No. 649,094. Patented May 8, 1900.

G. H. WOODMAN.

PNEUMATIC TUBE.

(Application filed Mar. 16, 1899.)

(No Model.) 3 Sheets—Sheet 1.

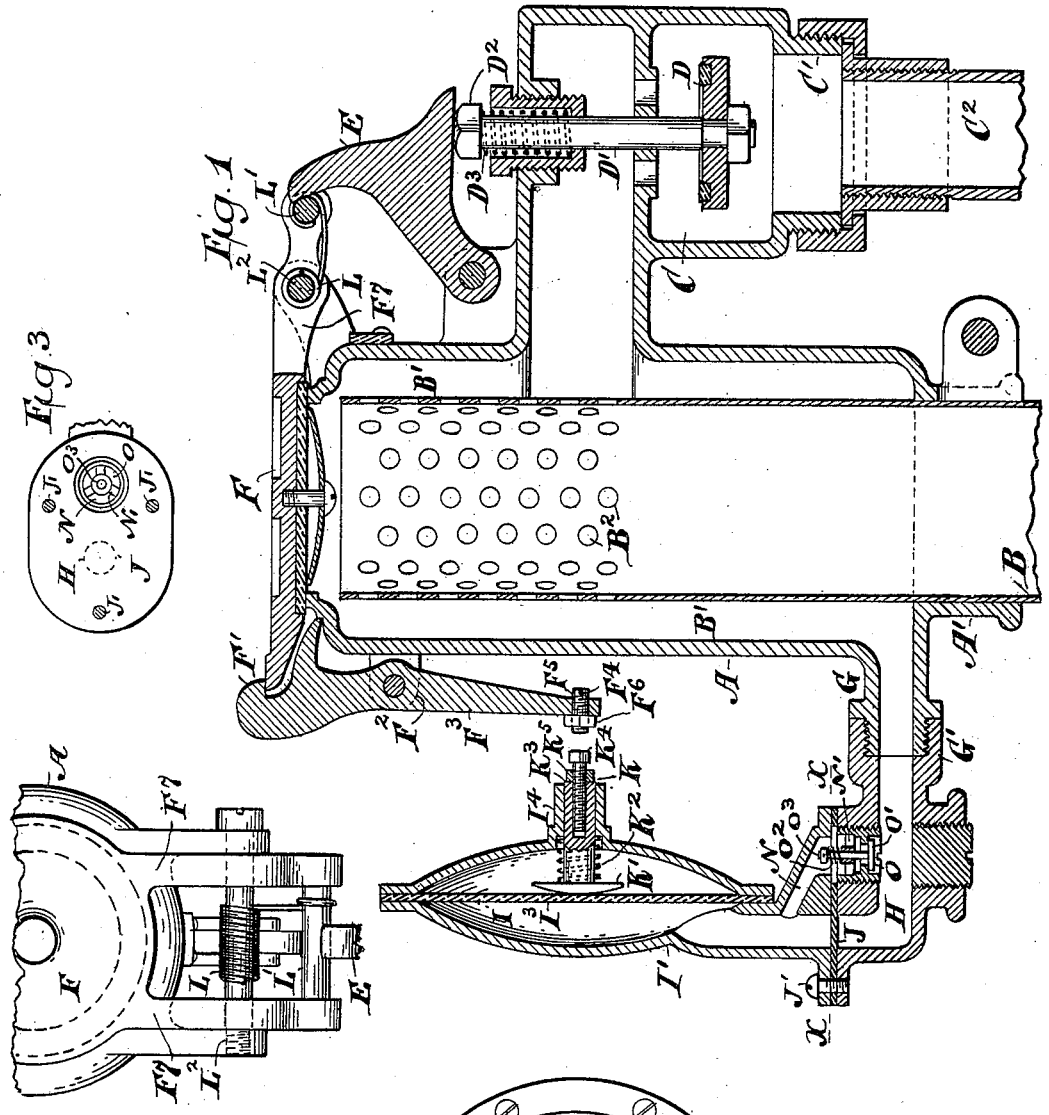

Fig. 1

Fig. 3

Fig. 4

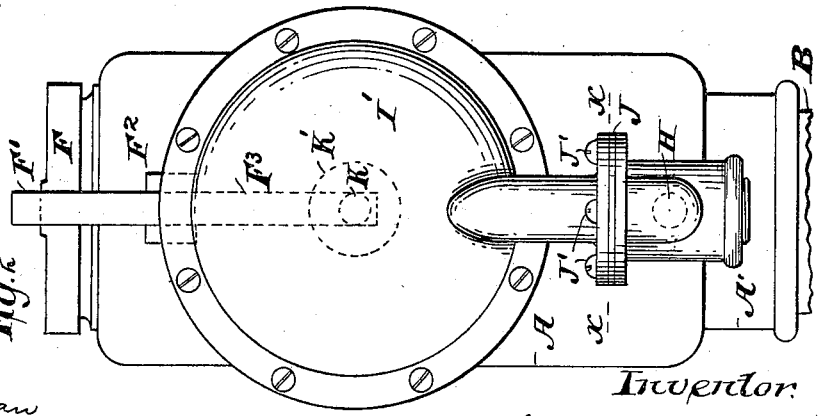

Fig. 2

Witnesses
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Fig. 5

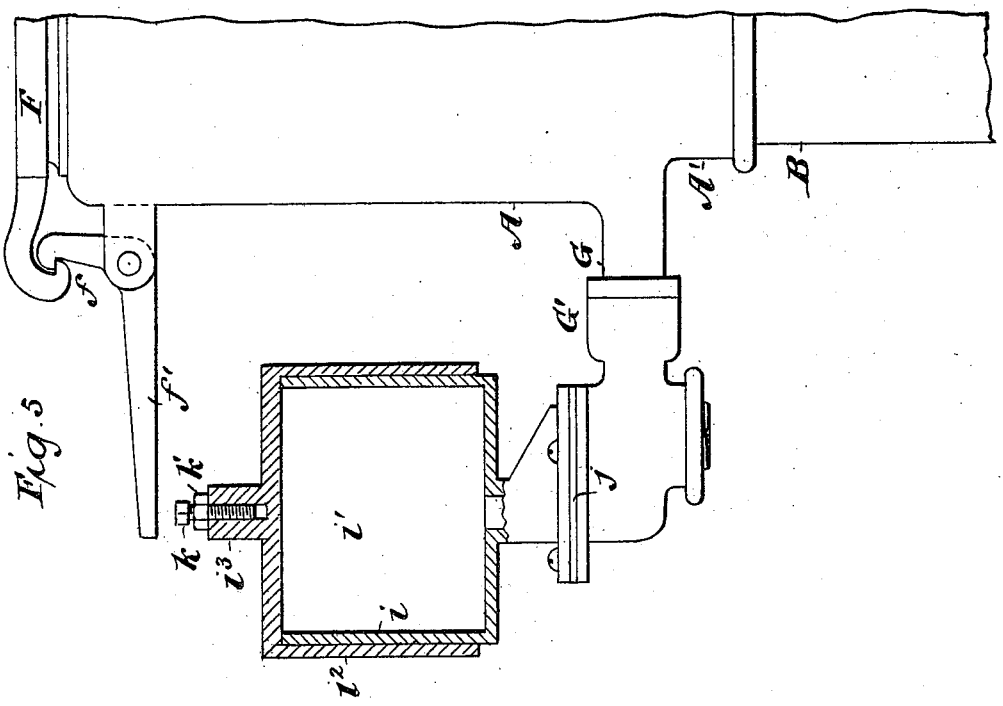

Fig. 6

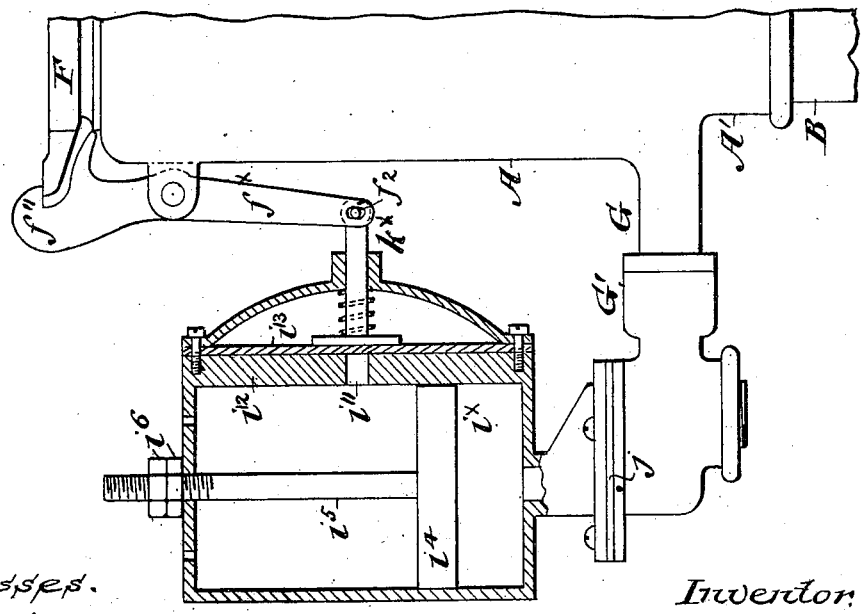

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Fig. 7

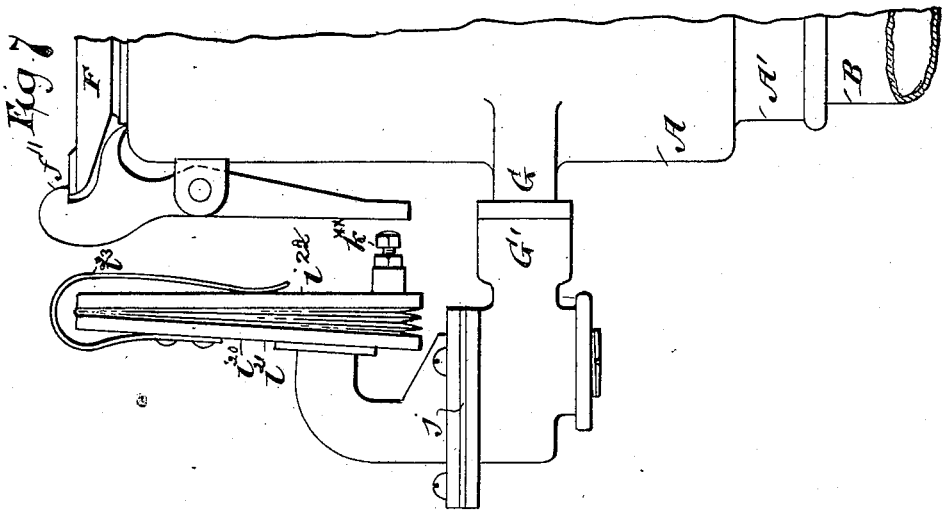
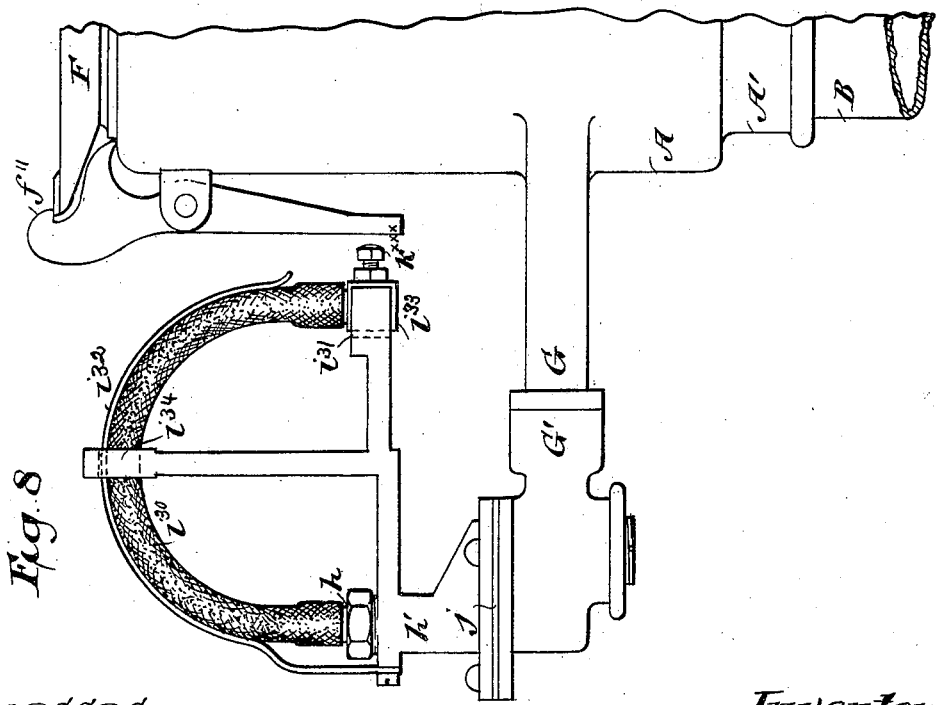


Fig. 8



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UNITED STATES PATENT OFFICE.

GEORGE H. WOODMAN, OF NEW YORK, N. Y.

PNEUMATIC TUBE.

SPECIFICATION forming part of Letters Patent No. 649,094, dated May 8, 1900.

Application filed March 16, 1899. Serial No. 709,377. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. WOODMAN, of the city, county, and State of New York, have invented certain Improvements in Pneumatic Tubes, of which the following is a specification.

This invention consists, broadly, in the employment of a permeable barrier for effecting a slow delivery of compressed air by permeation to a working chamber for the purpose of securing the slow actuation of an instrumentality rendered operative by the pressure of compressed air admitted to said working chamber. Among its uses is that of facilitating the accurate timing of the occurrence of the result ensuing from the action of the compressed air introduced into said working chamber.

The invention is herein illustrated in connection with a pneumatic-despatch-tube system and in a number of the various forms in which it may be employed to invariably effect the closing of the valve which admits compressed air to the despatch-tube at a predetermined interval of time after said valve has been opened—as, for example, at an interval of time corresponding to the time the carrier takes in completing an excursion through the despatch-tube from the sending end to the delivery end.

The invention is based upon the fact that air under pressure will pass sluggishly through porous substances. The said permeable barrier is accordingly made in whole or in part porous, the degree of porosity having relation to the required speed of movement of the air through it. A sufficiently-slow delivery of compressed air to working chambers of such moderate dimensions as are available in despatch-tube systems for the accomplishment of the purpose stated cannot be had if the air is supplied through a continuous passage, no matter how small such passage or a section of it may be, because of the velocity of movement of compressed air through a continuous passage. In the present invention this velocity of movement is rendered impossible by the retarding effect of the permeable barrier, which checks the air-current and only permits the air to work slowly through it by interstitial or porous permeation. It is preferred to make the permeable barrier of leather and to arrange it across any convenient part of the air-passage like a diaphragm; but it is obvious that other substances may be used instead of leather, and accordingly the term "permeable barrier" is to be taken as including any obstruction of whatever form or character of construction suitably arranged and constituted to check the current of air in the compressed-air-supply conduit and to afford a slow delivery of such air through it by permeation.

As will be obvious, the invention may be usefully employed for effecting the release of any of the various forms of latches, pins, and stops used in pneumatic-tube apparatus for directly or indirectly maintaining the air-supply valve in its open position.

In the accompanying drawings the preferred mode of equipping a despatch-tube system with the invention is illustrated in Figures 1, 2, 3, and 4, the remaining figures illustrating modifications.

Fig. 1 is a longitudinal section of one of the terminals of the despatch-tube and the adjacent releasing device, in which the cover for the terminal is represented as closed and the air-supply valve is represented as open. Fig. 2 is an end elevation of the releasing device. Fig. 3 is a transverse section of the releasing device, taken through the plane intersected by the lines x x on Figs. 1 and 2. Fig. 4 is a top view of a portion of the terminal cover and adjacent parts. Fig. 5 illustrates a modification in which the working chamber is telescoped into a cupped piston carrying the adjustable tripper. Fig. 6 illustrates a modification in which the tripper is connected with a flexible diaphragm driven by compressed air supplied through an outlet from the working chamber, which is uncovered by the main piston at a given stage in its operative stroke, whereby at the proper time there is imparted to the tripper a rapid operative movement. Fig. 7 illustrates a modification in which the working chamber is in the form of bellows, one side of which is fixed, while the other side, carrying the tripper, is movable. Fig. 8 illustrates a modification in which the working chamber is composed of an elastic tube closed at one end, normally maintained by a suitable spring in a semicircularly-curved position, tending to straighten itself

out under pressure, and carrying the tripper at its closed end.

The despatch-tube system represented in the drawings embraces the terminal A, having a contracted neck A′, through which is inserted the despatch-tube B, which extends nearly to the extremity of the terminal opposite the neck. The terminal has preferably cast integrally with it on one side the valve-chamber C, provided with a screw-threaded neck C′ for attachment to the compressed-air-supply pipe C^2. The compressed-air-supply valve D is provided with a stem D′, which projects through a suitable bearing formed in the shell of the valve-chamber C and has applied to it the abutment D^2. The valve D is rendered self-closing by the expanding spiral spring D^3 abutting at one end against the shell of the valve-chamber and delivering its thrust against the abutment D^2.

The valve D is opened by means of the bell-crank lever E, which is appropriately oscillated to act on the extremity of the valve-stem D′ by the movement of the cover F of the terminal A from its normally-open position to its closed position, as represented in Fig. 1 of the drawings.

The cover F is held closed by the latch F′, which is pivoted to a lug F^2 on the shell of the terminal. When the parts are in the positions shown in Fig. 1, compressed air flows from the valve-chamber C into the annular space B′ between the despatch-tube B and the wall of the terminal A. From the annular space B′ compressed air is admitted into the despatch-tube B through the group B^2 of perforations in the shell thereof for the purpose of driving the carrier to the distant end of the despatch-tube.

The terminal A has cast integrally with it the laterally-projecting neck G, which is screw-threaded for attachment to the nozzle G′ of the conduit H, through which compressed air is furnished for supplying the operative chamber I of the releasing device. The compressed air reaches the working chamber I by permeation through the permeable barrier J, which is preferably a partition or diaphragm composed of leather extending across the conduit H and confined between the opposed ends of the conduit H and the shell I′ of the releasing device by means of the bolts J′ J′.

The function of the releasing device is to trip the latch F′. The tripper for effecting this purpose may be the stem of an ordinary piston adapted to slide in an operative chamber of cylindrical form, but preferably is in the form of the follower K, made at its inner end or head K′ to bear continuously upon the flexible diaphragm I^3, which constitutes a yielding wall of the operative chamber I. Such constant bearing of the follower upon the diaphragm is induced by the expanding spiral spring K^2 bearing at one end against the head K′ and at the opposite end against the box I^4, in which the stem K^3 of the follower is loosely seated. Such flexible diaphragms have heretofore been designated as "frictionless pistons." In the present case the diaphragm is composed of elastic material having a rather more than sufficient range of extensibility and resilience to impart to the follower K the length of operative stroke required to enable it to trip the latch F′ by its impact against the lever-arm F^3 of the latch. Means are provided for accurately gaging such fractional part of the operative stroke of the follower as may be required to be employed in order to have the tripping of the latch F′ and the consequent opening of the cover F and release of the compressed-air-supply valve D to the influence of its spring D^3 concurrent with the arrival of the carrier at the distant end of the despatch-tube. For this purpose there may be employed either the adjusting-screw K^4, inserted in a hole tapped in the outer end of the follower and retained in the position to which it may have been adjusted by the check-nut K^5, or the lever-arm F^3 may be provided with an adjustable anvil for receiving the impact of the follower—such as, for example, the screw F^4, inserted in the hole F^5, tapped transversely through the arm F^3, with a check-nut F^6 for rigidly holding the screw F^4 in the position to which it may have been adjusted. By means of this organization the follower moves slowly and steadily outward as the air is gradually supplied to the operative chamber I by slow permeation through the permeable barrier J.

When the cover F is released from the latch F′, it is thrown open either by the influence of gravity when the terminal opens downwardly or by the influence of a suitable spring—as, for example, the coil-spring L—one end of which is secured to the pin L′, which is rigidly connected to the lugs F^7 of the cover, and the other to the pivot L^2 of the cover, around which the spring is coiled. When the cover F has thus been opened and the compressed-air valve D resultantly closed, the air in the conduit H is reduced to atmospheric pressure, and the compressed air in the operative chamber I is then allowed a free escape through the exhaust-passage N and the check-valve O, which has previously been held closed in part by the pressure upon its head O′ of the compressed air in the conduit H and in part by the light contracting-spring O^2, coiled around the stem O^3 of the check-valve and having one end fastened to the valve and the other fastened to a spider N′, through which the stem of the check-valve is loosely inserted.

In the modification illustrated in Fig. 5 the wall *i* of the working chamber *i′* is telescoped into the cupped piston i^2, and the adjustable screw *k*, inserted in the upper end of the neck i^3 of said cupped piston, constitutes the tripper. When the air-pressure is slowly delivered through the permeable barrier *j* from the conduit *h* into the working chamber *i′*, the

cupped piston i^2 is thereby moved slowly upward, carrying with it the screw k until the latter trips the latch f by its impact against the adjacent lever-arm f' of said latch. The extent of the operative movement of the tripper or screw k is determined by the depth of its insertion in the neck i^3, where it is held securely in the position to which it is adjusted by the check-nut k'. Upon the release of the latch the air-pressure in the working chamber i' escapes through the check-valve and conduit h in the manner before described, and said cupped piston being sufficiently heavy returns to its starting-point by gravity. The tripper itself need not be adjustable, and it may be connected to the latch, as shown in the modification illustrated in Fig. 6, wherein the tripper is the follower $k^\times$, which is loosely connected at its outer end to the lever-arm $f^\times$ of the latch f^{11} by the pin f^2. The construction is otherwise varied by the provision of the working chamber $i^\times$, having the passage i^{11} opening from it through its wall i^{12} for supplying compressed air at the proper time to act upon the flexible diaphragm i^{13} for operating the tripper. In the working chamber $i^\times$ is seated the piston i^4, whose stem i^5, projecting upwardly, is loosely extended through the cap of said working chamber, having its outer end provided with the adjusting-nuts i^6 i^6. The piston i^4, yielding to the expansion of compressed air slowly delivered into the lower end of said working chamber by the permeable barrier j, rises slowly until it opens the port or passage i^{11} to the compressed air under it, whereupon the flexible diaphragm i^{13}, becoming suddenly actuated by the air-pressure released through said passage, effects the immediate disengagement of the latch. The piston i^4 then drops to its starting position, and the compressed air behind said flexible diaphragm escapes through said passage into the upper end of said working chamber and thence into the atmosphere through the openings provided in the cap of the chamber. The timing of the trip in this form of construction is controlled by the position of the adjusting-nuts i^6 i^6 on the piston-stem i^5, which position determines the point in said working chamber to which said piston is permitted to fall below said passage i^{11}, and hence the length of its operative stroke.

The permeable barrier may be usefully employed for delivering compressed air slowly to chambers for other purposes than the actuation of pistons, as is illustrated in the modified forms of construction shown in Figs. 7 and 8.

In Fig. 7 the permeable barrier j delivers compressed air slowly into the passage extending therefrom through the fixed board i^{20} of the bellows i^{21} and into the interior chamber thereof, and the air-pressure slowly expands the bellows, and thereby gradually moves the movable board i^{22}, which carries the adjustable tripper $k^{\times\times}$, until the latter trips the latch f^{11}. The spring i^{23} insures the quick collapse of the chamber as soon as the air-pressure is shut off.

In Fig. 8 the working chamber is the interior of the hollow elastic tube i^{30}, which is closed at its outer end, where it is connected to a head i^{31}, which carries the adjustable tripper $k^{\times\times\times}$, and is connected at its other end with the nozzle h at the upper end of the compressed-air conduit h', in which is arranged the permeable barrier j. The said elastic tube is held in its semicircular position by the curved spring i^{32}, the latter being rigidly connected at one end to a part of the wall of said conduit adjacent to said nozzle and adapted to bear continuously upon the outer side of said elastic tube. The other end of said spring is left free to expand, and thus permit the head i^{33} to move slowly outward toward the latch f^{11} when the elastic tube is under the influence of compressed air until the tripper $k^{\times\times\times}$ is moved sufficiently to trip said latch. The elastic tube moves itself slowly, and thereby imparts a slow motion to said head and tripper, owing to its tendency to gradually straighten itself while compressed air is being slowly supplied to its interior area by the permeable barrier j. The guides i^{34} i^{34} furnish the requisite lateral supports for holding said elastic tube in its proper position and for rendering its movement steady as it extends the tripper to trip said latch and while returning to its normal position under the influence of said spring.

It will be apparent that the invention as applied to a despatch-tube system may be considered as a time-operated tripper and embraces a tripper for tripping a latch or other instrumentality, a working chamber for receiving compressed air for effecting the operation of said tripper, a permeable barrier for admitting compressed air to said working chamber by permeation, and hence slowly, means whereby said tripper may be made to perform its tripping function at any desired period of time after the compressed air begins to be supplied to said working chamber, and means for enabling the compressed air to be quickly discharged from said working chamber as soon as the tripper has performed its tripping function.

What is claimed as the invention is—

1. In combination with a compressed-air conduit, a permeable barrier arranged across the path of travel of the compressed air in said conduit for effecting a slow delivery of the compressed air from said conduit by permeation through said barrier.

2. In pneumatic apparatus, a chamber for receiving compressed air; a compressed-air-actuated instrumentality having operative connection with said chamber; and a permeable barrier for slowly supplying compressed air by permeation to said chamber.

3. In pneumatic apparatus, a chamber for receiving compressed air; a compressed-air-actuated instrumentality having operative connection with said chamber; a compressed-

air-supply conduit; and a permeable barrier in said conduit for delivering the compressed air slowly to said chamber by permeation through said barrier.

4. In mechanisms operated by compressed air, a chamber to receive compressed air for effecting the operative movement of such mechanism; a conduit for supplying the compressed air; and a permeable barrier in said conduit for delivering the compressed air slowly to said chamber by permeation through said barrier.

5. In compressed-air-actuated trippers for tripping latches or other instrumentalities, a tripper; a working chamber for receiving compressed air for effecting the actuation of said tripper; and a permeable barrier for slowly supplying said working chamber with compressed air by permeation from a compressed-air-supply conduit.

6. In compressed-air-actuated trippers for tripping latches or other instrumentalities, a tripper; a working chamber for receiving compressed air for effecting the actuation of said tripper; a permeable barrier for slowly supplying said working chamber with compressed air by permeation from a compressed-air-supply conduit; and means for regulating the point of time at which said tripper performs its tripping function after the compressed air begins to be supplied to said working chamber.

7. In compressed-air-actuated trippers for tripping latches or other instrumentalities, a tripper; a working chamber for receiving compressed air for effecting the actuation of said tripper; a permeable barrier for slowly supplying said working chamber with compressed air by permeation from a compressed-air-supply conduit; and means for varying the quantity of compressed air required to effect the actuation of said tripper.

8. In time-operated trippers for effecting the closing of the compressed-air-supply valve in pneumatic-despatch tubes, in combination with said compressed-air-supply valve; a latch or other instrumentality for holding said compressed-air-supply valve open; a tripper for tripping said latch or other instrumentality; a tripper-actuating piston; a working chamber for containing compressed air for operating said piston; a permeable barrier for admitting compressed air to said working chamber by permeation, and thereby imparting to said piston a slow operative stroke, and means for varying the distance between said latch or other instrumentality and the adjacent end of said tripper for the purpose of predetermining the stage in the operative stroke of said piston at which said tripper trips said latch out of its holding position.

9. In compressed-air-operated trippers for tripping latches or other instrumentalities, a tripper; a working chamber; means for delivering compressed air to said working chamber slowly for effecting the actuation of said tripper; and a check-valve adapted to secure the quick discharge of the compressed air from said working chamber as soon as the tripper has performed its tripping function.

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