United States Patent

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[32] Priority **Sept. 22, 1967**
[33] **Germany**
[31] **P 15 56 604.8**

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[54] **APPARATUS FOR TRANSPORTING TEXTILE GOODS OR THE LIKE**
18 Claims, No Drawings

[52] **U.S. Cl.** **302/2,** 302/27, 302/28
[51] **Int. Cl.** **B65g 53/00**
[50] **Field of Search** ..... 302/2, 27, 28, 17, 24, 26 (Inquired)

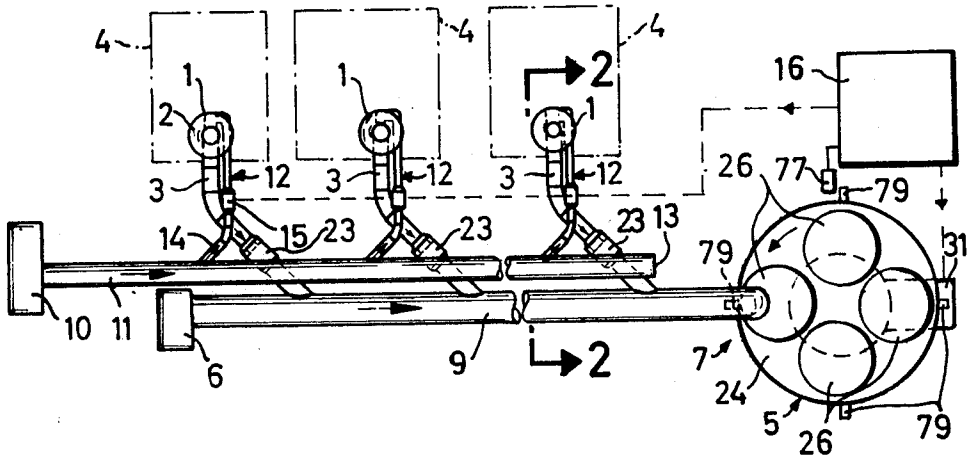
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Assistant Examiner—John J. McLaughlin
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ABSTRACT: Apparatus for transporting stockings or other textile goods from one or more textile machines to a series of receptacles at a collecting station comprises a motor which indexes the receptacles into registry with the discharge end of a pneumatic duct which communicates with feed conduits each of which can receive goods from one output of a corresponding machine and is normally sealed by a one-way valve. Injectors cooperate with the feed conduits to admit into such conduits compressed air which can cause opening of one-way valves and delivery of goods from the corresponding machines into the duct for transfer into a selected receptacle. The pressure of air in the duct is less than the pressure of air which is admitted by the injectors. The injectors can be grouped, and their operation is regulated by a single control unit which also regulates the operation of the indexing motor for the receptacles.



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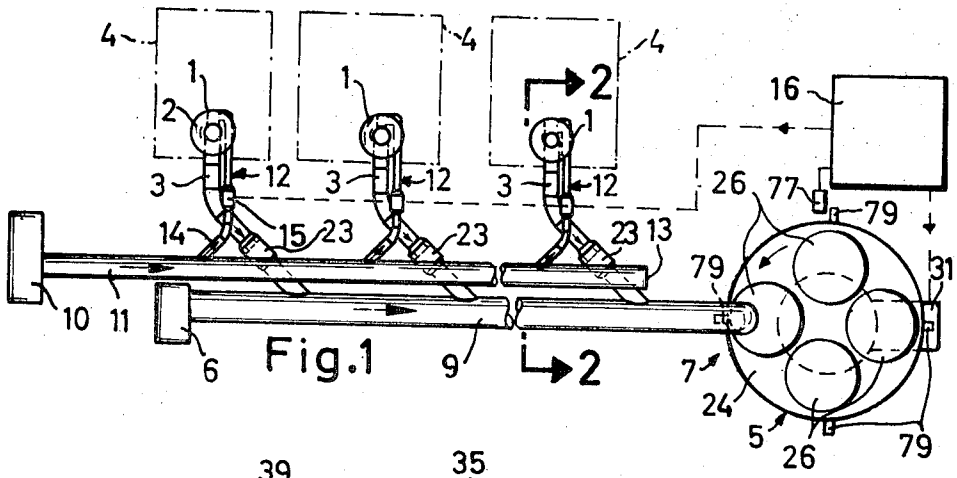


Fig.1

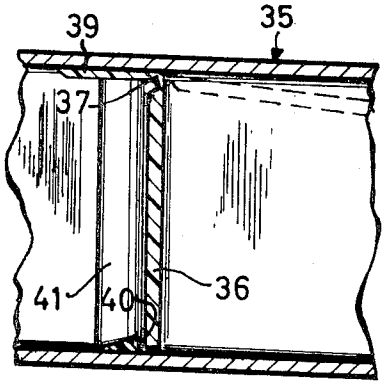


Fig.5

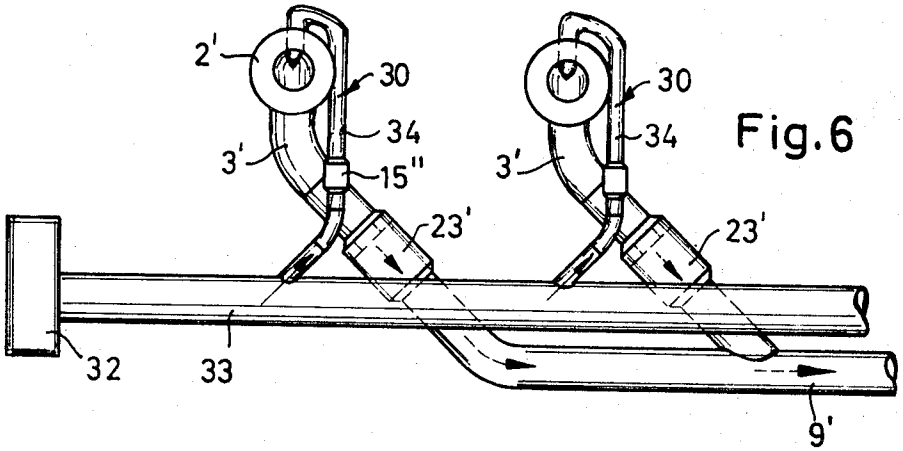


Fig.6

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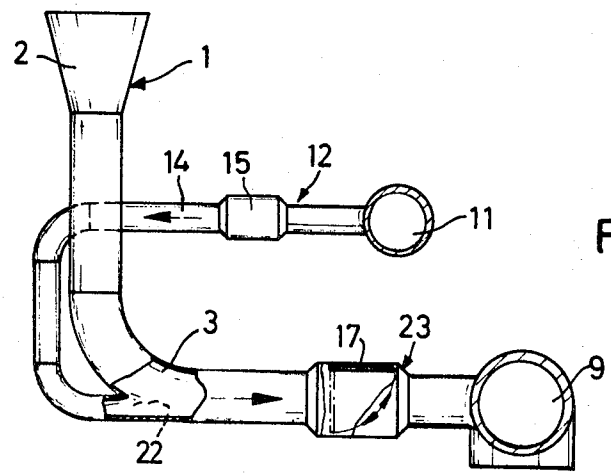


Fig.2

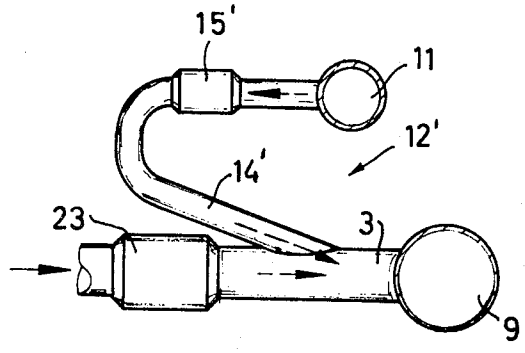


Fig.3

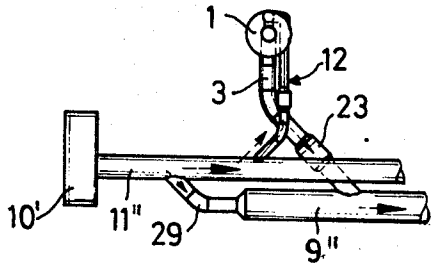


Fig.4

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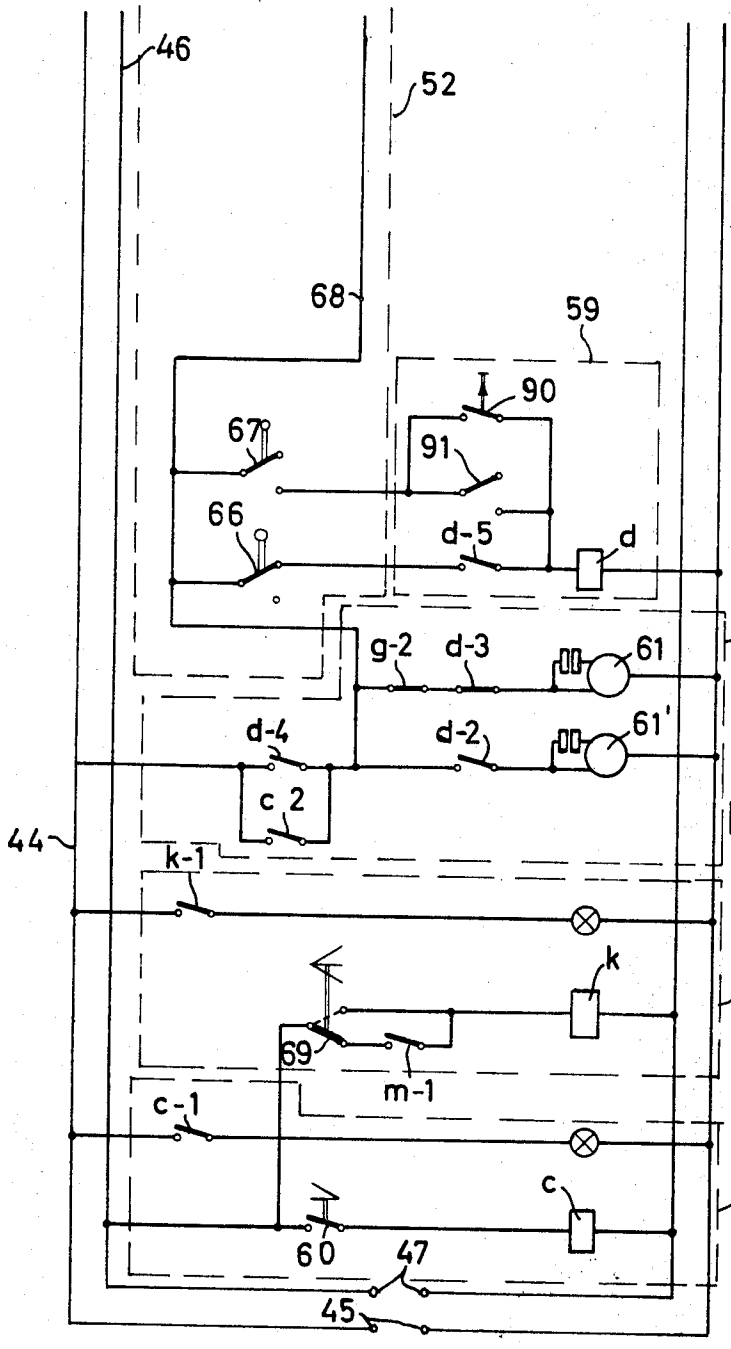


Fig.7a

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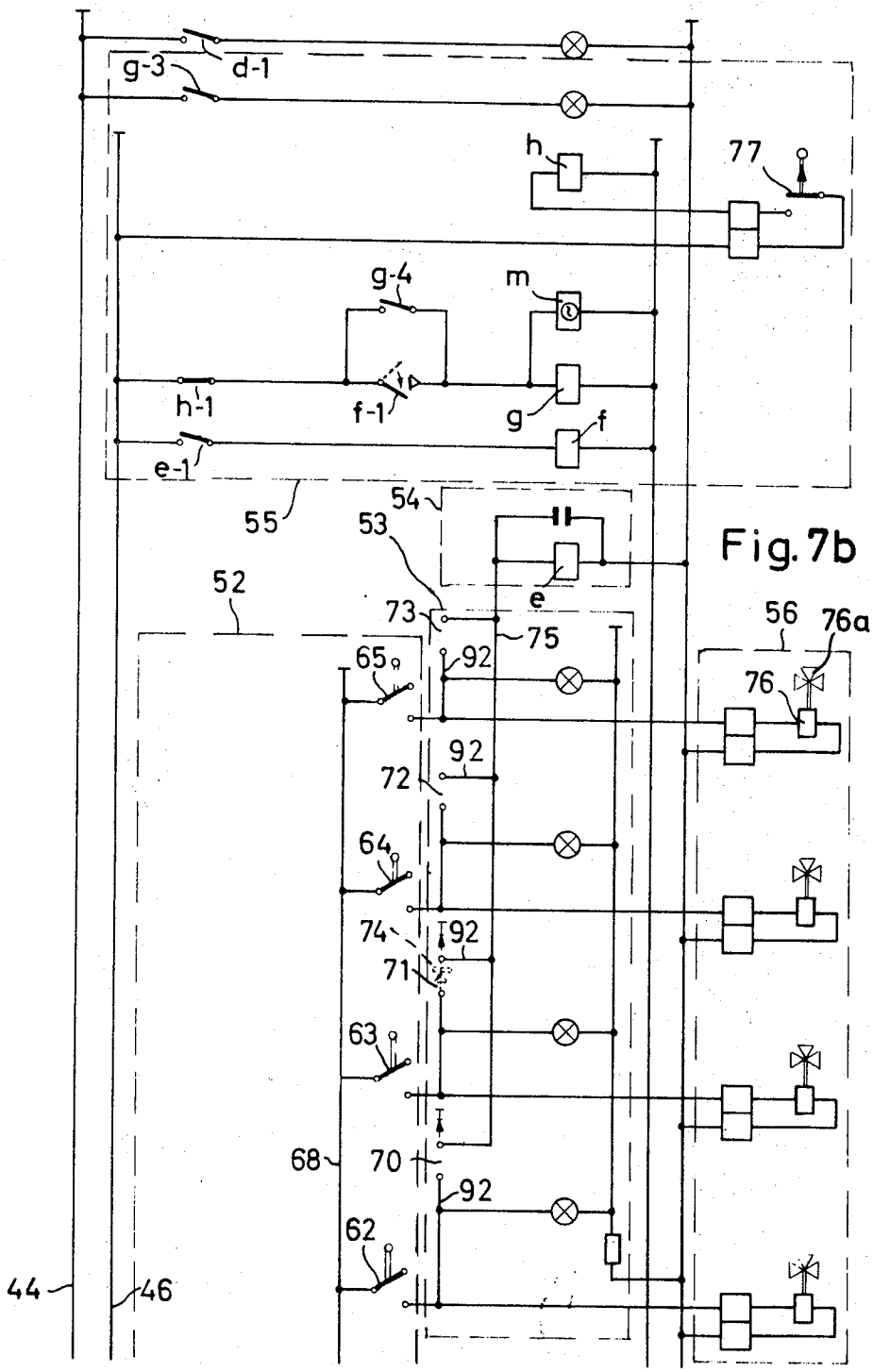


Fig. 7b

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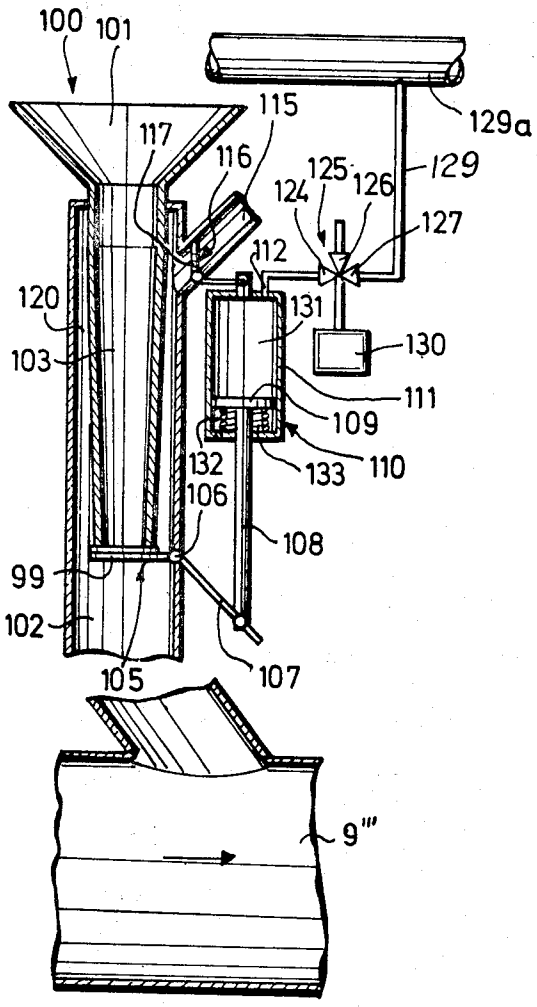
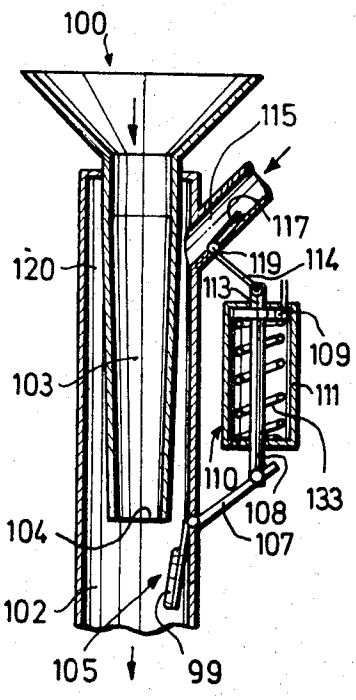


FIG. 8

FIG. 9



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APPARATUS FOR TRANSPORTING TEXTILE GOODS OR THE LIKE

BACKGROUND OF THE INVENTION

The present invention relates to improvements in apparatus for transporting stockings or other textile goods from one or more textile machines or makers to a collecting, sorting and/or receiving station. More particularly, the invention relates to improvements in apparatus which are especially suited for transportation of sensitive textile goods from a battery of textile machines to a receiving station where the goods can be collected according to size, shape, color and/or other characteristics.

SUMMARY OF THE INVENTION

One of the objects of my invention is to provide an apparatus which can transport the output of one or more producing machines to one or more receiving stations, for example, to worktables or benches in textile-manufacturing plants.

Another object of the invention is to provide a conveying apparatus which can transport sensitive textile goods, particularly stockings, in such a way that the goods are automatically assembled or collected according to size and/or other characteristics.

A further object of the invention is to provide a versatile conveying apparatus which can be rapidly and readily converted for transport of different classes of goods, for transport of goods from a desired number of producing machines to one or more receiving stations, and for manually controlled, semiautomatic or fully automatic operation.

An additional object of the invention is to provide a conveying apparatus wherein the goods are treated gently and wherein the goods can be transported at several speeds, along shorter or longer paths and in any desired sequence or in some case simultaneously.

Still another object of the invention is to provide a conveying apparatus which comprises a relatively small number of simple parts and wherein all of the goods, regardless of their origin, can be transported along a single path even if such goods are to be classified according to size, shape, color and/or other characteristics.

A further object of the invention is to provide an apparatus which can be supervised by semiskilled or unskilled personnel, which can be converted for transport of different types of goods to one or more destinations in a single and time-saving manner, and wherein the conversion can be carried out by resorting to mass-produced parts.

One feature of the present invention resides in the provision of an apparatus for transporting goods, particularly for transporting stockings or like sensitive textile goods by means of air. In one of its presently preferred forms, the apparatus comprises a plurality of loading units each of which is associated with an output of a textile machine and can accumulate and store a supply or batch of goods, a plurality of receptacles or analogous receiving means remote from the loading units, pneumatic duct means having a discharge end which can deliver goods to a selected receiving means, feed conduits connecting the loading units with the duct means, intercepting means preferably including suitable one-way valves associated with the feed conduits and operative to respectively permit or prevent the transfer of goods from the corresponding loading units into the duct means, and control means preferably including an electric circuit arrangement and having selector means for effecting operation of selected intercepting means as well as shifting means for effecting delivery of goods from the duct means into selected receiving means.

The selector means of the control means is preferably designed to effect operation of groups of intercepting means while the duct means delivers goods to a selected receiving means, i.e., the operation of each group of intercepting means can result in the delivery of goods from selected loading units into a predetermined receiving means. Each such group may include one or more intercepting means. The shifting means is preferably designed to effect delivery of goods from the duct means into a different receiving means in automatic response to completion of operation of a preceding group of intercepting means and prior to operation of the next group of intercepting means in a sense to admit goods from the corresponding loading units into the duct means.

The control means preferably further comprises switching means which is controlled by an operating means and can bring about opening of intercepting means in a desired and preferably changeable sequence. Such switching means may comprise a plurality of master switches (preferably microswitches) each of which is associated with one of the intercepting means, and the switching means further comprises cams or analogous means for cyclically actuating the master switches.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved transporting apparatus itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a diagrammatic top plan view of a transporting apparatus which embodies one form of the invention.

FIG. 2 is an enlarged transverse vertical sectional view as seen in the direction of arrows from the line 2–2 of FIG. 1;

FIG. 3 is a similar fragmentary transverse vertical sectional view of a second transporting apparatus;

FIG. 4 is a fragmentary top plan view of a third transporting apparatus;

FIG. 5 is an enlarged horizontal sectional view of a one-way valve which can be utilized as one of the intercepting means in the transporting apparatus;

FIG. 6 is a fragmentary top plan view of a fourth transporting apparatus;

FIG. 7 (composed of FIGS. 7*a* and 7*b*) is a diagram showing details of the control means in the apparatus of FIG. 1;

FIG. 8 is a fragmentary vertical sectional view of a fifth apparatus; and

FIG. 9 is a similar sectional view but showing certain parts of the fifth apparatus in different positions.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The apparatus which is illustrated in FIGS. 1 and 2 is employed to transport textile goods (e.g., stockings) from a battery of textile machines 4 to a collecting, receiving or sorting station 7 which accommodates a receiving unit 5 here shown as including a turntable or carousel 24 with several equidistant receptacles or receiving means 26 for textile goods. Each textile machine 4 discharges its output into one of a series of loading or charging units 1 and each such loading unit 1 comprises a magazine or hopper 2 constituting the inlet of a pneumatic feed conduit 3 whose outlet is connected to a main transporting conduit or duct 9. A source 6 of compressed air (e.g., a suitable air compressor or blower) is installed at one end of the duct 9 to produce an airstream which travels in the direction indicated by arrow. A second source 10 of compressed air (e.g., a second blower) is connected to one end of an elongated control conduit or pipe 11 the other end of which is closed, as at 13. The pipe 11 serves to supply compressed air to injectors 12 each of which is associated with one of the feed conduits 3. Each injector 12 comprises an injector conduit 14 of constant cross section which branches from the pipe 11 and discharges at 22 into the corresponding feed conduit 3 upstream of an intercepting means here shown as a one-way flap valve 23. Each injector conduit 14 contains a shutoff valve 15. The valves 15 are

operated by a control unit **16** which will be fully described in connection with FIGS. *7a* and *7b*. The outlets **22** of injector conduits **14** make an acute angle with adjoining portions of the respective feed conduits **3** (see FIG. **2**). Each one-way valve **23** comprises a pivotable flap **17** which opens in response to increasing fluid pressure in the upstream portion of the corresponding feed conduit **3** and closes automatically when the pressure in the upstream portion of such feed conduit decreases below the pressure in the duct **9**. The valves **23** are installed in straight horizontal portions of the respective feed conduits **3**, and the discharge end of each feed conduit makes an acute angle with the adjoining portion of the duct **9**. As shown in FIG. **2**, the valves **23** are closely adjacent to the discharge ends of their feed conduits **3**. The pressure of air in the pipe **11** exceeds the pressure of air in the duct **9** so that the flaps **17** open automatically in response to opening of the respective shutoff valves **15**. The pressure of air in the duct **9** depends on the desired speed at which the goods are to be conveyed to the receiving station **7**. The pressure in the control pipe **11** is selected in such a way that, when a valve **15** is caused to open in response to a signal from the control unit **16**, the current of air flowing through the respective injector conduit **14** invariably opens the associated flap **17** and produces suction in the upstream portion of feed conduit **3** and in the hopper **2** to effect immediate transfer of a batch or supply of goods from the hopper into the duct **9**.

The turntable **24** of the receiving unit **5** is indexible by a motor **31** and may comprise one, two or more receptacles **26** for textile goods. In the illustrated embodiment, the turntable **24** is formed with four equidistant receptacles **26** each of which constitutes a concave recess in the top surface of the turntable.

As a rule, an apparatus which embodies the features shown in FIGS. **1** and **2** comprises a large number of feed conduits **3** and an equal number of injectors **12**. For example, the apparatus may be employed to transport the output of a battery of 40 or more textile machines **4** to the receiving station **7** where the goods can be grouped according to size, quality, color and/or other characteristics. The loading units **1** are preferably arranged in or combinable into groups each of which receives the same type of goods. The goods transported from each group of loading units **1** are preferably collected in a separate receptacle **26**. Thus, and assuming that the apparatus transports the output of 40 textile machines **4** and that these machines are subdivided into said four groups whereby each group of machines **4** produces stockings of a different size, the loading units **1** can be grouped in the same way as the respective textile machines **4** and their injectors **12** can be operated successively by the control unit **16** in a way to insure that each of the receptacles **26** receives stockings of a certain size for further processing. As a rule, the various groups of injectors **12** are operated in a predetermined sequence so that the motor **31** can index the turntable **24** prior to a switch from the delivery of a first size of stockings to the delivery of a second size of stockings.

The operation of the apparatus shown in FIGS. **1** and **2** is as follows:

In the first step, the motors of the blowers **6** and **10** are started so that the duct **9** conveys a stream of compressed air in the direction indicated by arrow. The blower **10** fills the pipe **11** with compressed air and such air also fills the injector conduits **14** all the way to the respective shutoff valves **15**. The control unit **16** is programmed so that it successively opens and closes the shutoff valves **15** of a first group of injectors, and so forth until the cycle is completed so that the same procedure can be started all over again. Each stage of a cycle involves short-lasting opening of a shutoff valve **15** in the corresponding group of injectors **12** so that the outlet **22** of the respective injector conduit **14** admits current of pressive air which opens the adjoining one-way valve **23** and effect transfer of goods from the corresponding hopper **2** into the duct **9** which in turn discharges the goods into one of the receptacles **26**. The length of interval during which each shutoff valve **15** remains open is variable and is selected in such a way that the entire batch of goods in the corresponding loading unit **1** is invariably transferred into the duct **9**.

The arrangement is preferably such that all of the shutoff valves **15** remain closed for a short period of time during each interval when the control unit **16** switches from the operation of a preceding shutoff valve **15** to the operation of the next-following shutoff valve. During the change between two groups of shutoff valves this period of time is preferably longer than between the successive operations of two shutoff valves of one group. Such longer delay in operation of the next-following group of shutoff valves **15** is desirable to insure that each article of the foregoing group which has been introduced into the duct **9** invariably reaches the corresponding receptacle **26** before the next receptacle is shifted in a receiving position. The periods during which all of the valves **15** are closed are preferably adjustable and their duration depends on the speed of the airstream in the duct **9**, on the length of this duct, etc.

The motor **31** is thereupon caused to index the turntable **24** through 90° or through a multiple of 90° so as to place an empty or partially filled receptacle **26** into registry with the discharge end of the duct **9**. The new angular position of the turntable **24** is detected by a suitable detecting, scanning or sensing device which transmits a signal to the control unit **16**, so that the latter opens the next group of shutoff valves **15**.

Of course, the apparatus of FIGS. **1** and **2** can be used with equal advantage to deliver goods of identical quality, size and/or other characteristics to a single receptacle which is evacuated periodically during intervals between opening of successive groups of shutoff valves **15**. In such modified apparatus, the turntable **24** can be replaced by a single receptacle or by a platform or table which can receive one receptacle at a time or which serves as a receiving means for goods.

FIG. **3** illustrates a portion of a second apparatus wherein the injector conduits **14'** of the injectors **12'** communicate with the corresponding feed conduits **3** downstream of the one-way valves **23**. The shutoff valves **15'** are operated by the control unit **16** (not shown in FIG. **3**) in the same way as described above. The outlet of each conduit **14'** makes an acute angle with the adjoining part of the corresponding feed conduit **3**. The pressure of compressed air which enters the feed conduit **3** in response to opening of the shutoff valve **15'** is sufficient to effect automatic opening of the one-way valve **23** so that the goods can be transferred into the duct **9**. The current of air flowing by way of the injector conduit **14'** and entering the duct **9** creates in the corresponding hopper **2** (not shown) suction which causes the goods to advance through the feed conduit **3** and to enter the airstream in the duct **9**.

In FIG. **4**, the duct **9''** receives compressed air by way of a restrictor **29** which communicates with the pipe **11''**. The latter is connected with the pressure side of a blower **10'**. The construction of injectors **12** and loading units **1** is the same as described in connection with FIGS. **1** and **2**. The restrictor **29** insures that the pressure of air in the duct **9''** is less than that in the pipe ''.

It is clear that the apparatus shown in FIGS. **1–2**, **3** or **4** can be provided with means for automatically closing the one-way valves **23** independently of the pressure prevailing in the duct **9** or **9''**. However, automatic closing of flaps **17** in the valves **23** by compressed air in the duct **9** or **9''** when the corresponding injectors **12** or **12'** are inoperative, is particularly advantageous because such valves can be of exceptionally simple design and comprise a minimal number of parts.

FIG. **5** illustrates a presently preferred embodiment of a one-way valve or intercepting means which is installed in a feed conduit **35** of rectangular outline. The valve comprises a flap **36** which preferably consists of synthetic plastic material and is hingedly connected to an integral plate **39** by a flexible web **37**. The plate **39** is bonded or otherwise secured to the top wall of the conduit **35** and the flap **36** normally abuts

against a substantially vertical stop surface **40** provided on a U-shaped seat **41** which is installed in or formed on the conduit **35**. When the pressure at both sides of the flap **36** is the same, the flap pivots by gravity and bears against the stop surface **40**. The same situation exists when the pressure at the right-hand side of the flap **36** exceeds the pressure at the left-hand side.

It is clear that the flap **36** may be connected with a weight which tends to move it to closed position. It is also possible to employ springs which urge the flaps **36** against the seats **41**. All that counts is to provide valves which close automatically as soon as the respective injectors cease to deliver currents of compressed air.

FIG. **6** shows a portion of a further transporting apparatus wherein the currents of air issuing from feed conduits **3'** form in the duct **9'** a stream which transports goods to the receiving station, not shown. The pipe **33** is connected to the pressure side of a blower **32** and supplies compressed air to the injector conduits **34** of injectors **30**. The hoppers are shown at **2'**, the one-way valves at **23'**, and the shutoff valves at **15''**. The injectors **30** are analogous to or identical with the injectors **12** or **12'**. The cross-sectional area of the duct **9'** is selected in such a way that the pressure of the airstream therein remains above atmospheric pressure. When the control unit (not shown) opens the valves **15''**, currents of air flowing through the injector conduits **34** cause the goods to enter the feed conduits **3'**, and such currents also serve to open the one-way valves **23'**.

The duct which transports goods from the feed conduits to the receptacles or receiving means **26** will be provided with a separate source (**6** in FIG. **1**) of compressed air or other suitable gas when the duct is rather long whereby such separate source establishes in the duct a stream of air which flows continuously from the separate source toward the receiving station. Thus, the currents of air discharged by feed conduits **3** in FIGS. **1** and **2** merely serve to effect delivery of goods from the respective loading units **1** into the duct **9** whereupon the airstream in the duct takes over and continues to transport such goods into one of the receptacles **26**. As a rule, the pressure of air in the duct is considerably less than the pressure of air which is confined in the pipe **11, 11''** or **33**. For example, the pressure of air in the duct may be in the range of 20—100 millimeters water column; such pressures were found to be particularly satisfactory for proper operation of my apparatus.

The shutoff valves in the injector conduits are normally closed and they open only in response to signals from the control unit **16**. As will be described hereinafter, the shutoff valves can be opened by solenoids; however, it is also possible to employ mechanical opening means, pneumatic opening means and/or a combination of mechanical and fluid-operated means or the same. The pressure of air or other gas which is entrapped in the pipe **11, 11''** or **33** may be in the range of 100—5,000 millimeters water column, preferably between 500—2,500 millimeters water column. This pressure is lower than in presently known pneumatic transporting systems for textile goods which brings about a number of important advantages. High compression of air can be achieved by resorting to complicated and costly compressors which must be provided with means for preventing penetration of oil into compressed air. Pressures which are necessary for operation of injectors in my transporting apparatus can be readily achieved by resorting to conventional radial or axial flow compressors which furnish compressed air that is free of oil or other contaminants. Moreover, and since the apparatus operates with gases whose pressure need not exceed 5,000 millimeters water column, it can employ very simple, inexpensive and rugged shutoff and/or one-way valves.

When the duct is rather short, the apparatus can operate properly with a single source of compressed gas which supplies gas into the duct as well as to the injectors. As shown in FIG. **4**, the pipe **11''** can supply gas continuously into the intake end of the duct **9''** whereby the restrictor **29** insures that the pressure of the gas stream which transports goods through the duct **9''** does not exceed the pressure of gas which serves to transport goods from the feed conduits **3** into the duct **9''**. Alternatively, and as described in connection with FIG. **6**, the duct **9'** can receive gas only when an injector **30** is in the process of delivering compressed gas to the corresponding feed conduit **3'**.

The apparatus of FIG. **4** or **6** can be equipped with a photoelectric or otherwise constructed detector system which is installed in or on the duct **9'** or **9''** and serves to monitor the travel of goods through the duct. Such detector can be employed to shut off an injector when the transfer of a batch of goods from the corresponding loading unit to the receiving station **7** is completed. The optical detector can also serve as a means for blocking operation of a next-following injector prior to completion of transfer of goods which are admitted into the duct in response to actuation of a preceding injector. In this way, one insures that goods coming from separate loading units cannot mix in the duct and that the turntable **24** can be indexed before a different type of goods is about to leave the duct.

FIGS. **7***a* and **7***b* illustrate the details of the control unit **16**. This control unit comprises a source **44** of 24-volt current with terminals **45**, a source **46** of 220-volt current with terminals **47**, a starter circuit **50**, an operating circuit **51**, a switching assembly **52** which is controlled by the operating circuit **51**, a group selector circuit **53**, a detector circuit **54**, a group-shifting circuit **55** which controls the switchover from operation of a preceding group to operation of the next-following group of injectors, a valve-operating circuit **56** which effects opening and closing of shutoff valves **15**, an indexing circuit **57**, and a rapid-return or resetting circuit **59**.

The characters *c, d, e, f, g, h, k, m* denote relays whose contacts are identified by similar characters followed by numerals. For example, the relay *c* has contacts *c*–**1** and *c*–**2**.

The starter circuit **50** comprises a manually operated starter switch **60** and the aforementioned relay *c*. The operating circuit **51** comprises two electric motors **61, 61'**, the first of which effects normal (slow-speed) operation of moving parts in the switching assembly **52** and the latter of which effects rapid return movement of moving parts in the assembly **52** to starting position.

The switching assembly **52** comprises a set of movable cams which open and close various switches. Such assemblies are known in the art and, therefore, all details of the assembly **52** form no part of the present invention. The switches **66** and **67** perform functions which will be explained later. The assembly **52** further comprises master switches **62, 63, 64, 65** which are connected to a conductor **68** and serve to effect closing and opening of shutoff valves **15** in a predetermined sequence. These master switches are actuated by cams which are driven by the motor **61**. In this preferred embodiment a separate master switch is provided for each loading unit **1**. As stated before, the apparatus normally comprises a rather large number of loading units and the four master switches **62—65** of FIGS. **7***a*–**7***b* are merely representative of a much larger number, for example, 40 or 100. Each master switch is preferably a microswitch.

The group selector circuit **53** comprises a large number of circuit-breaking devices **70—73**, one for each master switch, which can be bridged by diode plugs **74**. The devices **70—73** are provided in selector leads **92**. Each circuit breaking device is in series with one of the master switches **62—65**. If a circuit-breaking device is bridged by a plug **74**, the corresponding master switch can complete the group-shifting circuit **55** by way of a conductor **75**, and the circuit **55** then carries out a series of functions in connection with a shift from operation of a preceding group to operation of the next-following group of injectors. The detector relay *e* constitutes the sensing element of the detector circuit **54**.

The group-shifting circuit **55** comprises a set of relays and switches including the aforementioned relay *m* which is a time-lag relay and is adjustable, for example, to furnish delays

of between 0 and 60 seconds. The contact *f*–1 of the relay *f* is a wiper which completes a circuit only when it returns to the illustrated starting position. The circuit **55** further comprises a limit switch **77** which is actuated for a short interval of time by one of four trips **79** on the turntable **24** (FIG. **1**) when the latter is caused to change its angular position so as to place a fresh receptacle **26** into registry with the discharge end of the duct **9**.

The valve-operating circuit **56** comprises a series of solenoids **76**, one for each shutoff valve **15** and each in series with the corresponding master switch. The solenoids **76** control the opening and closing of the corresponding shutoff valves **15**. The means for directly effecting closing and opening of shutoff valves **15** comprises three-way valves **76***a* which are controlled by the respective solenoids **76**. The valves **76***a* regulate the flow of compressed air which opens or closes the associated shutoff valves **15**.

The indexing circuit **57** includes the aforementioned relay *k* which can open or complete the circuit of the motor **31**. This circuit **57** further includes a manually operated switch **69** which is movable between two end positions. In the illustrated end position, the switch **69** allows for automatic indexing of the turntable **24**. In the other end position of the switch **69**, the turntable **24** is indexible in response to manually produced signals.

The rapid-return or resetting circuit **59** includes a pushbutton **90** which can be depressed to effect rapid return movement of moving parts in the switching assembly **52** to starting position, and a switch **91** which can be closed for a short interval of time upon completion of a cycle. Such closing of switch **91** can be effected by a relay (not shown) which is energized in automatic response to closing of the last master switch **65** of the last group of injectors **12**.

The control unit **16** further comprises a system of signal generators, preferably lamps, which serve to furnish visual indications of the condition of various circuits in the unit **16**. Such lamps preferably indicate energization and/or deenergization of the respective circuits and their operation will be readily understood with reference to the diagram of FIGS. **7***a* and **7***b*.

The operation of the control unit **16** is as follows:

The operator closes the starter switch **60** to energize the relay *c* which closes the contact *c*—**2** in the operating circuit **51**. The motor **61** is started and rotates the cams in the switching assembly **52** at a slow speed. This causes the master switches **62**—**65** to close for a short time interval one after the other and to effect temporary opening of corresponding shutoff valves **15**. If the circuit-breaking devices **70**—**73** of the group selector circuit **53** are not bridged, the cycle is completed without a group change and all of the goods are delivered successively into a single receptacle **26**. The circuit-breaking devices are preferably assembled on a wall or the like and are identified by numerals or other indicia to facilitate insertion of plugs **74**. Each circuit-breaking device may be a suitable socket.

If the output of textile machines **4** is to be delivered to two or more receptacles **26**, the operator inserts a plug **74** into each circuit-breaking device (e.g., **73**) which is associated with the last injector of a desired group of injectors **12**.

By selecting the circuit-breaking device or devices which are to receive plugs **74**, the operator makes an election of groups. For example, let it be assumed that the master switch **63** is the last master switch of the series in a group. Thus, the operator must insert a plug **74** into the circuit-breaking device **71** which is associated with the master switch **63**. When the latter closes, the corresponding shutoff valve **15** is actuated and the master switch **63** also energizes the relay *e* which closes the contact *e*–**1** so that the latter energizes the relay *f* which moves the contact *f*–**1** to the broken-line position. When the master switch **63** opens, the relay *f* is deenergized and the contact *f*–**1** causes energization of the time-lag relay *m* and of the relay *g*. The relay *g* opens the circuit of the motor **61** and remains energized by way of its holding contact *g*–**4**. The delay produced by relay *m* is selected in such a way that the goods can pass through the duct **9** and enter the adjoining receptacle **26**. When the delay is terminated, the relay *m* closes the contact *m*–**1** which completes the circuit of the motor **31** so that the latter places a different receptacle **26** into registry with the discharge end of the duct **9**, i.e., that receptacle which is to receive goods coming from machines **4** associated with the injectors **12** which are controlled by the master switch **64** (which follows the master switch **63**). The limit switch **77** is actuated by a trip **79** when the turntable **24** assumes its new position and the limit switch **77** cooperates with the relay *h* to deenergize the relays *g* and *m* so that the relay *k* is also deenergized and arrests the motor **31**. At the same time, the blocking contact *g*–**2** of the relay *g* closes and thus starts the motor **61**. Thus, the relay *g* can block the operation of the switching assembly **52** following the completion of opening of a group of one-way valves **23**. The control switch **64** and the next-following master switches cause opening of the corresponding group of shutoff valves **15**. When the last master switch of the group starting with the master switch **64** is energized, the control unit **16** switches over to delivery of goods from a further group of machines **4** or the just-described cycle is started all over again if the master switches energized during the preceding operation are the master switches of the last group. The parts **77**, *g* and *h* constitute a blocking means which prevents opening of a fresh group of shutoff valves **23** for a given interval of time following the opening of a preceding group of shutoff valves.

When a cycle is completed, the switch **91** is closed and the relay *d* is energized. This relay thereupon remains energized by way of its holding contact *d*–**5** and completes the circuit of the motor **61′** which rapidly resets the cams of the switching assembly **52**. Shortly before the cams return to starting position, the switch **66** opens automatically and the fresh cycle begins with the motor **61** running at a slow speed to move the cams away from starting position. The contact *d*–**4** of the relay *d* also completes a circuit which insures complete resetting of cams in the assembly **52** even if the switch **60** is released and returns to open position. The switch **67** is a synchronizer switch which insures that the motor **61′** is not started at random but only at certain stages of a cycle. The remaining characteristics of the control unit **16** can be readily understood by referring to the diagram of FIGS. **7***a* and **7***b*.

The time-lag or delay means of the control unit **16** can be readily designed and adjusted in such a way that a fresh group of injectors **12** is actuated while the goods which were admitted into the duct in response to actuation of a preceding group of injectors are still in the process of travelling toward the receiving station **7**, as long as the goods which are in the duct invariably reach the receiving station in good time prior to completed transport of a different type or style of goods to the turntable **24** so that the motor **31** will have ample time to index the turntable in order to place an appropriate receptacle **26** into registry with the discharge end of the duct **9** for reception of the different type of goods. As a matter of fact, the intervals between deliveries of successive types of goods can be made so short that the duct **9** transports a practically uninterrupted stream of goods and that the intervals between deliveries of different types of goods are barely long enough to insure proper indexing of the turntable **24** whenever necessary.

FIGS. **8** and **9** illustrate a portion of a further apparatus which is provided with modified one-way valves and shutoff valves. The loading units **100** (only one shown) comprise hoppers **101** at the upper ends of chutes **103** the lower ends of which cooperate with one-way valves **105**. Each chute **103** is installed in a feed conduit **102** which is connected to a duct **9‴** corresponding to the duct **9** of FIG. **1**. The chutes **103** resemble hollow cones and taper downwardly from the hoppers **101** toward the respective valves **105**. The lower ends of the chutes **103** define seats **104** for pivotable flaps **99** of the respective one-way valves **105**. The hinge of the valve **105** shown in FIGS. **8** and **9** is denoted by the numeral **106**. Each

flap 99 is connected to a lever or arm 107 which is pivotable about the axis of the hinge 106 and is articulately coupled to the lower end of a piston rod 108 which can move the flap 99 between the closed and open positions respectively shown in FIGS. 8 and 9. The piston rod 108 is rigid with a piston 109 which is reciprocable in a floating cylinder 111 forming part of a pneumatic cylinder and piston assembly 110. The upper end wall of the cylinder 111 is connected with a flexible conduit 112 and carries a pivot 113 for an arm 114 which is hingedly mounted in an injector conduit 115, as at 119, and is rigid with the flap 117 of a shutoff valve 116 in the injector conduit 115. The latter corresponds to the conduit 14 of FIG. 2 and is connected to a pipe 129*a* which corresponds to the pipe 11 of FIG. 1 and receives compressed air from a blower, such as the blower 10 of FIG. 1. The hinges 106, 119 are designed in such a way that they prevent communication between the conduit 102 or 115 and the surrounding atmosphere. The injector conduit 115 communicates with the feed conduit 102 at a point close to the upper end of the chute 103 and can admit compressed air into an annular compartment 120 between the chute 103 and feed conduit 102. When the flap 117 of the shutoff valve 116 is moved to the open position shown in FIG. 9, air rushing into the compartment 120 opens the flap 99 of the valve 105 and such air flows downwardly through the feed conduit 102 to create suction in the chute 103 whereby the goods delivered into the hopper 101 of the loading unit 100 are automatically advanced into the duct 9''' and are transported to the receiving station.

The conduit 112 is connected with the outlet 124 of a three-way valve 125 which corresponds to one of the valves 76*a* shown in FIG. 7*b*. The valve 125 has a second outlet 126 which can connect the outlet 124 with the atmosphere, and an inlet 127 which is connected to a supply conduit 129 receiving compressed air from the pipe 129*a* which corresponds to the pipe 11 of FIG. 1 and supplies compressed air to each injector conduit 115. The numeral 130 denotes a solenoid which controls the three-way valve 125 and corresponds to one of the solenoids 76 shown in FIG. 7*b*.

The cylinder 111 is mounted on the arms 107 and 114 so that it can move up or down with reference to the feed conduit 102. This cylinder comprises an upper chamber 131 which communicates with the conduit 112 and is separated from a lower chamber 132 by the piston 109. The lower chamber 132 is in permanent communication with the atmosphere and accommodates a helical return spring 133 which tends to move the piston 109 to the upper end position shown in FIG. 9. Such upward movement of the piston 109 can take place when the chamber 131 is connected with the atmosphere by way of the conduit 112, outlet 124 and outlet 126. When the solenoid 130 causes the valve 125 to admit compressed air from the supply conduit 129 to the conduit 112, the piston 109 moves rapidly toward the position shown in FIG. 8 and causes the return spring 133 to store energy. As the piston 109 moves downwardly, the piston rod 108 causes the arm 107 to close the flap 99 of the one-way valve 105 so that the lower end of the chute 103 is sealed from the feed conduit 102. Pressure of air in the upper chamber 131 also causes the cylinder 111 to move upwardly and to thereby pivot the arm 114 about the axis of the hinge 119 whereby the flap 117 of the shutoff valve 116 moves to the closed position shown in FIG. 8. When the valve 105 is closed, the piston rod 108 is held by the flap 99 against further downward movement and the cylinder 111 is compelled to move upwardly and to effect closing of the shutoff valve 116. As long as the chamber 131 continues to communicate with the supply conduit 129, the valves 105 and 116 remain in closed positions.

When the contents of the loading unit 100 are to be transferred into the duct 9''' and thence into a receptacle at the receiving station, the corresponding master switch (62—65 in FIGS. 7*a*–7*b*) is closed so that the solenoid 130 actuates the three-way valve 125 which then connects the conduit 112 with the atmosphere by way of the outlet 126. The pressure of air in the upper cylinder chamber 131 drops and the spring 133 is free to expand so that the piston 109 moves upwardly and the piston rod 108 entrains the arm 107 which opens the valve 105. The flap 117 of the shutoff valve 116 is moved to the fully open position shown in FIG. 9 before the piston 109 reaches its upper end position so that the spring 133 then causes the piston 109 and piston rod 108 to move downwardly and to effect opening of the one-way valve 105 by way of the arm 107. Thus, the valve 116 opens before the valve 105.

An important advantage of the just-described apparatus is the simplicity of its parts and that each shutoff valve and the corresponding one-way valve are operated in synchronism. Moreover, the valves 105, 116 can remain closed even if they are subjected to very strong pressure of compressed air. The cylinder and piston assembly 110 constitutes a simple servomotor which operates the valves 105, 116 and receives pressurized fluid from a source (pipe 129*a*) which is needed in the apparatus to operate the injectors, i.e., there is no need to provide a separate source of compressed fluid for the purpose of operating the valves 125. It is further clear that the cylinder and piston assembly 110 of FIGS. 8 and 9 can be replaced by other types of servomotors without departing from the spirit of my invention. All that is necessary is to provide a servomotor which has two output members one of which can actuate a shutoff valve and the other of which can actuate a one-way valve, or a single output member which can operate such valves in a desired sequence.

The important advantages of the apparatus shown in FIGS. 8 and 9 can be summarized as follows:

The servomotor is a simple pneumatic cylinder and piston assembly 110 wherein the piston rod 108 constitutes one output member and wherein the cylinder 111 constitutes the other output member. The feed conduit 102 surrounds a portion or extension 103 of the hopper 101 and defines therewith an annular compartment 120 which receives compressed air from the injector conduit 115. The one-way valve 105 is mounted on the feed conduit 102 and serves to seal or to expose the outlet 104 of the chute 103. The valves 105, 116 are simple flap valves which close automatically in response to connection of the chamber 131 with the atmosphere and in response to simultaneous sealing of cylinder chamber 131 from the source 129 of compressed air. Such closing of the valves 105, 116 is effected by a simple helical return spring 133 or by analogous biasing means for the piston 109 and piston rod 108. Finally, the pipe 129*a* which supplies compressed air to the cylinder 110 can serve as a means for supplying compressed air to the injectors.

I claim:

1. Apparatus for transporting goods, particularly for transporting sensitive textile goods, comprising a plurality of loading units each arranged to accommodate a supply of goods; a plurality of receiving means remote from said loading units; pneumatic duct means; intercepting means associated with said feed conduits and operative to respectively permit or prevent transfer of goods from the corresponding loading units into said duct means; and control means including selector means for effecting operation of groups of said intercepting means, shifting means for effecting delivery of goods from said duct means into selected receiving means, and delay means for delaying the operation of the next-following group of intercepting means for a predetermined interval following completion of operation of the preceding group, said delay means comprising adjustable time-lag relay means.

2. Apparatus for transporting goods, particularly for transporting sensitive textile goods, comprising a plurality of loading units each arranged to accommodate a supply of goods; a plurality of receiving means remote from said loading units; pneumatic duct means; feed conduits connecting said loading units with said duct means; intercepting means associated with said feed conduits and operative to respectively permit or prevent transfer of goods from the corresponding loading units into said duct means; and control

means including selector means for effecting operation of groups of said intercepting means, shifting means for effecting delivery of goods from said duct means into selected receiving means, switching means, and operating means for said switching means, said stitching means being arranged to bring about operation of said intercepting means in a predetermined sequence and comprising a plurality of master switches each associated with one of said intercepting means and means for cyclically actuating said switches, said selector means further comprising lead means, a plurality of circuit-breaking means provided in said lead means, each of said circuit-breaking means being connected with one of said master switches, and means for bridging selected circuit-breaking means, said control means further comprising detector means connected with said switching means by way of said lead means to detect closing of said master switches upon bridging of the corresponding circuit-breaking means, each of said bridging means comprising a diode plug.

3. Apparatus for transporting goods, particularly for transporting sensitive textile goods, comprising a plurality of loading units each arranged to accommodate a supply of goods; pneumatic duct means; a receiving station remote from said loading units and arranged to receive goods from said duct means; feed conduits connecting said loading units with said duct means; intercepting means including first valves provided in said feed conduits and movable between open and closed positions to respectively permit or prevent transfer of goods from the corresponding loading units into said duct means; a source of compressed gas; a plurality of injector means each connectable with said source and each associated with one of said feed conduits to effect transfer of goods from the corresponding loading unit into said duct means in response to admission of compressed gas from said source into such injector means, each of said injector means comprising an injector conduit connected with said source and with the respective feed conduit and a second valve provided in the injector conduit and movable therein between open and closed positions; control means for effecting operation of said valves in a desired sequence; and a plurality of servomotor means, one for each of said first valves, for operating said first valves and the corresponding second valves in response to signals from said control means.

4. Apparatus as defined in claim 3, wherein currents of air flowing through said injector conduits and into said duct means by way of the respective feed conduits are arranged to form in said duct means a stream serving to transport goods from the loading units to said receiving station.

5. Apparatus as defined in claim 3, wherein said source contains gas at a pressure of between 100 and 5,000 millimeters water column.

6. Apparatus as defined in claim 3, wherein the gas in said source is maintained at a pressure of between 500 and 2,500 millimeters water column.

7. Apparatus as defined in claim 3, wherein the gas pressure in said duct means is substantially less than the pressure of gas of said source.

8. Apparatus as defined in claim 7, wherein the gas pressure in said duct means is between 20 and 100 millimeters water column.

9. Apparatus as defined in claim 3, wherein each of said loading units comprises a magazine arranged to accommodate a supply of goods and having a chute extending into the corresponding feed conduit to define therewith a substantially annular compartment, each of said injector conduits having an outlet connected with the respective compartment.

10. Apparatus as defined in claim 9, wherein each of said first valves is a one-way valve having a member which seals the respective chute from the corresponding feed conduit in the closed position of such first valve.

11. Apparatus as defined in claim 3, wherein each of said first valves comprises a flap.

12. Apparatus as defined in claim 3, wherein each of said servomotor means comprises first and second output members which are movable with reference to each other, said first output members being arranged to actuate the associated first valves and said second output members being arranged to actuate the corresponding second valves.

13. Apparatus as defined in claim 12, wherein one output member of each servomotor means is arranged to open the corresponding valve before the other output member starts to open the associated valve and said other output member is arranged to close the associated valve before said one output member starts to close the corresponding valve.

14. Apparatus as defined in claim 12, wherein each of said servomotor means constitutes a fluid-operated cylinder and piston assembly having a piston rod which constitutes one of said output members and a cylinder which constitutes the other output member.

15. Apparatus as defined in claim 14, wherein said control means comprises means for admitting compressed gas from said source into said cylinder to thereby effect movement of corresponding first and second valves to open positions.

16. Apparatus as defined in claim 14, wherein each of said cylinder and piston assemblies further comprises means for moving said output members to positions which correspond to one of the two positions of the respective first and second valves.

17. Apparatus as defined in claim 16, wherein said last-mentioned means comprises resilient means.

18. Apparatus as defined in claim 16, wherein said control means comprises means for admitting into said cylinders compressed gas to thereby effect movement of the output members to positions which correspond to the other of the two positions of the respective first and second valves.