April 21, 1964 C. HARTSHORN 3,129,979

MEANS FOR DELIVERING LIGHT ARTICLES FROM ONE POINT TO ANOTHER

Filed July 6, 1961 4 Sheets-Sheet 1

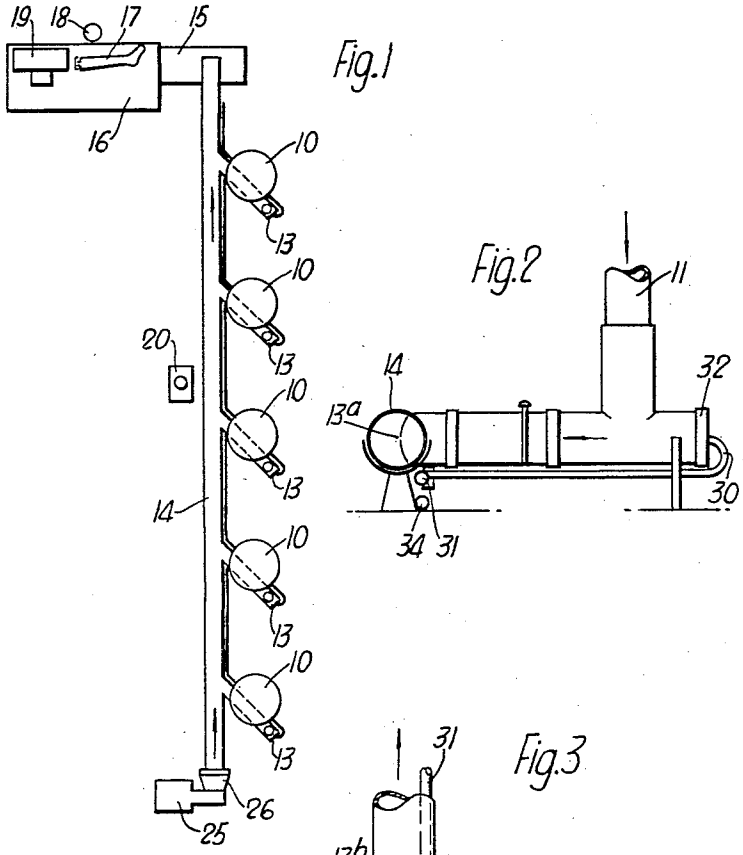


Fig.1

Fig.2

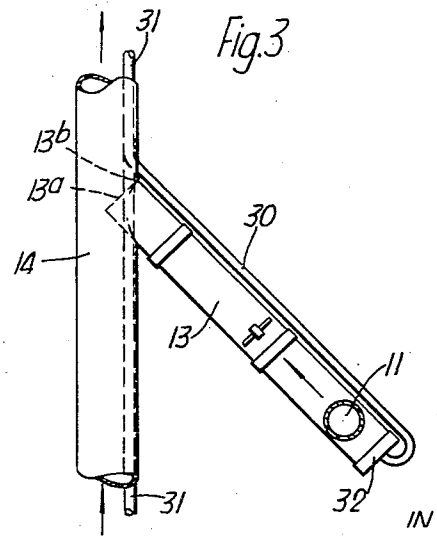


Fig.3

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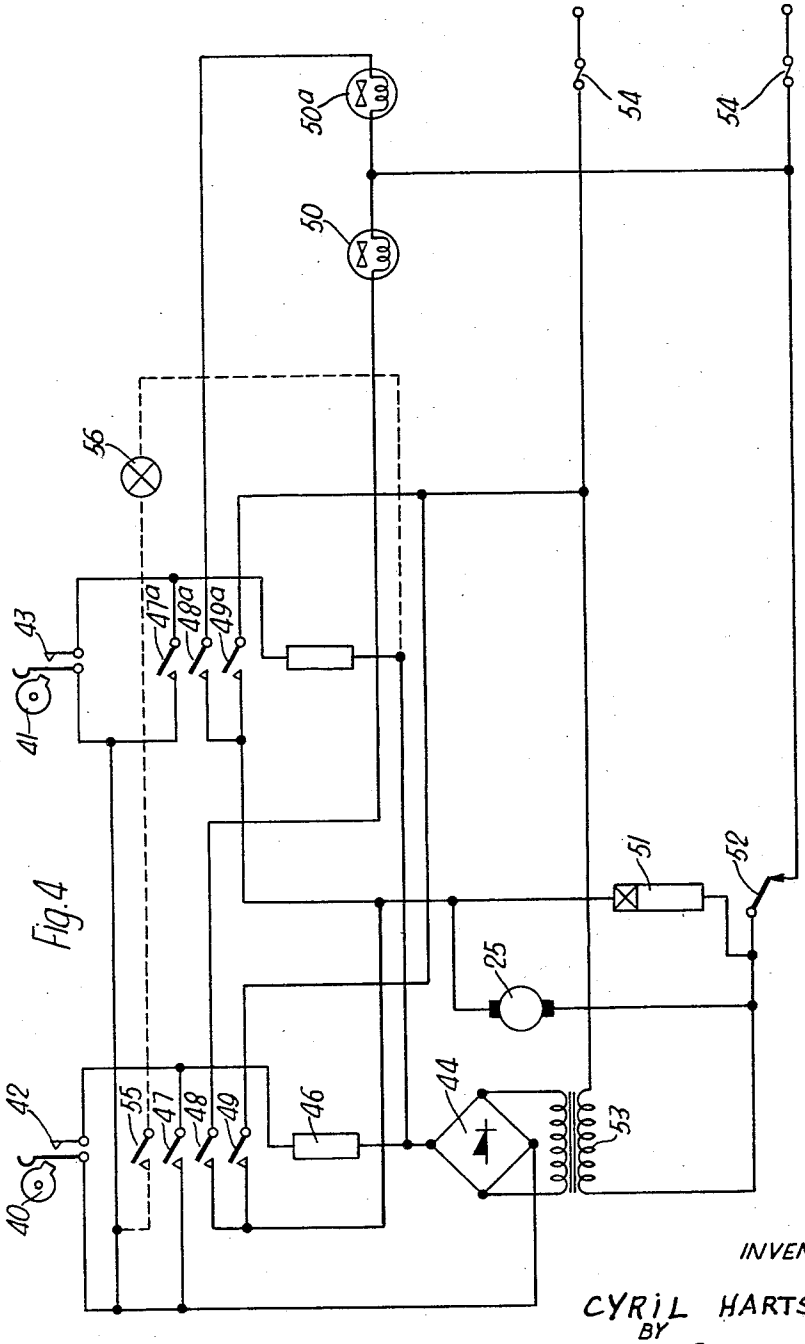


Fig. 4

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MEANS FOR DELIVERING LIGHT ARTICLES FROM ONE POINT TO ANOTHER

Filed July 6, 1961 4 Sheets-Sheet 3

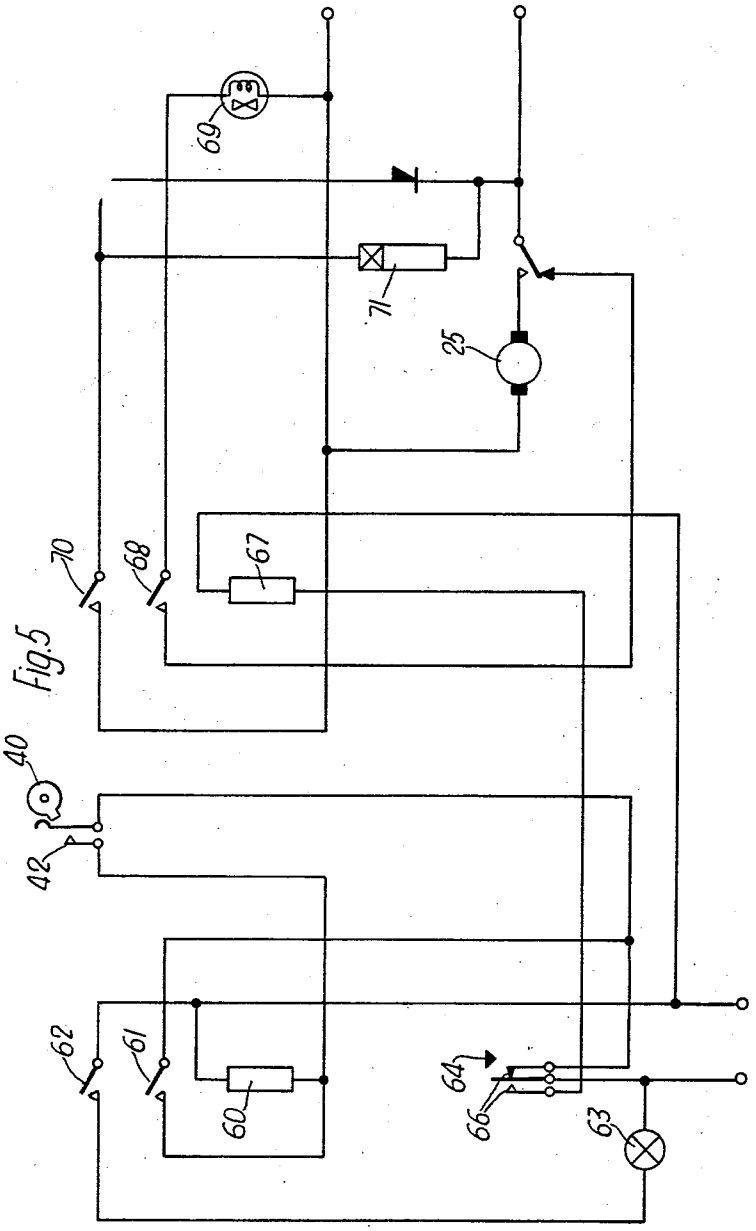


Fig.5

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MEANS FOR DELIVERING LIGHT ARTICLES FROM ONE POINT TO ANOTHER

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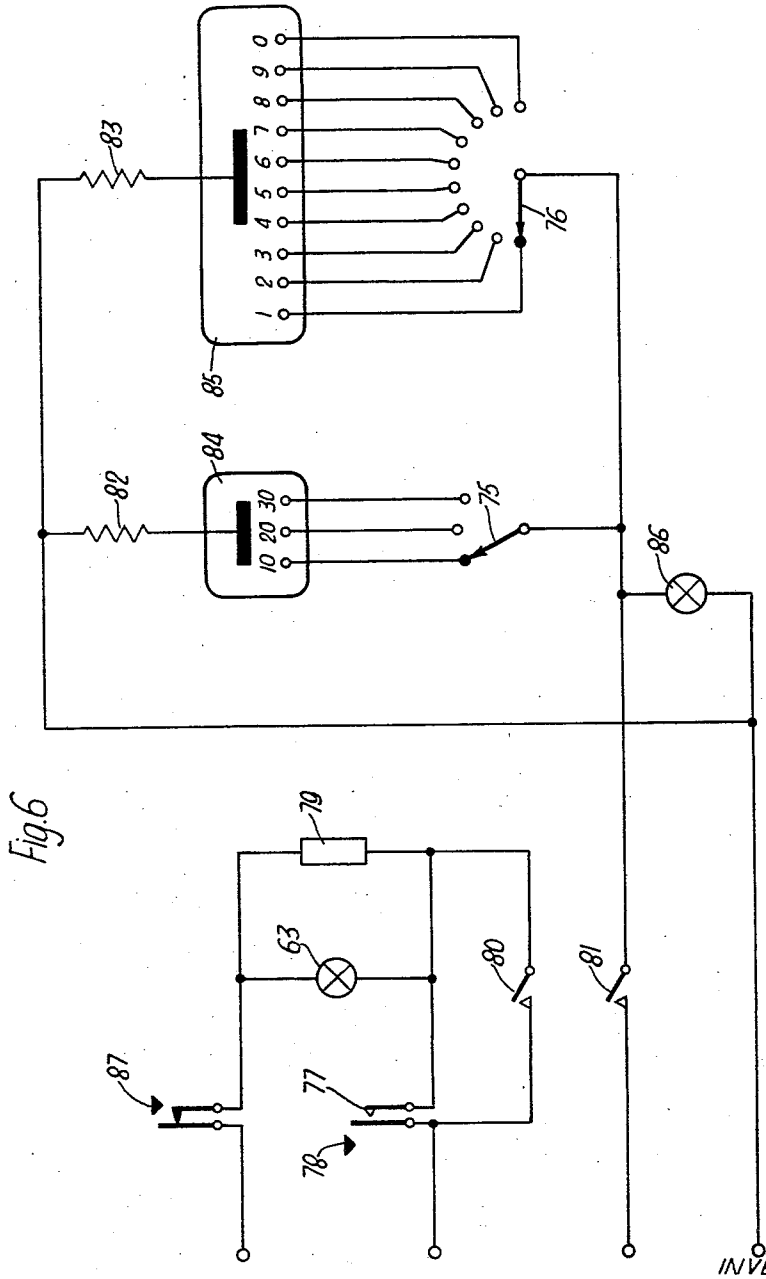


Fig.6

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MEANS FOR DELIVERING LIGHT ARTICLES FROM ONE POINT TO ANOTHER

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6 Claims. (Cl. 302—2)

This invention relates to means for delivering light articles from one point to another.

The invention has been developed chiefly for feeding women's stockings or other garments from a machine, for instance a circular knitting machine, to a receiving station where the articles can be examined.

For the sake of convenience in description, therefore, the articles will be referred to simply as stockings, but it is to be understood that this term is used in an illustrative sense and is not to be interpreted as restricting the use of the invention to stockings.

Systems for conveying stockings from knitting machines to a prescribed destination make use of a tube or duct through which a current of air is blown. The stockings are introduced into the tube or duct and the air current carries them along the tube or duct to the destination point. In general it may be observed that existing systems are of rather restricted value since they require a tube or duct from each knitting machine, or other originating point, to the examining station, or other destination point. Moreover they rely on the air flow through the tube or duct to suck the stockings into the tube or duct from a mouthpiece or lateral inlet, and they demand, therefore, a rather strong flow of air through the said tube or duct. Any air flow which is of a sufficiently high velocity to guarantee transmission to the prescribed destination is likely at the same time to create a rough tumbling action of the stocking, which will often require to travel a considerable distance. Because of the delicate nature of the stockings this is clearly undesirable.

Again in a typical production lay-out there will usually be a number of knitting machines or other producing units associated with a single point of destination common to them all, normally represented by a room in which the stockings are subjected to examination by trained staff. Its expeditious functioning therefore requires that stockings from all the machines in the system shall be transmitted to the examining station, and that the staff in the examining station shall not only be able to identify the particular machine from which each individual stocking has come, but shall also be able to exercise control of or call attention to each machine in the system in the event of faulty work from it having been revealed by the examination of its output.

An object of the present invention is to provide an improved pneumatic system by which stockings from a number of machines can be conveyed to a single destination such as an examining station.

A further object of the invention is to ensure successful transmission of the stockings from all the originating points in the system to the destination point, without having to use air flows of such a high velocity as would be liable to cause damage to the stockings during their transmission.

A further object of the invention is to enable staff at the examining station or other point of destination to identify from which machine or other originating point any individual stocking has come.

A further object of the invention is to enable staff at the examining station or other point of destination to exercise control of each machine in the system, by calling attention visually or otherwise to the fact that a particular machine has given rise to faulty work, or by stopping the defective machine.

A further object of the invention is to initiate the flow of the air for transmission of the stockings automatically as a stocking is delivered into the system from a knitting machine.

Other objects will be evident from the ensuing description.

Referring to the drawings which form a part of this specification:

FIGURE 1 is a diagrammatic plan of a schematic lay-out showing a simple transmission system.

FIGURE 2 is a part sectional elevation of the same.

FIGURE 3 is a part sectional plan of a portion of the system.

FIGURES 2 and 3 are drawn to a larger scale than FIGURE 1.

FIGURE 4 is an electrical circuit diagram in one form of system.

FIGURE 5 is an electrical circuit diagram of another form of system.

FIGURE 6 is an electrical circuit diagram incorporating features additional to those of FIGURES 4 and 5.

Referring to FIGURES 1, 2 and 3, a group of knitting machines 10 is employed; as shown there are five machines arranged in a straight line but it will be evident that there may be more or fewer and they will not always be in line as here illustrated for the sake of convenience. Each machine is provided with a receiver, here illustrated as a take-down tube 11, into which the newly knitted articles fall as each comes from the machine. It will be appreciated that this take-down tube is a conventional standard fitment on a knitting machine. Each take-down tube is arranged in vertical alignment and register with a vertically disposed receiving tube 12 whose lower end is open and communicates with a branch delivery tube 13. Each branch tube 13 leads into a main tube 14 leading in turn to a receiving station 15 where a table or the like 16 is provided where stockings, one of which is indicated at 17, can be subjected to careful scrutiny under favourable conditions, by a skilled examiner represented at 18. The receiving station also has associated with it a control unit which will be presently referred to in more detail but which is here generally represented at 19. Associated with the control unit 19 there is an indicator panel 20 which is positioned alongside the knitting machines 10. It will be understood that although for convenience in illustration the examining station and the knitting machines have been shown as a compact lay-out, in actual practice there will often be a considerable distance between the machines and the station.

It is essential that where the branch tubes 13 enter the main tube 14 there shall be no rough or raw edges of material, and it may be found preferable to construct the tubing of plastic material, although the invention is not restricted to particular details in this respect and metal tubing can be used if desired. An important feature of the invention resides in the way in which the branch tubes 13 deliver the stockings into the main tube 14, and as can be seen clearly from FIGURE 3, the delivery end of each branch tube is arranged to extend into the main tube somewhat, thereby creating a venturi or suction effect by the air flow along the main tube 14. The end of each branch tube is cut off on an angle, as shown at 13^a, the direction of inclination being such that the open side faces in the direction of the flow along the main tube 14, indicated by arrows, the open side of the end of the branch tube 13 merging as indicated at 13^b into the wall of the main tube. The ends of the branch tubes 13 thus partly obstruct the bore of the main tube 14, and this, in conjunction with the angle at which the branch tubes merge into the main tube, ensures smooth

delivery of the stockings from the branches into the main tube. As illustrated the branch tubes approach the main tube at an angle of 45° or thereabouts, and while this angle is not particularly critical nevertheless it will be evident that for the best results they must be arranged to approach at an angle which is substantially less than 90°.

The air flow along the main tube is produced by a motor driven fan or blower **25**, FIGURE 1, which is provided with an outlet mouth **26** which communicates with the end of the main tube **14**. The blower **25** thus produces an air flow along the main tube in the direction of the arrows. It is desirable, as already mentioned, to produce only a rather gentle air flow along the main tube, sufficient to propel a stocking along the tube to its destination without risk of damaging it. Such a gentle flow could be accompanied by failure of the transmission function were it not for the before-mentioned venturi effect. Another important feature of the invention, however, which still further rules out any possibility of transmission failure, consists in providing a compressed air line **30** to each branch tube **13**, see especially FIGURE 2. The compressed air lines **30** are fed from a pipe **31** and each line **30** is curved round to deliver into the closed end of the branch pipe **13**, which is fitted with an end closure **32** having the air line **30** fitted to it. The stockings, therefore, as they drop down from the take-down tube **11** into the receiving tube **12**, are subjected to a jet of compressed air immediately on entering the branch tube **13** and are thus given a positive impetus which is adequate to blow them along the branch tube **13** into the main tube **14**. In some cases the onset of the air jet through the air lines **30** will be derived automatically by means actuated from the respective knitting machines as each completes the knitting of a stocking. In other cases the control unit **19** will embody means for initiating the air jets. The wiring for electrical circuitry can be enclosed in ducting represented at **34**, FIGURE 2.

It will be evident that the electrical circuitry may vary within wide limits according to the lay-out of the system and the precise functions of control which are to be exercised.

In some cases, for instance, the stockings are in accordance with the normal practice obtaining at certain factories, identifiable in themselves, that is to say each knitting machine has some individual way of marking the stockings knitted upon it, so that its output can be readily distinguished from the output of the other machines in the system. One of the ways in which this is sometimes achieved is by means of a coloured thread. In these cases, the system of the present invention has only to provide for the propulsion of the goods from the machines to the point of destination, without making provision at the examining station for indicating from which machine each stock has come. Moreover in many factories it will not be regarded as essential for the staff at the examining station to control delivery from the knitting machines. It will be sufficient if each machine, on completion of a stocking, automatically initiates the transmission of that stocking to the examining station. When a stocking is knitted and delivered, therefore, the air flow will be set up and transmission will follow without manual intervention. This may be regarded as the simple basic form of control, and a typical example of circuitry for enabling this to be achieved is illustrated in FIGURE 4. Control for two machines only is shown, it being evident that the circuitry can be repeated for any number of machines to suit each particular installation.

Each machine has associated with it a cam, **40**, **41** respectively, so that the cams are operated in synchrony with the knitting cycle of the machine, for example the cams may be fitted to the cam rings on the knitting machines. Each machine also has a switch **42**, **43** respectively, fitted to it. When the first machine completes the knitting of a stocking its cam **40** closes the contacts of the switch **42**, which allows an electric current to flow from one side of a metal rectifier **44** through the solenoid coil of a relay **46** and the energisation of the solenoid closes the contacts of three further switches **47**, **48**, **49**. The switch **47** bridges the switch **42** and keeps the solenoid of relay **46** energised when the cam **40** moves the switch **42** to the off position. The switch **48** on being closed actuates an air control valve **50** by which the jet of compressed air is operated through the air line **30** into the branch tube **13**. The switch **49** on being closed completes the circuit controlling the blower **25** which is thus caused to create the air flow along the main tube **14**. Alternatively the blower may not be connected with the switch and the air flow down the main tube may be continuous instead of being switched on and off at the same time as the air jets in the branch tubes. The switch **49** simultaneously sends current through a delay switch **51**, which may be of the well-known mercury type, and after the prescribed delay the delay switch opens and closes the contacts of a switch **52**. This stops the flow of current to the primary winding of a transformer **53** from the external source or mains **54**. Consequently the relay **46**, air jet control **50** and blower **25** are all de-energised, and while the air jet through tube **13** shuts off at once, the blower **25** rotates for a short time by impetus and provides sufficient air flow along the main tube **14** to carry the stocking to the examining station. The cam **41** and switch **43** on the second machine are similarly associated with duplicate switches **47a**, **48a**, and **49a** controlling a second air jet control valve **50a** and similarly associated with the blower and mains circuitry. Additional contacts **55** are indicated in dotted lines wired up to an indicator system **56** embodying a numbered or otherwise identifiable light for each machine, for use in cases where the articles have no means of identification in themselves and the examiner is thereby shown from which machine an article has come.

FIGURE 5 shows a modification of the system for use in those cases where it is not desired to initiate transmission of stockings automatically as explained with reference to FIGURE 4, but instead the transmission is initiated by an operator in the examining station. In this modification the circuitry for one machine only is illustrated but obviously it can be extended to the remainder in the system. The machine has an associated cam **40** and switch **42** as in the case of the FIGURE 4 arrangement. The switch **42** when its contacts are closed by the cam energises the solenoid of a relay **60** which closes the contacts of two switches **61**, **62**. The switch **61** retains the relay solenoid energised when the switch **42** has moved to the off position. The switch **62** allows electrical current to pass to a signal lamp **63** at the control unit **19** in the examining station. Obviously there will be a different lamp for each machine in the system and the lamps may be distinguished by numbers or in any other convenient way. Each lamp has associated with it a switch, for instance a press button, by operating which the operator completes a circuit which is controlled by the button. The press button switch is indicated at **64** and the contacts which it controls at **66**. These allow current to flow to the solenoid of a relay **67**, closing the contacts **68**, which completes a circuit through an air control valve **69**, from which is derived the operation of the air jet which blows the stocking through the branch tube **13** into the main tube **14**. The relay **67** simultaneously closes contacts **70** and a current is thus sent through a time delay switch **71** which in turn transfers current to the blower **25**. The air generated by the blower effects the transmission of the stocking along the main tube **14** to the examining station. The operator can then re-open the contacts **66**, and thus re-set the circuit in readines for the next cycle of operations.

It may be desirable, either in the FIGURE 4 or FIGURE 5 arrangements, to provide an alarm or indicator circuit, by which the examiner has a movable switch with a number of contacting positions, one for each machine

in the system, correspondingly numbered or identified to agree with the indicator lamps **63**, so that when a machine is faulty the operator can move the switch to the appropriate contact corresponding to that particular machine and so operate an alarm on the indicator panel **20** alongside the machines, showing which machine requires attention. The arrangement shown in FIGURE 6 provides for this. The movable switch is shown as two rotary components, one **75** corresponding to tens and one **76** to units so that an examiner on discovering faulty work can turn the switch components to the appropriate number corresponding to the number of the machine which has produced the faulty work. The examiner can then operate a switch **77** by means of a button or the like **78**, which allows current to energise the solenoid of a relay **79** which in turn closes contacts **80**, **81**. The former on closing permanently bridges the switch **77** and keeps the relay **79** energised at the same time passing a current through the signal lamp **63**. The contacts **81** on closing allow the current to flow through small resistances **82**, **83** to the anodes of digital valves **84**, **85** respectively, thus completing the circuit through the cathodes of the valves according to the position of the rotary switch components **75**, **76**. This illuminates the number or numbers of the digital valves selected by the examiner and also operates a flashing light **86** on the panel **20**. Moreover in the case where each individual machine is driven by its own individual electric motor, this same circuit which operates the light **86** may also switch off the motor of the faulty machine and at the same time if required illuminate a tell-tale light associated with the individual machine. When the mechanic or other person has rectified the fault on the machine in question, a cancelling press button on the panel **20**, indicated at **87**, can be operated, to break the flow of current to the solenoid of the relay **79**, thereby causing the signal lamp **63** to be de-energised and the contacts **80** and **81** to open, which in turn stops the flow of current to the digital valves **84**, **85**.

It will be understood that the apparatus described herein, and in particular the electrical circuitry and components, are capable of wide variation within the scope of the invention.

I claim:

1. A pneumatic transmission system comprising a main tube, means for blowing air into one end of the tube, an examining station at the other end of the tube, a plurality of branch tubes leading into the main tube at intermediate points along its length, means for directing a jet of air through each branch tube towards the main tube, and means for operating the said air jets concurrently with receipt by the respective branch tube of an article requiring transmission to the examining station, each branch tube is associated with one of a group of knitting machines, and in which the operation of the air jets is effected by electrical circuitry and valve means associated with each branch tube in the system, and each air jet is operated through the medium of an electrical switch operated by a cam synchronized with the working cycle of the associated knitting machine.

2. A pneumatic transmission system comprising a main tube, a plurality of branch tubes leading into the main tube at intervals along its length, means for blowing air along the main tube, means for blowing air along each branch tube towards the main tube, a delivery end on the main tube, an examining station at the delivery end, and means at the examining station for initiating the air flows to effect the transmission of an article from any one of the branch tubes into the main tube and thence to the examining station, indicating means at the

examining station corresponding to each branch tube, means associated with each branch tube operatively associated with the indicating means in the examining station, by which an indication can be given at the examining station to show from which branch tube an article is ready for transmission, and by which the operator at the examining station can initiate the air flows necessary to effect that transmission.

3. A pneumatic transmission system comprising a main tube, a plurality of branch tubes leading into the main tube at intervals along its length, a motor driven blower positioned to direct an air flow into the main tube from one end to the other thereof, an air jet positioned on each branch tube to direct a jet of air under pressure along the branch tube towards the main tube, and means controlling the said air flows by which they can be brought into operation when it is required to transmit an article and shut off when the said transmission is completed, a series of connecting members one associated with each branch tube and with a knitting machine positioned to discharge its output into the connecting member, a cam synchronized with the knitting cycle of each machine, a switch operable by each cam, and means automatically responsive to the actuation of each switch by its associated cam serving to initiate the air flows.

4. A pneumatic transmission system comprising a main tube, a plurality of branch tubes leading into the main tube at intervals along its length, a motor driven blower positioned to direct an air flow into the main tube from one end to the other thereof, an air jet positioned on each branch tube to direct a jet of air under pressure along the branch tube towards the main tube, and means controlling the said air flows by which they can be brought into operation when it is required to transmit an article and shut off when the said transmission is completed, a series of connecting members one associated with each branch tube and with a knitting machine positioned to discharge its output into the connecting member, a cam synchronised with the knitting cycle of each machine, a switch operable by each cam visual indicating means responsive to the actuation of each switch situated at a point remote from the knitting machine, and further switch mechanism positioned near the visual indicating means by which the requisite air flows can be initiated.

5. A pneumatic transmission system comprising a main tube, a plurality of branch tubes leading into the main tube at intervals, a delivery end on the main tube, the branch tubes leading into the main tube at angles of less than 90° therewith in the direction of the delivery end thereof, each branch tube having an end portion projecting into the main tube, said end portion being inclined so that it projects into the main tube chiefly at the side furthest from the delivery end and merges into the main tube at the side nearest the delivery end, a blower serving to create a flow of air along the main tube towards the delivery end, means for intermittently blowing a jet of air into each branch tube towards the main tube, and means for synchronizing the action of each jet of air with the delivery of an article into the individual branch tube.

6. A pneumatic transmission system as claimed in claim 5 in which the blower is also subjected to the control of the intermittently acting means.

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