

June 15, 1965

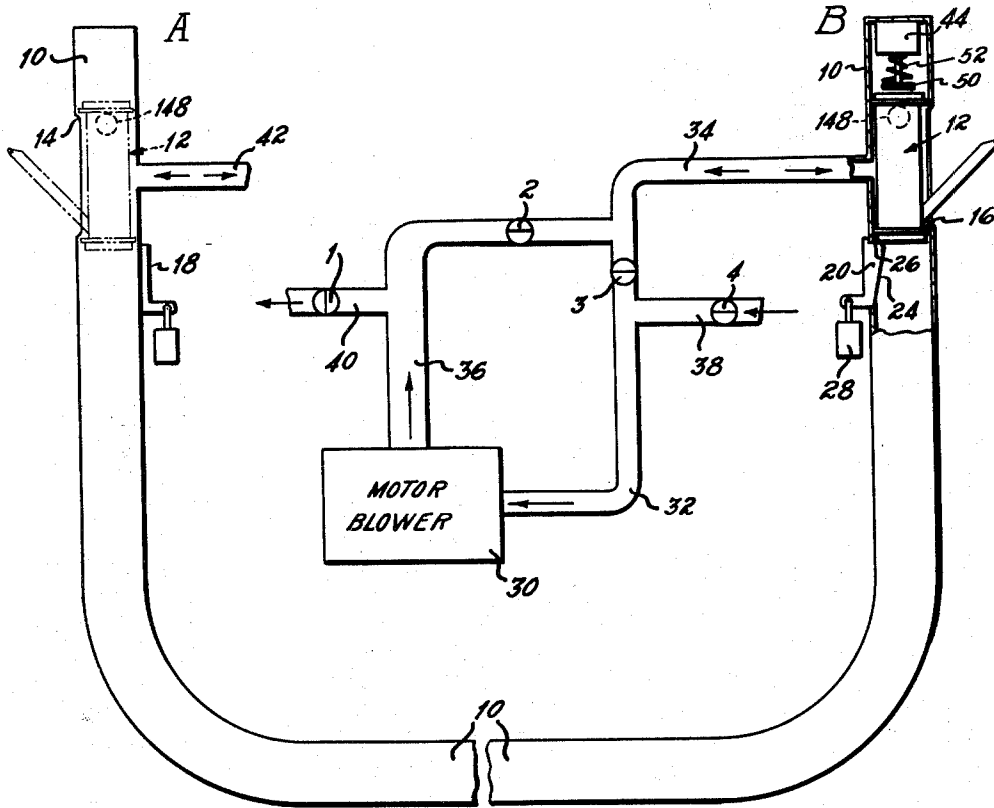
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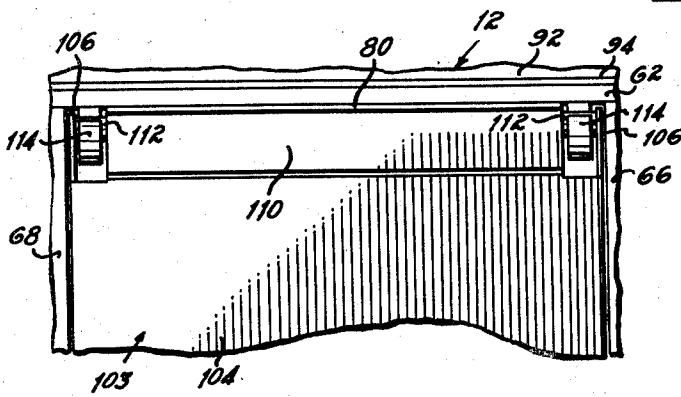
PNEUMATIC TUBE CONVEYER SYSTEM

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3 Sheets-Sheet 1



*Fig. 1*



*Fig. 2*

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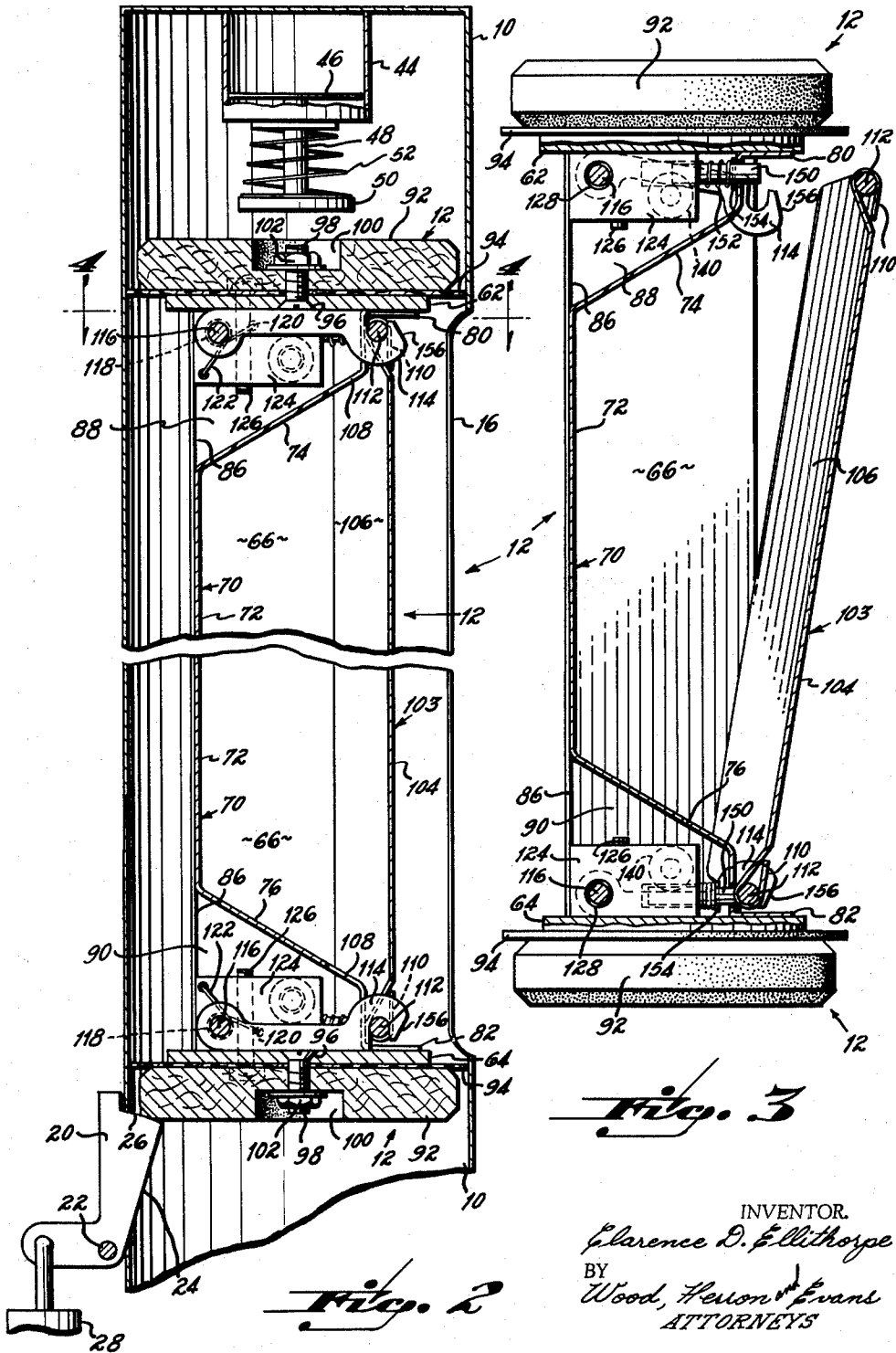
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3 Sheets-Sheet 2



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PNEUMATIC TUBE CONVEYER SYSTEM

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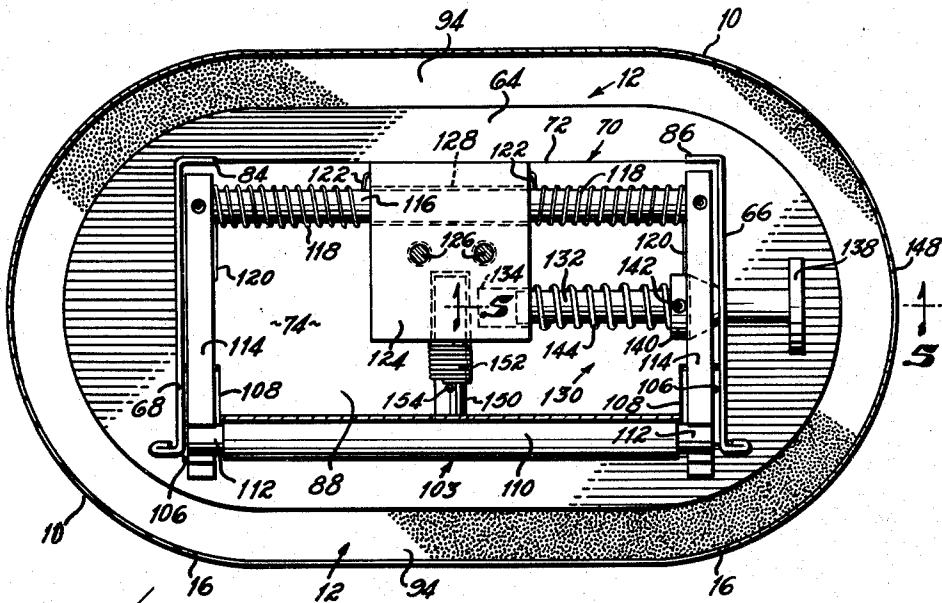


Fig. 4

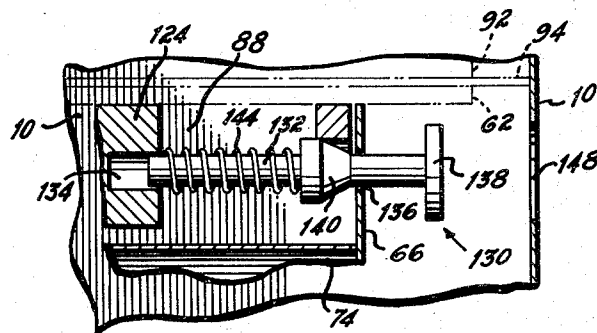


Fig. 5

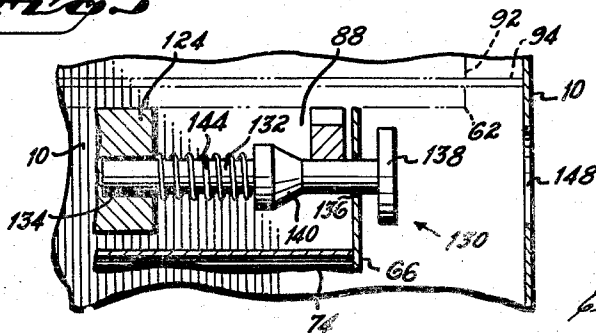


Fig. 6

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## PNEUMATIC TUBE CONVEYER SYSTEM

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9 Claims. (Cl. 243—19)

This invention relates to pneumatic tube conveyer systems and more particularly to a "captive carrier" or non-removable carrier type of pneumatic conveyer system.

Pneumatic tube conveyers have been known and used for a long time to convey articles between a plurality of stations. One area in which this type of conveyer system has had wide commercial application is in the large department stores where the pneumatic conveyers have been used to convey money and receipts from the clerks to a central accounting department. This type of merchandising system has the advantage of eliminating numerous cash drawers throughout the store and placing money handling and bookkeeping in a central department where there is less chance of clerical error.

In recent years there has been renewed interest in this type of conveyer system with the advent of closed circuit television. By utilizing a pneumatic tube conveyer system in combination with closed circuit television it is possible for a single clerk in a store or a teller in a bank to take care of several customers simultaneously. This type of system is also very advantageous in the drive-in banking business where widely separated customers in automobiles are waited upon by a teller who is separated from the customers by a substantial distance. By using a pneumatic tube conveyer system in this type of bank, the customer need only deposit his money and deposit slip in the carrier of the conveyer system, after which the teller watching the closed circuit television screen is able to move the carrier to his station, take care of the customer's transaction and then return the carrier with the necessary papers or money to the customer station. One patent which shows and describes this type of banking system is my earlier Patent No. 2,912,066.

In a pneumatic tube conveyer system which is designed to be handled and operated by a customer or clerk who is unskilled in the operation and use of this type of apparatus, it is important that the customer or clerk not be required to handle the equipment any more than is absolutely necessary and that the equipment that he does handle be absolutely safe in operation.

In the older pneumatic conveyer systems such as those described above and utilized in department stores, the carrier of the system had to be removed bodily from the pneumatic tube in order to open or close the door of the carrier to insert or remove papers. This type of conveyer system was not desirable for use in newer systems designed to be handled by the customer because of the skill required in the use of the equipment and the opportunity for customers to injure themselves. My earlier Patent No. 2,912,066 was an improvement over these old systems because it utilized a hinged door on the carrier and did not require that the customer bodily remove the carrier from the pneumatic tube of the conveyer system. However the system disclosed in this patent does require that the carrier be completely removed from the pneumatic tube at the teller's station in order for him to gain access to the contents of the carrier. In any system in which the carrier is removed bodily from the conveyer tube of the system, there is an opportunity for the carrier to be lost or damaged during handling. A better pneumatic conveyer system is one in which the carrier is never removed from the conveyer tube. Such a system, however presents a new problem, because in moving from one

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station to another, the carriers are usually reversed end for end so that that end of the carrier which is at the top in one station, is at the bottom at the other station. Thus if the carrier door is hinged at the bottom in one station, at the other station the hinge is in the upper position. At that station at which the hinge is at the top of the door, money or papers within the carrier have a tendency to fall out onto the ground when the door is opened while at the other station items within the carrier are properly held therein until withdrawn manually. One solution to this problem would be to hinge the door along the side rather than at the top or bottom. However if the door is hinged in this manner, papers or articles are still prone to fall out of the carrier as the door is opened.

It has been an objective of this invention to provide a pneumatic tube conveyer system in which a carrier having a single door need never be removed from the pneumatic tube during usage. To this end the present invention provides a carrier having an access door hinged at both the top and bottom so that it may be opened outwardly about that hinge which is in the lowermost position at any particular station.

Another objective of this invention has been to provide a pneumatic conveyer in which a carrier having a door selectively operable to open about either an upper or lower hinge may only be pivoted into an open position about the lowermost hinge.

Another objective of this invention has been to provide door lock release mechanisms in the pneumatic conveyer system such that only the lock release mechanism associated with the uppermost end of the door may be actuated at any station in the system. Thus the system is foolproof and the door of the carrier can only be opened outwardly and downwardly about the lowermost hinge pin regardless of which end of the carrier is in the uppermost position at a particular station.

This invention has the advantage of permitting money or papers to be placed in the carrier, the carrier moved to another station where it is in an inverted position from the first, and the door opened about the lower pivot without the danger of money or papers falling out of the carrier.

In addition, this system has the advantage of permitting the carrier to be used in a closed system by persons untrained in its use without the necessity of the sender or receiver removing the carrier from the system.

This invention can best be further described with reference to the drawings in which:

FIGURE 1 is a diagrammatic view partly broken away of the pneumatic tube conveyer system,

FIGURE 2 is a cross-sectional view of the carrier at one station in the pneumatic tube,

FIGURE 3 is a side elevational view partly broken away of the carrier,

FIGURE 4 is a cross-sectional view taken along line 4—4 of FIGURE 2,

FIGURE 5 is a cross-sectional view of the lock release plunger in the locked position taken along the line 5—5 of FIGURE 4,

FIGURE 6 is a cross-sectional view of the lock release plunger in the unlocked position,

FIGURE 7 is a front elevational view of a portion of the door in the latched position.

Referring to FIGURE 1, it will be seen that the pneumatic tube conveyer system of this invention includes a generally U-shaped conveyer tube 10 for conveying a carrier 12 between operating stations A and B at each end of the pneumatic tube. In this system the carrier 12 is designed to remain within the pneumatic tube at all times and therefore access openings 14 and 16 are provided in the sides of the conveyer tube, at each of the

stations A and B respectively. These access openings are smaller than the carrier so as to prevent removal of the carrier from the tube 10 while still providing means whereby a person using the conveyer is able to insert and withdraw papers or money from the carrier.

In normal operation, the carrier 12 is usually in a vertical position when located at either of the stations A and B. In order to hold the carrier in the upper portion of the pneumatic tube adjacent the access openings 14, 16, electric latches 18 and 20 are provided. These electric latches are generally L-shaped and are mounted on a pivot pin 22 at the juncture of the two legs of the L-shaped latch. The vertical leg of the latch has a generally tapered portion 24 which normally yieldable extends through a slot in the wall of the pneumatic tube. When the carrier is located at the station B, the lower portion of the carrier rests upon the upper surface 26 of the vertical leg of the latch. A solenoid 28 is connected to the horizontal leg of the latch 20 so that when the solenoid is energized, the latch is pivoted about the pivot pin 22 and the upper surface of the latch is withdrawn from a position beneath the carrier. As a result, whenever the solenoid is energized, the carrier is free to drop down into a lower portion of the pneumatic tube. In a similar manner, whenever the solenoid of electric latch 18 is energized, the carrier drops away from the station A down into the lower portion of the pneumatic tube 10.

A push-pull type of pneumatic system is provided to propel the carrier from one station to the other. The push-pull pneumatic system consists of a motor blower 30 having its air intake port connected by air flow tubes 32 and 34 to the conveyer tube 10. The air flow tube 34 opens into the carrier tube 10 at the station B. The motor blower exhaust port is connected by an air flow tube 36 to the air flow tube 34. An air intake tube 38 extends off of the air flow tube 32 and a similar air exhaust tube 40 extends off of the air flow tube 36. Each of the air flow tubes 40, 36, 32 and 38 has an electrically actuated windgate 1, 2, 3, and 4 respectively, located therein.

The electrically actuated windgates 1, 2, 3, and 4 and the electric latches 18 and 20 are controlled by electrical switches through conventional circuitry. Since the circuitry to control the latches and windgates is conventional and forms no part of this invention, it has not been illustrated. A control circuit suitable for these purposes is illustrated in Ellithorpe Patent No. 2,916,066. The control switches may all be located at one of the stations and controlled by a single operator using a closed circuit television to indicate when the switches should be actuated or each switch may be located at one of the stations and controlled by a person at that particular station.

The windgates are all normally closed and the latches are normally in a position in which the tapered portion 24 of the latch yieldably extends inwardly into the pneumatic tube. To move the carrier from the B station to the A station, a control switch (not shown) is actuated to cause the solenoid 28 to pivot the latch 20 out of engagement with the carrier 12 and the carrier then drops down into a lower portion of the carrier tube 10. This switch also causes the windgates 2 and 4 to open and air is then blown through the air flow tubes 36 and 34 to the conveyer tube 10. This air flow pushes the carrier around to the A station. As the carrier passes by the tapered portion 24 of the latch 18 at the A station it forces or cams the latch outwardly to allow the carrier to pass by the latch. After the carrier has passed by the latch, the latch moves back into the carrier tube 10 into a position beneath the carrier in which it prevents the carrier from dropping back down into a lower portion of the carrier tube. After the carrier has reached the A station the windgates 2 and 4 are caused to close by any conventional means such as a switch actuated by the carrier at the A station or a time delay switch in the control circuit to these windgates.

In order to move the carrier from the A station to the

B station, a second control switch (not shown) energizes the solenoid of the electric latch 18 and pulls this latch out of engagement with the carrier. The carrier then drops into a lower position of the carrier tube 10. Simultaneously with the actuation of the electric latch 18, the windgates 1 and 3 are caused to open by means of a conventional control circuit and with the windgates 2 and 4 remaining closed, a suction is created in the air flow tubes 32 and 34 to pull or suck the carrier 12 around to and into the B station.

It should be noted that while a cover plate or door has not been shown over the access opening 16 at the B station, such a cover plate is necessary in order to avoid loss of air pressure in the carrier tube. This cover plate could consist of either a conventional hinged door, as shown in my own Patent No. 2,912,066, or a conventional sliding door to cover this access opening. However such a cover plate is not required over the access opening 14 of the A station because the carrier is equipped with the conventional air gaskets at both ends of the carrier. If a cover plate is used over the access opening 14 at the A station, an air intake and exhaust tube 42 would be required to permit air flow into and from the carrier tube at the A station.

Referring to FIGURES 1 and 2, it will be seen that each station A and B is provided with a cushion or air bumper. These bumpers serve to absorb the impact of a rapidly moving carrier as it arrives at either station. A bumper is required because in moving through large distances under air pressure, the carrier develops relatively high speeds which must be reduced or the impact must be safely absorbed when the carrier arrives at a station. These bumpers serve to absorb the impact without damaging the carrier or the pneumatic carrier tube.

The bumper or cushion comprises an air cylinder 44 mounted on the upper wall of the pneumatic carrier 10 at each station. A piston 46 is mounted within the cylinder 44 and has a piston rod 48 depending therefrom and extending through an aperture in the lower wall of the cylinder 44. The lower end of the piston rod 48 has an enlarged head 50 which serves as an abutment surface for a compression spring 52 mounted between the lower wall of the cylinder 44 and the upper wall of the head 50 on the piston rod 48. Whenever a carrier arrives at either station, it engages the abutment 50 on the piston rod and causes the piston to move upwardly in the cylinder and compress the air enclosed therein. When the force or impact of the carrier against the bumper has been absorbed by the air cushion in the cylinder the piston 46 is again forced downwardly into its lowermost position by the spring 52.

The tubular body of the carrier 12 consists of two end plates 62, 64, a pair of side plates 66, 68 and a rear cover plate 70. The side cover plates are generally Z-shaped in cross section (FIGURE 4) and are welded or brazed at their top and bottom edges to the end plates 62 and 64. The rear cover plate 70 consists of a flat vertical rear wall from which extend outwardly and forwardly a top wall portion 74 and a bottom wall portion 76. The top wall portion 74 is bent upwardly and then outwardly at the end and similarly the bottom wall portion 76 is bent downwardly and then outwardly at the end. The outwardly extending portion 80 of the top wall portion 74 is welded to the end plate 62 and the outwardly extending portion 82 of the bottom wall portion of the rear cover plate is welded to the end plate 64. In order to increase the rigidity of the body of the carrier, the rear cover plate 70 fits within and between the side cover plates 66 and 68 with the rear wall 72 of the rear cover plate welded to the inwardly directed flanges 84 and 86 of the side plates. A top recess 88 is thus provided between the top wall portion 74 of the rear cover plate 70 and the top end plate 62 and a lower recess 90 is provided between the bottom wall portion 76 and the lower end cover plate 64. These recesses house the lock mechanism.

Conventional felt bumpers 92 are attached to each end of the carrier 12. Air gaskets 94 are provided between the carrier end plates 62, 64 and the felt bumpers 92 to provide an air seal between the ends of the carrier and the carrier tube 10. The air gaskets 94 and the felt bumpers 92 are connected to the end plates 62, 64 by screws 98. The heads of the screws fit within counter-sunk central apertures 96 in the carrier end plates and pass through central apertures in the air gaskets and the felt bumpers. The central aperture 100 in the felt bumpers is counter bored to receive lock nuts and washers 102 which when secured to the screws 98 hold the felt bumpers and gaskets in assembled position.

The carrier door 103 is generally in the shape of a tray with the bottom 104 of the tray forming the outside wall of the carrier door. The sides 106 of the tray extend inwardly into the carrier when the door is in the closed position. Spaced slots 108 are provided in the top wall 74 and bottom wall 76 of the rear cover plate 70 to accommodate or receive the side walls 106 of the carrier door when the door is closed. The bottom wall 104 of the carrier door has central tab portions 110 which extend inwardly and wrap around hinge pins 112 at both ends of the carrier door. The hinge pins 112 extend between the two side walls 106 of the carrier door and are held in position by the central tab portion 110 of the bottom wall. Because the central tab portion 110 does not extend completely across and between the side walls 106, a portion of each hinge pin is exposed adjacent to each side wall 106 (see FIGURE 7). These exposed portions of each hinge pin serve as pivots or hinges about which the door can be opened at either end.

The lock mechanisms at the upper and lower ends of the carrier are identical and therefore only the upper lock mechanism will be explained in detail. However it should be understood that the lower lock and hinge mechanism is identical to the top so that the carrier door 103 may be opened about either the top or bottom hinge.

The combination lock and hinge consists of a pair of lock dogs 114 rigidly connected to a pivot shaft 116. The lock dogs on each end of the carrier are connected to the same shaft so that they pivot and move together. Each lock dog is equipped with a hook at its operating end which is adapted to be received over the hinge pin 112 to lock the door in closed position. When moved away from the hinge pin 112, the lock dogs release the pin 112 to permit the door to swing outwardly about the opposite end of the door. The lock dogs are normally biased by a pair of torsion springs 118 into the unlocked position in which the lock dogs permit the door to pivot outwardly. Each of the torsion springs 118 has one end 120 rigidly connected to one of the lock dogs and the opposite end 122 embedded in and rigidly connected to a mounting block 124. Each mounting block 124 is rigidly connected by a pair of locking screws 126 to one of the end plates 62, 64. The pivot shafts 116 are each rotatably mounted within a transverse aperture 128 through the mounting blocks.

Two lock release plungers 130 are mounted in the carrier in a position in engagement with the lock dogs 114. Each of these lock release plungers is associated with one of the combination hinge locks so that when actuated it will release the lock with which it is associated and permit the carrier door to pivot outwardly about the opposite hinge pin.

Each lock release plunger consists of a shaft 132 journalled in a recess 134 of the mounting block 124 and passing through an aperture 136 in the side plate 66. At its outer end and outside of the carrier, each shaft 132 has an enlarged head 138. A truncated conically shaped cam 140 is rigidly attached to each plunger shaft 132 by a set screw 142. Of course the conical shaped cam could also be made integral with the shaft. The cam 140 is located intermediate the ends of the shaft 132 in a position to engage one of the lock dogs 114 and to force

that lock dog into a closed position or a position in which the lock dog is hooked over the door hinge pin with which it is associated. A compression spring 144 is mounted over the shaft 132 between the mounting block 124 and the cam 140. This compression spring normally biases the lock release plunger outwardly into a position in which the cam 140 holds the dogs 114 in the closed position.

A lock release opening 148 is provided in the carrier tube 10 at each station A and B. The opening 148 is in a position immediately adjacent to the upper lock release plunger 130 when the carrier is located at a station. To release the door and cause it to pivot outwardly about the lowermost hinge, it is only necessary to reach through the opening 148 and push inwardly upon the lock release plunger 130. In the inner position of the lock release plunger, the cam 140 becomes disengaged from the lock dog 114 with which it is associated and permits the lock dog to move out of engagement with the hinge pin 112 and pivot the shaft 116 upon which the cooperating lock dog is mounted. This pivoting of the pivot shaft 116 is effected by the torsion springs 118 acting between the stationary mounting block 124 and the movable lock dogs 114 fixedly mounted upon the shaft 116. When the lock dogs 114 become disengaged from the hinge pin 112, a carrier opening plunger 150 journalled in the mounting block 124 forces the door outwardly into an open position. The plunger 150 is biased outwardly by a compression spring 152 journalled on the plunger 150 between the mounting block 124 and a stop pin 154. When the plunger is in its outer position and the door is open, the stop pin 154 engages a surface of the rear wall cover plate 70 to prevent the plunger from falling out of the carrier.

To close the door it is only necessary to push the carrier door closed with sufficient force to overcome the spring pressure of the springs 144 and 118. This is possible because the outer surfaces 154, 156 of the lock dogs are tapered inwardly so that as the door is closed, the hinge pin engages and cams the lock dogs downwardly until the hinge pin 112 has passed into the recess of the hook shaped portion of the lock dogs at which time the springs 118 will urge the lock dogs upwardly into a locked position.

The operation of the illustrated embodiment of the invention should now be obvious. A person desiring to use the pneumatic conveyer system merely reaches into the lock release opening 148 and pushes the plunger to open the door about the lowermost hinge. The access opening 148 is so located at each station so as to permit only that lock release plunger which is in the uppermost position to be actuated. Of course a cam or any other automatic mechanism could be mounted on the pneumatic tube 10 at a position which corresponds to that of the lock release opening 148 so as to engage and force inwardly the uppermost lock release plunger when the carrier is located at one of the stations. When the lock release plunger 130 is forced inwardly, the lock dogs 114 move downwardly so as to permit the door to be pushed outwardly by the spring biased pin 150. After the money or other articles to be conveyed are placed in the carrier, the door is pushed shut and the force of the upper door hinge pin 112 against the cam surface 156 of the lock dogs forces the lock dogs downwardly against their spring bias until the hinge pin is passed over the cam surface at which time the lock dogs are spring biased upwardly into a locked position to hold the door closed. The control switch is then energized to open the appropriate wind gates and move the carrier latch 20 out of engagement with the bottom of the carrier so that it is free to move from one station to another.

While a preferred embodiment of the invention has been illustrated in the drawings and described herein, it should be obvious that numerous changes and modifications may be made by those skilled in this art without

departing from the spirit and scope of the appended claims.

Having described my invention, I claim:

1. A pneumatic conveyer system for moving articles between plural stations, said system comprising a conveyer tube extending between said plural stations, a carrier movable through said conveyer tube between said stations in response to airflow in the tube, a door mounted upon said carrier, a pair of hinge means attached to two opposite ends of said door, a pair of lock means mounted upon said carrier and engageable with said hinge means to permit said door to open about either of said pair of hinge means, a pair of opening means each of which is operable to selectively actuate one of said lock means so as to cause said door to open about one of said hinge means, and means at each of said stations to render operable only one of said pair of opening means.

2. A pneumatic conveyer system for moving articles between plural stations, said system comprising a conveyer tube extending between said plural stations, a carrier movable through said conveyer tube between said stations in response to airflow in the tube, a door mounted upon said carrier, a pair of hinge pins mounted upon opposite ends of said door, a pair of lock assemblies mounted at opposite ends of said carrier and releasably engageable with said hinge pins to permit said door to be selectively opened about either of said hinge pins, a pair of opening means for selectively releasing one of said lock assemblies so as to permit said door to open about one of said hinges, and means at each of said stations to render operable only one of said pair of opening means.

3. A pneumatic conveyer system for moving articles between plural stations, said system comprising a conveyer tube extending between said plural stations, a carrier movable through said conveyer tube between said stations in response to airflow in the tube, a door mounted upon said carrier, a pair of hinge pins mounted upon opposite sides of said door, a pair of lock assemblies mounted at opposite ends of said carrier and releasably engageable with said hinge pins to permit said door to be selectively opened about either of said hinge pins, a pair of opening actuators each of which is operable to cause one of said pair of lock assemblies to release from engagement with that one of said hinge pins with which it is operatively associated, means at each of said stations to render operable only one of said pair of opening actuators, and access openings in the sides of said tube at each of said stations, said access openings being smaller than said carrier so as to prevent removal of said carrier from said access openings at each of said stations.

4. A carrier for use in a pneumatic conveyer system comprising a closed tubular housing having an opening in one side, a door mounted within said opening, a hinge pin mounted on one side of said door, a pair of pivoted hook members mounted on said housing and adapted to be received over said hinge pin, a lock release means associated with said pair of hook members and selectively operable to permit said hook members to move out of engagement with said hinge pin and thereby permit said door to pivot outwardly about the opposite side of said door and spring means operable to urge said hook members out of engagement with said hinge pin, said lock release means comprising a spring biased plunger having a cam portion thereon adapted to urge said hook members into engagement with said hinge pin.

5. A pneumatic conveyer system for moving articles

between plural stations, said system comprising a conveyer tube extending between said plural stations, the axis of said tube being located in a vertical plane at each of said plural stations, a generally tubular carrier having a longitudinal axis movable through said conveyer tube between said stations in response to airflow in the tube, said carrier axis being located in a vertical plane when said carrier is located at each of said stations, said carrier having a single longitudinally extending door thereon, said door being selectively operable to open about either of two hinges located on opposite ends of said door, a pair of opening means each of which is associated with one of said hinges and is operable to open said door about one of said hinges, and means at each of said stations to render operable only that one of said pair of opening means which causes said door to open about that one of the hinges which is lowermost at each of said stations.

6. A pneumatic conveyer system for moving articles between plural stations, said system comprising a conveyer tube extending between said plural stations, a carrier movable through said conveyer tube between said stations in response to airflow in the tube, a single door mounted upon said carrier at one side thereof, hinges on opposite ends of said door, a pair of opening means each of which is operable to selectively open said door about one of said hinges, and access openings in the side of said tube at each of said stations, said access openings all being located on the same side of said conveyer so as to provide access to said door means at each of said stations, and means at each of said stations to render operable only one of said pair of opening means.

7. A pneumatic conveyer system for moving articles between plural stations, said system comprising a conveyer tube extending between said plural stations, a carrier movable through said conveyer tube between said stations in response to airflow in the tube, a single door mounted upon said carrier at one side thereof, hinges on opposite ends of said door, a pair of opening means each of which is operable to selectively open said door about one of said hinges, access openings in the side of said tube at each of said stations, and means at each of said stations to render operable only one of said pair of opening means.

8. The pneumatic conveyer system of claim 7 wherein means associated with each of said stations is operable to prevent the removal of said carrier from said conveyer tube at each of said plural stations.

9. The pneumatic conveyer system of claim 7 wherein said access openings are smaller than said carrier so as to prevent removal of said carrier from said conveyer tube through said access openings.

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