

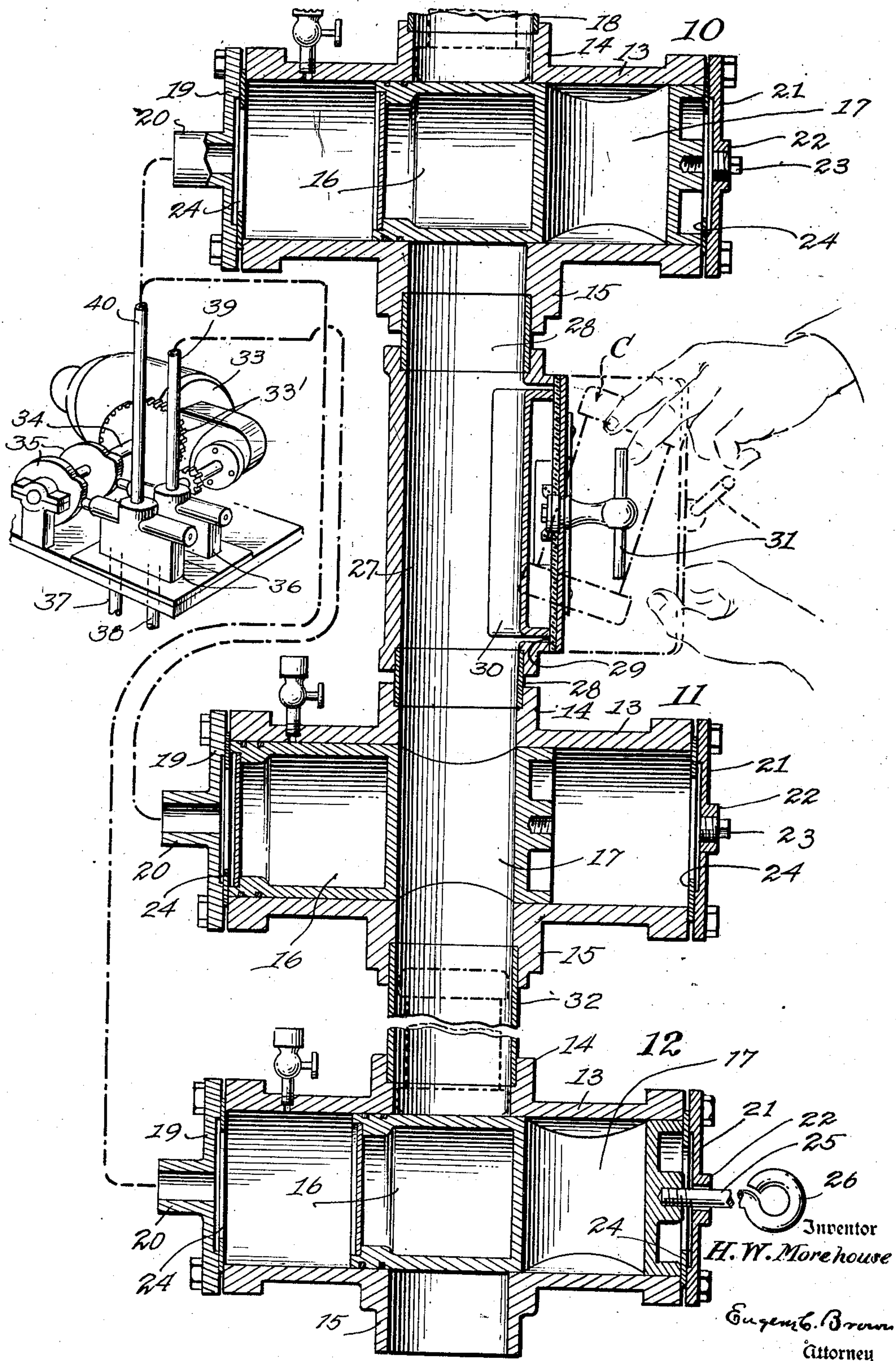
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PNEUMATIC TUBE SYSTEM

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PNEUMATIC TUBE SYSTEM

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This invention relates to pneumatic tube systems of the type in which short cylindrical carriers are used to convey messages and articles of other sorts through long tubes from place to place under pneumatic pressure.

In such systems it is usual to supply air under pressure at one end of the long tube and to produce a partial vacuum at the other end of such tube. Such long tubes are frequently arranged to form a series of sections, in which case air under pressure is supplied at the beginning of each section and a partial vacuum is produced at the terminal portion of each section, suitable valve means being provided between the sections to control the passage of the carriers through the system. The operation of the valves is so arranged that the vacuum at the end of one section and the pressure at the beginning of the next section may not counteract each other. In the operation of such systems provision is sometimes necessary to permit the introduction or removal of carriers at an intermediate point or points. For this purpose a laterally opening door is provided at each point where it is desired to introduce or remove carriers and it is usual to locate these doors between adjacent sections. If such a door is located on the pressure side of the valve means between the sections, opening of the door causes loss of pressure and the outflowing air renders it difficult to introduce the carrier. If such door is located on the vacuum side of such valve means, the opening of the door breaks the vacuum. In either case the operation of the system is injuriously affected.

Among the objects of the present invention are the provision of a novel valve and door arrangement at the junction of the sections of a pneumatic tube whereby the door may be opened and a carrier introduced or removed without appreciably affecting the efficiency of the system; the provision of a valve arrangement wherein the door will open on a zone of neutral pressure, that is to say, a zone wherein the pressure within the pneumatic tube is substantially that of the external atmosphere, so that the carrier

may be introduced or removed without difficulty, the provision of a triple valve arrangement between successive sections of the tube; and the provision of means for actuating the individual valves in such timed relation that the vacuum end of one section is always cut off from the pressure end of the next section.

With the above and other objects in view one form of the invention will now be described in detail, reference being had to the accompanying drawing which is a view partly in section and partly in perspective and illustrating the complete device.

In the embodiment of the invention as herein illustrated there is shown that portion of a pneumatic tube system which lies between adjacent tube sections, the remainder of the system being omitted as not necessary to an understanding of the invention.

In this part of the system there is employed an upper or vacuum cut-off valve 10, an intermediate valve 11 and a lower or pressure cut-off valve 12, all of which are here shown as substantially identical in construction. Each of these valves has a cylindrical body or casing 13 arranged transversely of the main tube line. An upper connecting nipple 14 extends upwardly from this casing and a similar lower connecting nipple extends downwardly from the body in alinement with the upper nipple. A plunger 16 of hollow construction but closed at both ends is slidably mounted in the casing or body and has adjacent one end a tubular passage 17 of the same diameter as the pneumatic tube in which the valve arrangement is used, a portion of such tube being shown at 18 attached to the nipple 14 of valve 10. The plunger is provided with the usual piston rings. This plunger and the casing or body 13 are of such lengths that the plunger may slide to one end of the casing to bring the passage 17 into alinement with the nipples 14 and 15 and may slide to the other end of the casing to close communication between the nipples 14 and 15. The extreme positions of these plungers are clearly shown in the figure wherein

the valves 10 and 12 are shown as having their plungers in positions to cut off communication between the nipples 14 and 15 and the valve 11 is shown with its plunger
 5 alined with the nipples to permit free communication therebetween so that a carrier may pass the valve 11 in movement down the tube. A head 19 closes one end of each casing 13 and is provided with a nipple or
 10 pipe socket 20. Similarly a head 21 closes the other end of each casing 14 and is provided with a nipple 22 which may be closed by a plug 23. The impact of the plunger is
 15 cushioned by boring a small hole through the plug 23 or by cutting a notch in the threaded portion of the plug. Packing gaskets 24 are interposed between the heads 19 and 21 and the casing 14. If it is de-
 20 sired to provide means for operating a valve manually a stem 25 may project through the opening of a nipple 22 and have its inner end screwed into the plunger 16 and its outer end provided with a finger grip or
 25 ring 26.

The length of the carriers and the number which are to be handled in any cycle; deter-
 mine the spacing or distance between the valves. The proper spacing will permit the
 30 handling of an accumulation of carriers without jamming or blocking. Under these conditions in case a carrier is caught on the closing of a piston, it will be engaged at an intermediate portion and as the piston
 35 action is yieldable; no injury to the carrier will result.

A door section 27 of tubular form is arranged between the valves 10 and 11, being
 connected to said valves by short tube sections or nipples 28. A door opening 29 is
 40 formed in this door section and is normally closed by a door 30, hinged to the section 27 and provided with an operating handle 31. Tubing 32 connects the valves 11 and 12.

In operation the plungers 16 of the valves
 45 10 and 12 move in unison to open and close at the same time but the plunger of the valve 11 moves in opposition to the plungers of valves 10 and 12, closing when they open and opening when they close. It is to be
 50 noted that each time the valves 10 and 12 open, pressure is established below the valve 11 and a partial vacuum is established above the valve 11 so that, upon the valves 10 and 12 being closed, opening of the valve 11 causes
 55 the pressure below valve 11 to be substantially neutralized by the partial vacuum above valve 11 and the door can thus be opened and a carrier C introduced or re-
 60 moved at this time without difficulty or hindrance. This operation is shown in broken lines in the drawing.

As one means for so operating valves 10 and 12 in unison and valve 11 in opposition thereto there has been shown a motor 33.
 65 Gearing 33' connects this motor to a cam

shaft 34 whereon are mounted cams 35. Control valves 36 are each connected to a pressure supply pipe 37 and a vacuum or suction pipe 38. One of these valves is con-
 70 nected by a pipe 39 with the nipple 20 of valve 11 while the other valve 36 is connected by a branched pipe 40 with the nipples 20 of valves 10 and 12. The cams 35 are ar-
 75 ranged to so operate the valves 36 that pressure is produced in the ends of the casings 13 to which the pipe 40 is connected to close valves 10 and 12 just prior to the establish-
 80 ment of a vacuum in the corresponding end of valve 11 and pressure is produced in said valve 11 just prior to the establishment of vacuum in valves 10 and 12. The valves 10 and 12 operate in unison and in timed alterna-
 85 tion with the valve 11. Thus the valve 11 is opened only when valves 10 and 12 are closed and the latter are opened only when valve 11 is closed. By this arrangement any ap-
 preciable loss of vacuum above valve 10 or of pressure below valve 12 is prevented and at no time can air blow out of the door when
 90 opened to violently eject a carrier from the system to the possible injury of the carrier or a nearby person or object.

I have described the apparatus as located at an intermediate point in the pneumatic tube system to serve as a relay device but it
 95 is evident that it may be employed at a terminal sending station as a transmitting device; or it may be employed at a receiving terminal station as a receiving device and I intend to cover all such uses in my claims.

I claim:

1. In a pneumatic tube system for carriers, a set of valves controlling the passage of the carriers through the tube or tubes of the sys-
 105 tem comprising an intermediate valve and a pair of valves arranged one on each side of the intermediate valve, each of said valves being mounted to move transversely of the tube and arranged to completely close the tube in one position and to permit free pas-
 110 sage therethrough in the other position; and actuating means arranged to open and close the pair of valves in unison and in timed alternation with said intermediate valve.

2. In a pneumatic tube system for carriers including adjacent tube sections, a set of valves between said tube sections including
 115 an intermediate valve and a pair of valves arranged one on each side of the intermediate valve, tubes connecting said valves in series, and means to open and close the pair of valves in unison and in timed alternation with the intermediate valve.

3. In a pneumatic tube system for carriers including adjacent tube sections, a set of
 125 valves between said tube sections including an intermediate valve and a pair of valves arranged one on each side of the intermediate valve, tubes connecting said valves in series, and means to open and close the pair of
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valves in unison and in timed alternation with the intermediate valve, each of said valves being arranged to shut off all communication between opposite sides of the valve when closed and to permit free passage of a carrier when open.

4. In a pneumatic tube system for carriers including adjacent tube sections, a set of valves between said tube sections including an intermediate valve and a pair of valves arranged one on each side of the intermediate valve, tubes connecting said valves in series, means to open and close the pair of valves in unison and in timed alternation with the intermediate valve, each of said valves being arranged to shut off all communication between opposite sides of the valve when closed and to permit free passage of a carrier when open, the tube connecting the intermediate valve with one of the pair of valves having a lateral opening for the admission or removal of carriers, and a normally closed door controlling said opening.

5. In a pneumatic tube system for carriers, including adjacent tube sections wherein the adjacent ends of the sections constitute respectively a pressure chamber and a vacuum chamber, a valve controlled connection between said adjacent ends, valves in said connection constantly preventing communication between said pressure and vacuum chambers but operable to permit passage of a carrier from the vacuum chamber to the pressure chamber, said valves being further arranged to establish pressure within the connection substantially equivalent to that of the atmosphere, and a normally closed door in said connection affording means for the insertion or removal of a carrier upon being opened.

6. In a pneumatic tube system for carriers, including tube sections having adjacent ends constituting a vacuum chamber and a pressure chamber respectively, a tubular connection between said ends, an intermediate valve interposed in said connection between the ends thereof, a second valve between said connection and the vacuum chamber, a lateral doorway in said connection between the intermediate valve and said second valve, a carrier admission door normally closing said doorway, and a third valve between said connection and said pressure chamber, said valves being arranged to constantly prevent communication between said vacuum and pressure chamber but operable to permit passage of a carrier from the vacuum chamber to the pressure chamber.

7. In a pneumatic tube system for carriers, including tube sections having adjacent ends constituting a vacuum chamber and a pressure chamber respectively, a tubular connection between said ends, an intermediate valve interposed in said connection between the ends thereof, a second valve between said

connection and the vacuum chamber, a lateral doorway in said connection between the intermediate valve and said second valve, a carrier admission door normally closing said doorway, a third valve between said connection and said pressure chamber, and valve actuating means arranged to open and close said second and third valves in unison and in timed alternation with the intermediate valve.

In testimony whereof I affix my signature.
HARRY W. MOREHOUSE.

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