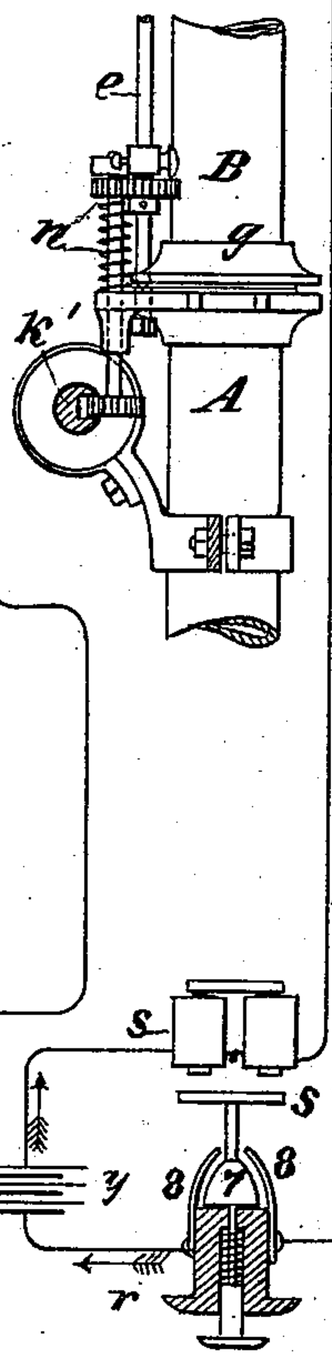

Fig. 4.

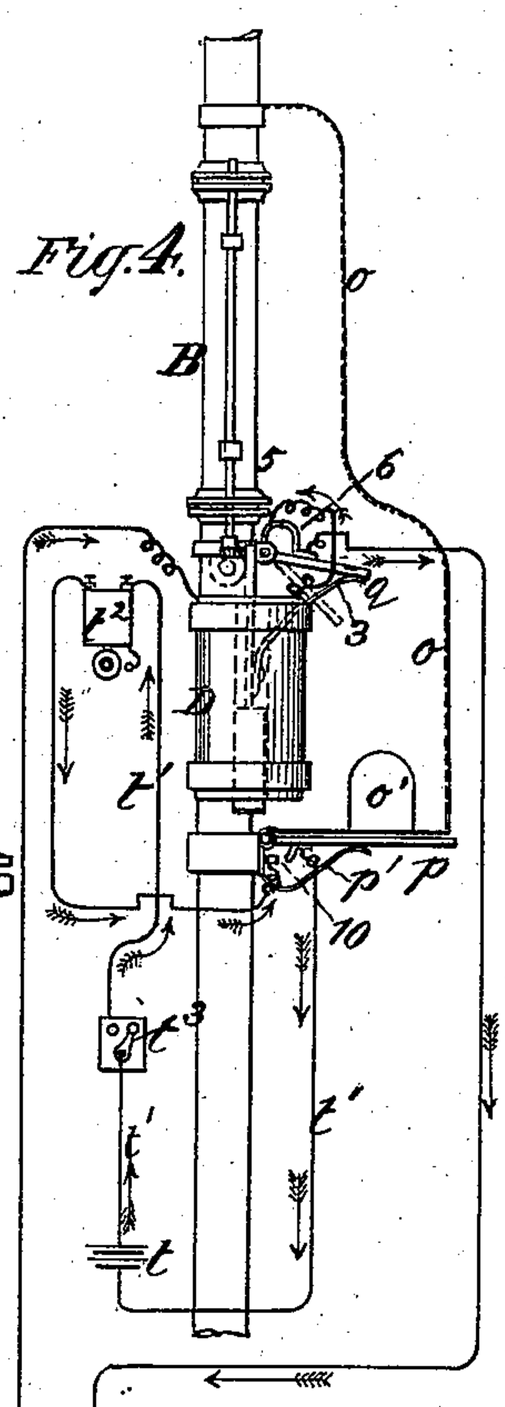

Fig. 5.

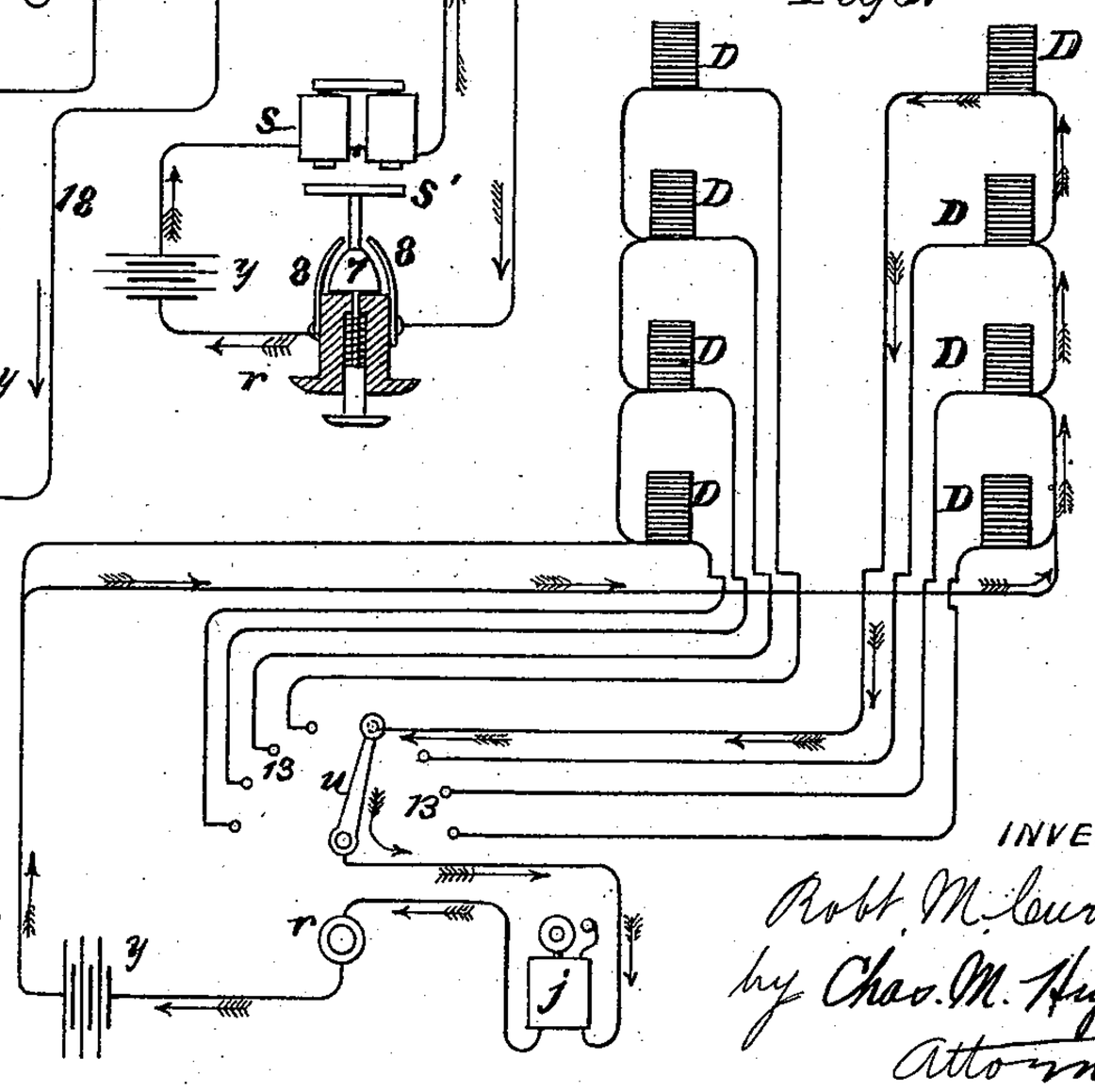

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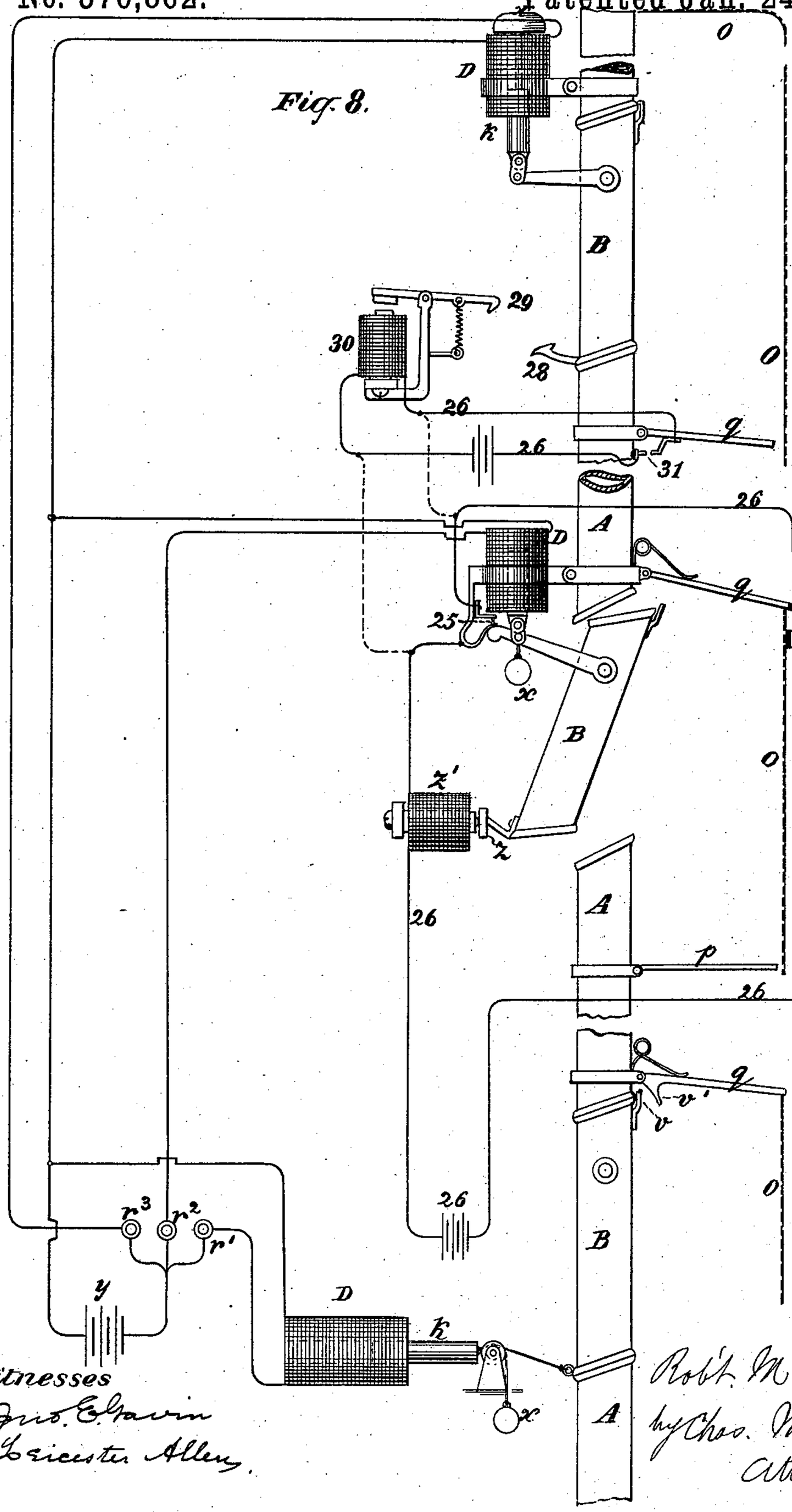
Fig. 8.



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UNITED STATES PATENT OFFICE.

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MEANS FOR AUTOMATICALLY OPERATING THE GATES OF PNEUMATIC TUBES AND SIMILAR WAYS.

SPECIFICATION forming part of Letters Patent No. 376,862, dated January 24, 1888.

Application filed June 11, 1886. Serial No. 204,891. (No model.)

To all whom it may concern:

Be it known that I, ROBERT M. CURTISS, of Brooklyn, Kings county, New York, have invented certain new and useful Improvements in Means for Automatically Operating the Gates of Pneumatic Tubes and Similar Ways or Conduits, of which the following is a specification.

My invention applies more especially to small pneumatic tubes or equivalent ways or conduits adapted for the conveyance of small packages or messages; and the object of my invention is to apply the power of electricity to automatically cause the opening of any gate along the line of the tube, so as to effect the ejection of the package or carrier at any point desired, and also to make the ejected package act to close the gate from which it has been ejected and to sound an alarm to indicate its delivery. Heretofore electro-magnets have been arranged to control valves within a system of pneumatic tubes so as to cause the carriers to be directed from the main line into any desired branch of the tube. Electro-magnets have also been arranged to release a detent on the gate, which then opened by the action of gravity to allow the ejection of the carrier, which, striking against the inclined side of the gate as it became ejected, reacted to close the gate. Now, in my improvement I operatively connect the armature of an electro-magnet directly to the gate, so as to open the same positively by the direct impulse from the magnet, and thus allow the package to be thrown out, while the reverse or closing motion of the gate is effected by the action of a spring or weight, which arrangement renders the operation of the gates much more positive and efficient. I also arrange a stop or arrester near the gate in the path of the ejected carrier and operatively connect the arrester with devices which control the closing of the gate, so that as soon as the ejected carrier strikes the arrester the gate becomes automatically closed. I also provide a receiver into which the ejected carrier is received or deposited, and which operates electric contacts in circuit with an electric alarm which will announce when the carrier is delivered. I also provide the circuit with a peculiar form of push-button or circuit-closer and with switch devices to close the circuit on the magnet of any particular gate to operate the same, as hereinafter shown.

My invention therefore consists, mainly, in the features above outlined, as hereinafter fully set forth and claimed.

In the drawings, Figure 1 gives a front elevation of a section of pneumatic tube provided with swinging gates and equipped with my improvements. Fig. 2 is a side elevation of Fig. 1. Fig. 3 is a cross section on line *x x* of Fig. 2, with the gate open. Fig. 4 is a side elevation similar to Fig. 2, but on a smaller scale, and illustrating the complete circuit arrangements for operating the gate mechanism, &c. Fig. 5 is a diagram of the circuit when used for a series of magnets operating a series of gates on a line of tubing. Fig. 6 is a side elevation showing a modification where the opening and closing motions of the gate are both performed by electro-magnets. Fig. 7 is a fragmentary section on line *y y* of Fig. 6. Fig. 8 represents a variation of my invention applied to a pneumatic tube provided with what is known as "tilting" or "pendulous" gates.

In Figs. 1 and 2, A indicates the pneumatic tube, which extends, as usual, from the central office to as many branch offices as desired, and is provided with a gate, B, in each branch office in which it is desired to deliver messages. This gate B is, in fact, a movable section of the tube, and is in this case what is known as a "swinging" gate, as it swings bodily to one side when opened, as seen in Fig. 3 and in dotted lines in Fig. 1. The gate B is mounted within a rigid frame or yoke, *c d d*, which has a base-plate, *c*, secured to the wall, as seen in Fig. 2, and heads *d d*, in which each end of the main tube A is received and between which the gate-section B plays, as shown. The gate B is secured to the rock-shaft *e*, which forms its axis of motion and which is journaled at each end in the heads *d d*. The heads *d d* have ground faces *f* to match with ground faces on the ends of the gate-section B, so as to secure an air-tight joint at the junction. Heretofore the ground face on the gate-section has been rigid on the ends thereof, so that the gate must either fit with great accuracy between the heads *d d* or is else likely to bind or to leak. In my improvement, however, I provide the ends of the tube with yield-

ing packing-collars *g g*, which slide air-tight on the ends of the gate and have a ground face to meet with the ground face *f* on the heads *d*, so that the joint is thus rendered elastic and a perfect and easy fit of the gate and a tight joint is insured. The collars *g g* are guided by pins *h* and pressed to their seats by springs *i*, or any equivalent means, as will be understood from Figs. 1 and 2.

Now, D represents a large electro-magnet or solenoid, which is secured to the tube or otherwise fixed near the gate, and its core or armature *k* is provided with a rack, *k'*, which meshes with a pinion, k^2, fixed on a spindle, on which is also fixed a miter-wheel, *l*, which gears with a second miter-wheel, *l'*, fixed on the end of the rock-shaft *e*. It will therefore be seen that if the magnet is put in circuit its core *k* will be forcibly attracted inward, and this will cause the rack *k'* to revolve the gearings k^2 *l l'*, and thus partially revolve the rock-shaft *e*, which will simultaneously swing the gate B open, as shown in Fig. 3 and in dotted lines in Fig. 1, and thus allow the package or carrier to be ejected from the tube at the open gate in the usual manner. To the base-plate *c*, behind the gate, is pivoted a deflecting-blade, *m*, which, when the gate is swung open, falls outward in an inclined position over the open end of the tube, as shown by dotted lines in Fig. 2, thus forming an inclined obstruction in the way of the carrier, which, when it issues from the tube, strikes the deflector, and thus becomes deflected or thrown out laterally.

In order to insure that the deflector *m* shall be positively moved out into its deflecting position when the gate is opened, a claw, *m'*, projects from the rock-shaft back of the deflector, and thus engages it and pulls it out when the gate is opened, as will be understood from Figs. 2 and 3.

Heretofore the deflector has been made in the form of a stiff spring, which tended constantly to press the gate open, so that the gate had to be closed against the resistance of said spring.

In my case no resistance is offered to the closing of the gate, except the necessary friction of the joints, and the closing motion is effected by the torsional spring *n*, which, as soon as the magnet D is thrown out of circuit, acts to swing the gate closed, and thus return it to its normal position, as seen in full lines in Figs. 1 and 2.

In Figs. 4 and 5 are shown the complete circuit arrangements for operating the gate-magnets.

In Fig. 4, B indicates the gate of the tube, and D the magnet, arranged and connected as already described. *o* indicates a wire-cloth cage or basket inclosing the gate portion of the tube to intercept or catch the ejected carrier, and having a hinged platform, *p*, at the base, on which the carrier finally falls, and a hand-hole, *o'*, through which the carrier may be removed. The upper part of the cage *o* is narrow, and at about the middle of the cage, where the narrow part blends into the wide part, is arranged a hinged obstructor or arrester, *q*, which projects out in the path of the carrier as it falls down from the narrow into the wide part of the cage. This arrester is constantly raised up by a spring, 3, so as to close the contacts 5 6, arranged as shown, which contacts are included in the circuit of the magnet D, as illustrated, and are always normally closed, as will be understood. These contacts 5 6 consist simply of a fixed point or tongue, 5, affixed to the tube or its framework, with a movable tongue, 6, attached to the arrester *q*, as shown in Figs. 4 and 6.

Now, *r* indicates the push-button or circuit-closer, which is arranged in the central office for closing the circuit from the battery or generator *y* on the magnet of any desired gate. The stem or plunger of this push has a conical contact, 7, which passes between two tongues, 8, through which the circuit is completed when the tongues are spread against the cone. On the end of the stem of the push-button is fixed an armature, *s'*, which is arranged in proximity to an electro-magnet, *s*, which electro-magnet is in the same circuit with the gate-magnet D and the push-button *r*.

It will now be seen by reference to Fig. 4 that the circuit is normally broken at the push-button only. Consequently if the push-button is pressed in, the circuit will be closed and the magnet D will at once act to forcibly swing the gate B open, while at the same time the armature *s'* will be pressed close to the poles of the magnet *s*, where it will now be held attracted, so that although the pressure of the finger may be momentarily removed from the push-button the button will still remain depressed, thus keeping the circuit closed and the magnet D energized, and thereby holding the gate open until after the carrier has been ejected. When the carrier is ejected, it will first be projected up into the cage *o* and will then fall down through the same and strike the arrester *q*, and thereby depress the same and open the contacts 5 6, and thus break the circuit, thereby demagnetizing the magnet D, and thus causing the gate B to fly shut, and at the same time demagnetizing the magnet *s* and allowing the push-button *r* to fly open. When the carrier falls past the arrester, the arrester will spring back to its normal position and again close the contacts 5 6, so that all parts will now be restored to their normal positions, as seen in Fig. 4. The carrier in dropping in the cage *o* will, however, finally fall upon the platform *p*, and thus depress the same against the action of the spring *p'*, and thereby close contacts 10, which are included in a local-battery circuit, *t t'*, including an electric bell, t^2, or other alarming or announcing device, which will now sound, and thus call attention to the fact that the carrier is delivered. When it is not desired to sound an alarm, the switch t^3 in the local circuit is opened.

In Figs. 4 and 5 for simplicity of illustration I have represented a battery as the electric source or generator; but in practice I employ a dynamo-machine driven by the same engine which drives the blowers for operating the pneumatic tube, and I thus procure a powerful electric current, which enables me to use the large magnets or solenoids illustrated in Figs. 1 and 2, and, as the armatures of these magnets are connected directly to the gate, hence a powerful impulse will be imparted to open the gate positively when the magnet is put in circuit, thereby rendering the operation of the gates very efficient and instantaneous, whereas when the gate is relied on to open by gravity or some secondary action after the release of a detent by a small electro-magnet, as heretofore, it is obvious that the operation of the gates cannot be so reliable, positive, or prompt.

The general circuit arrangement for a series of gate-magnets on a line of tube is shown in Fig. 5—that is, one terminal of all the gate-magnets D connects to the line-wire going to one side of the generator *y*, while the other terminals of the magnets connect individually to individual switch-points 13, over which a switch, *u*, is movable, said switch *u* being connected to the opposite side of the generator. In the line between the switch and the generator, or at any other suitable point, is introduced the push-button *r*, with its magnet *s*, as in Fig. 4, and also an electric bell or rattler, *j*. The switch *u*, button *r*, and rattler *j* are of course all placed in the central office, and the mode of operating the apparatus is as follows: When it is desired to send a message to any branch office along the line of the tube, the switch *u* is first turned on the point corresponding to the magnet D of said office, and the carrier is then put in the tube in the central office and the blast turned thereon. The button *r* is now depressed, which will close circuit with the desired magnet, and therefore open the gate in the desired office. The carrier will therefore move forward in the tube toward the open gate, where it will be ejected, and the rattler *j* will continue to sound during the passage of the carrier or while the gate is opened, but will cease as soon as the package is ejected and the gate closed by the breakage of the circuit at the contacts 5 6, as before described, so that the silence of the rattler *j* indicates to the operator in the central office that the message has been delivered at the desired gate. It will be seen that the armature *s'* and magnet *s*, in connection with the button *r*, form a very simple and effective means to hold the button depressed and the circuit closed until the desired action is produced, and thus obviate the necessity of keeping the finger on the button for a prolonged interval, which is a very desirable feature.

In Fig. 6 the arrangement is the same as already described, except that two magnets or solenoids are used to each gate, one to open and one to close the same.

D is the opening-magnet, and E the closing-magnet, with the core playing between the two, and provided with the rack *k'*, which engages spur-gearing connected with the rock-shaft *e* of the gate, as shown in Figs. 6 and 7. The opening-magnet D is circuited precisely as before described, the circuit being completed through the contacts 5 6, which are closed in the normal or raised position of the arrester *q*. The circuit of the closing-magnet E is, however, completed through a second set of contacts, 15, which are normally open, but are closed when the arrester *q* is depressed. The circuit of each magnet may be easily traced as follows: Thus the current will flow to magnet D from the generator *y* by line-wire 16 to one end of the magnet, and from the opposite end by wire 19 to the contacts 5 6, and thence by return-wire 18 to the generator *via* button *r* and magnet *s*. To the magnet E the current will flow by line-wire 16 to one end of the coils, and from the other end by wire 19 to the contacts 15, and from said contacts by return-wire 20 directly to opposite side of generator.

It will therefore now be seen, referring to Fig. 6, that when the circuit is closed on the opening-magnet D by depressing the button *r* the gate will be swung open, as before described, and in due time the carrier will be ejected into the cage *o*, where it will fall on the arrester *q*, which, being depressed, will first open contacts 5 6, and thereby break the circuit on the magnet D, and immediately after close the contacts 15, and thereby close the circuit on the magnet E, which will now act to forcibly shut the open gate. After the carrier has fallen past the arrester *q*, the arrester will spring back to its normal position, and thus break circuit on the magnet E and bring all parts back to their normal positions, as shown in Fig. 6.

Instead of having the push-button held depressed and the circuit closed to keep the magnet active during all the time that the gate remains open, I may arrange the apparatus so that a momentary closing of the circuit will actuate the magnet for a moment sufficient to pull the gate open, where it will then be retained by a detent, which will continue to hold the gate open after the circuit is broken and the magnet becomes inactive, and until the carrier is ejected, which, striking on the arrester, will then release the detent and allow the gate to close. This modification is shown in Fig. 8, in which I also show the pendulous or tilting gates. In this form of my invention I use simple or common push-buttons, r' r^2 r^3, each connected individually to one end of the respective magnets D of the individual gates and introduced in the circuit between the magnets and the generator *y*, while the opposite ends of the magnets are all connected to the opposite side of the generator, as fully shown in Fig. 8. At the three gates shown in Fig. 8 I illustrate a slightly different form of mechanism, all acting on the same general plan.

In all cases the armatures of the magnets D

are connected directly to the gate, so as to pull the same open when in action, while a weight, *x*, will close the gate when the magnet is decircuited. The special manner of connecting the armatures with the gates and the arrangement of the weights may vary, as shown at the three gates, without altering the result, as will be understood. When, therefore, the button *r'* is depressed, the lower magnet D will be put in action and will pull the lower gate open, and will cause a detent-tooth, *v*, on the top of the gate to engage a detent tooth or stop, *v'*, on the arrester *q*, which in this case is pivoted at the top of the cage *o*. The gate will thus be held open when so engaged, although the magnet may have been in action but a moment, due to a momentary depression of the button *r'*. When, however, the carrier is ejected, it will strike the arrester *q*, and thus release the detents *v v'* and allow the gate to close.

When the middle gate is opened, an armature, *z*, on its lower end will be brought against the poles of an electro-magnet, *z'*, and simultaneously contacts 25 will be closed, thus closing a local circuit, 26, on the magnet *z'*, which will now act to hold the gate attracted in its open position, although the gate magnet D may become immediately inactive. The arrester *q* is also in this case arranged at the top of the cage *o*, and is arranged to close contacts 27 in said local circuit, and thus keep said circuit closed. When, however, the ejected carrier strikes upon the arrester, it will raise the same and open the contacts 27, and thus break the circuit 26 and cause the magnet *z'* to release the gate and allow the same to close by the force of the weight.

The devices at the upper gate are as follows: When the gate is opened, the detent 28 on the lower end of the gate engages the detent-armature 29 of the magnet 30, which is included in a local circuit, 26, which is normally open at the contacts 31, operated by the arrester *q*, which is placed at the middle of the cage, as shown in the leading figures. The gate will therefore be held open by the momentary action of the magnet D and by the continued action of the detents 28 29 until the ejected carrier strikes against the arrester *q*, which will then depress the arrester and close the contacts 31, thereby closing the circuit 26 and causing the magnet 30 to attract the detent-armature 29, and thus allow the gate to close.

It will be readily understood that the advantage of the arrangements shown in Fig. 8 is that the circuit is closed but a moment on any one magnet to open the corresponding gate, and hence the circuit can be closed on one of the magnets of another tube to open another gate without having to wait until the first gate was closed, which in a large establishment operating a number of tubes from one central office is a great advantage.

It will be noted that my invention is not confined to the special details shown, and is not necessarily limited to pneumatic tubes, but may be applied to any similar light ways or conduits—such, for instance, as to cash-carriers.

Any other electric motive device which might be substituted for an electro-magnet may be used instead of the magnets shown and will be the equivalents thereof; but I consider the electro-magnet as the most suitable device for the purpose.

It will be understood that the yielding packing-collars *g* might be on the fixed end of the tube A instead of on the gate B; but I prefer the arrangement shown.

It will be seen by referring to Fig. 2 that the core *k* works like a piston in the tubular center of the magnet D, and that the rack-rod *k'* of the core works through a perforated head in the tube. This construction serves the purpose of a dash-pot or air-cylinder, which will prevent any sudden or violent movements of the core in the magnet.

What I claim is—

1. In combination with a pneumatic tube or equivalent way or conduit with a discharge-outlet therein, through which the carrier is ejected, and a movable gate arranged to open and close said outlet with reference to the air-current, an electro-magnet having its armature connected to the gate and arranged to move it with a positive impulse in one direction, with a spring or its equivalent arranged to move it in the reverse direction, with an electric circuit to energize said magnet, and a circuit-closer to throw the same into and out of action to positively open and close the gate, as desired, substantially as set forth.

2. In combination with a pneumatic tube or its equivalent and a gate thereon, an electro-magnet arranged to operate the gate, with a movable or yielding arrester placed in the path of the ejected carrier, and electric contacts operated by said arrester and included in an electric circuit with said magnet, whereby the circuit is broken and the gate closed when the carrier is ejected against said arrester, substantially as shown and described.

3. The combination, with a transmitting-tube and its gate, of a receiving support or platform on which the ejected carrier is deposited, electric contacts operated by said support, and an electric bell or sounder in circuit with said contacts, substantially as herein set forth.

4. In combination with a transmitting-tube and its gate or gates, and a magnet arranged to operate the gate, an electric circuit to energize said magnet, provided with a magnet, *s*, and a push-button or closer, *r*, having an armature, *s'*, arranged and operating substantially as shown and described.

5. In combination with a transmitting tube or conduit and a series of gates opening thereon, a corresponding series of electro-magnets controlling the opening of the gates, with one terminal of all of said magnets connected to one side of an electric generator and the opposite terminals connected to individual switch-points, with a switch connected at one

end to the generator and movable at the other end over the switch-points, and a circuit-closer or push-button arranged in the main line common to all the magnets and switch-points, substantially as shown and described.

6. In combination with a transmitting tube or conduit and a movable gate opening thereon, an electro-magnet controlling the opening of the gate, a catch or detent arranged to engage the gate when opened and hold it open, and an arrester placed in the path of the ejected carrier and operatively connected with the detent, whereby the detent is released and the gate closed by the ejection of the carrier against the arrester, substantially as set forth.

7. In combination with a pneumatic tube and its swinging gates B, the yielding packing-collars *g g*, substantially as and for the purpose set forth.

8. In combination with a pneumatic tube and its swinging gate B, the freely-pivoted deflecting-blade *m*, and a projection, *m'*, on the gate to engage and operate the same, substantially as set forth.

9. The combination, with a pneumatic tube or equivalent conduit, such as A, having at one or more points a movable coinciding or aligning tubular section, such as B, forming when swung out of line an ejecting outlet or gate on the tube, of an electro-magnet arranged in operative relation therewith, an armature connected to said movable section B to move the same in one direction, and a spring or retracting device to move the same in the opposite direction, substantially as shown and described.

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