April 21, 1964 C. C. SAMPSON ETAL 3,129,573

HOSIERY DELIVERY APPARATUS AND METHOD

Filed June 21, 1961 2 Sheets-Sheet 1

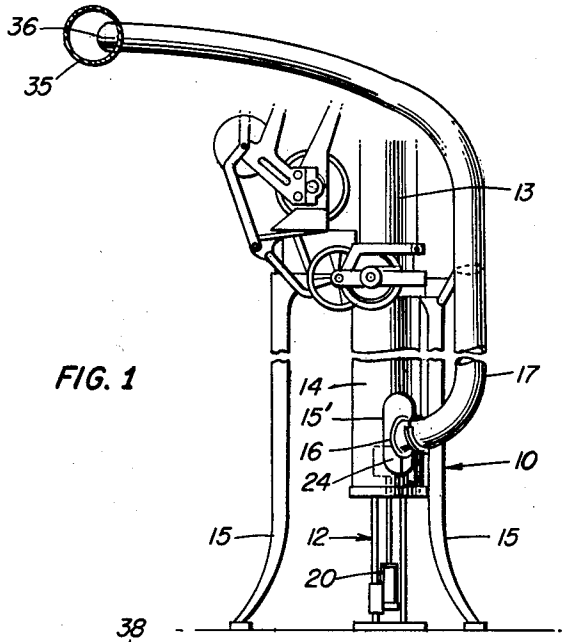


FIG. 1

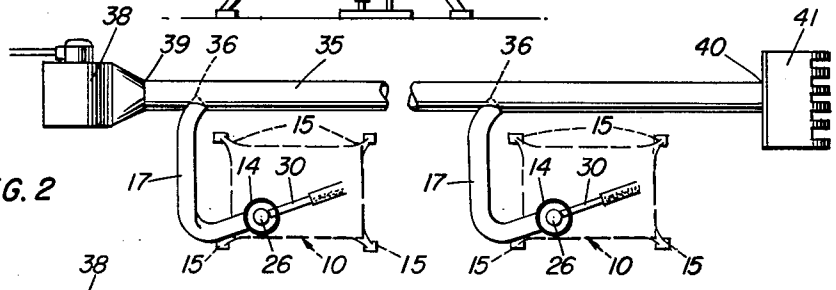


FIG. 2

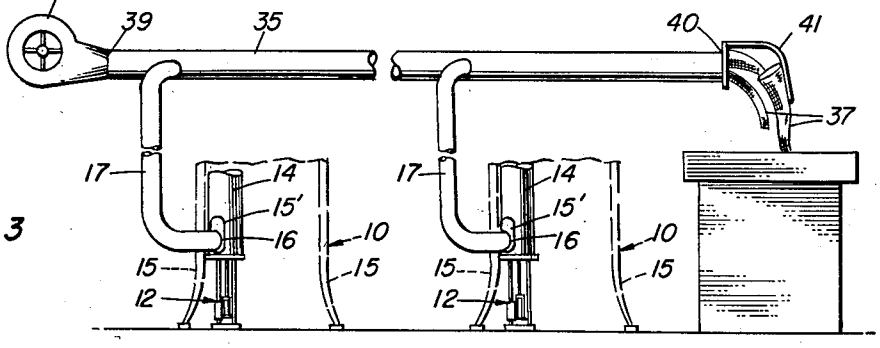


FIG. 3

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HOSIERY DELIVERY APPARATUS AND METHOD

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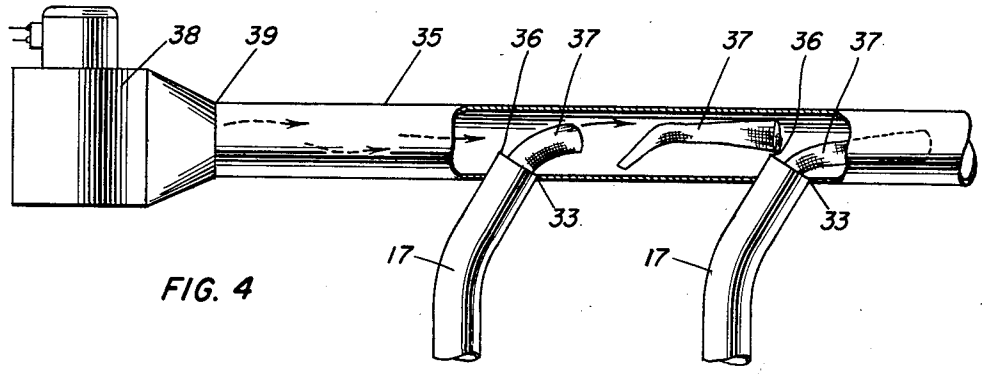


FIG. 4

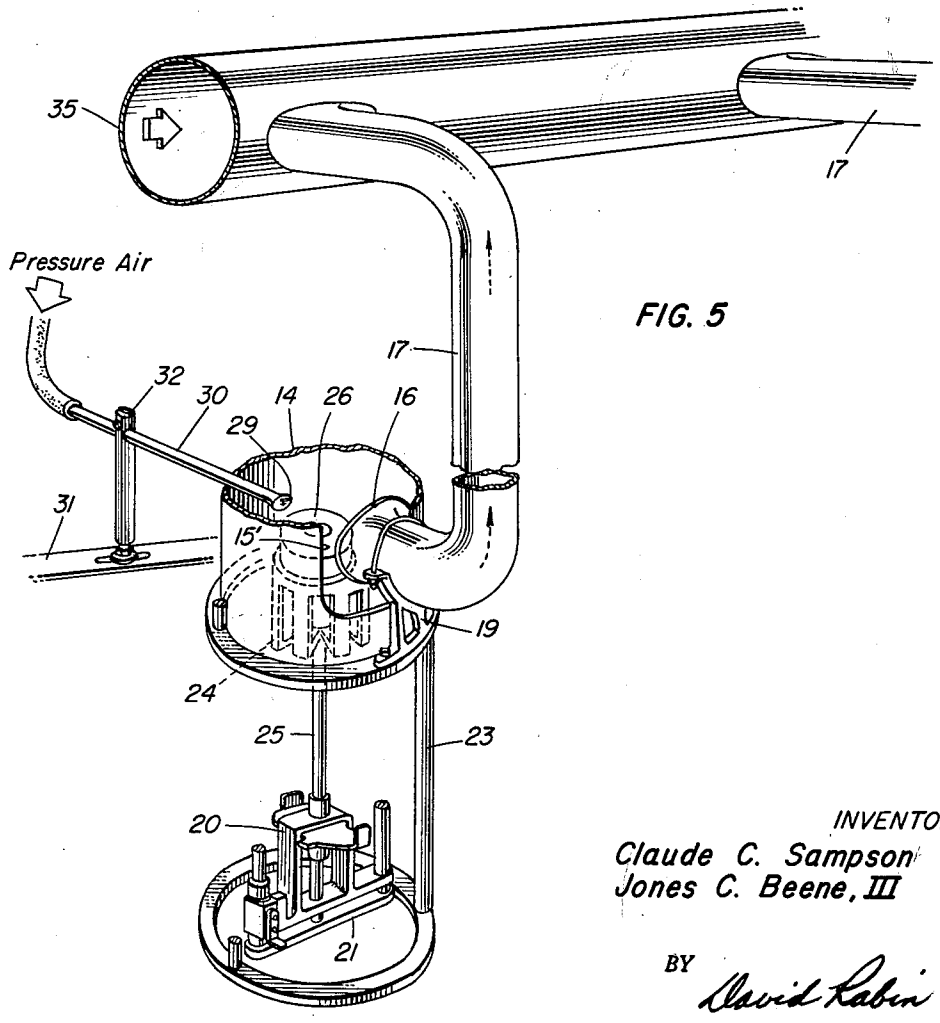


FIG. 5

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HOSIERY DELIVERY APPARATUS AND METHOD

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3 Claims. (Cl. 66—147)

This invention relates to a pneumatic conveyor system and method for transporting hosiery automatically from a battery of circular knitting machines to a central remotely located depository.

It has been the general practice in the manufacture of ladies' seamless hosiery knit on individual circular knitting machines to have each stocking knit on each individual knitting machine collected manually by a knitting machine attendant who customarily is responsible for supervising a battery of from twenty to thirty individual knitting machines. The task of collecting the individual stockings from each knitting machine is one which requires the operator to move along the machine aisle and remove each individual stocking after the completion of each knitting cycle for each machine. A substantial number, if not each stocking, is preliminary inspected for length standard and for defects by placing stocking on a hosiery-measuring board or form that is generally supported on a mobile cart or table as the operator moves from one machine to another collecting stockings discharged from each machine. The collected stockings are separated and sorted into suitable trays that may be either supported on the same mobile cart as the hosiery-measuring form or the trays will be located at a suitable position adjacent to the central or end knitting machines aligned in the battery or row of machines being tended.

The various types of ladies' seamless or circular knitting machines presently being employed incorporate various mechanisms and attachments for applying tension to the stockings during the knitting thereof for achieving uniform stitch length and these mechanisms and attachments may be either of the mechanical pull-down type or of the pneumatic or suction type. In many installations, the completed knitted stocking, before seaming or looping, is deposited at the knitting machine in a suitable receptacle or tray to await manual removal by the attendant.

Excessive handling of sheer ladies' hosiery results in a high incidence of defects and necessitates time consuming repairs, where possible. Also, excessive handling of hosiery is costly and time consuming and prevents the machine attendant from making more periodic adjustments and examination of each of the machines under his supervision.

Heretofore various types of pneumatic devices have been employed for various textile products, including bags, pillowcases, stockings, among other articles, in which the articles have been further processed as by removing yarn ends from hosiery, inspecting and everting hosiery and moving hosiery from one operational location to another of which the following patents are representative: United States Patents, Nos. 603,697; 964,959; 1,367,017; 2,684,187; 2,873,596; 2,979,802; Re. 24,316 and British Patent No. 217,980 of 1924.

The present invention contemplates the combination of a pneumatic hosiery conveyor system integrally connected to a battery of circular knitting machines arranged in suitable alignment in which knitted stockings from each individual circular knitting machine may be individually discharged pneumatically and automatically into a central conduit through which a constant flow of air is maintained at sufficient volume and velocity to induce the stockings from each machine to flow through a conduit to a remotely located station or depository for collection and inspection by an operator thereby reducing

operator fatigue and hosiery defects, such as picks and pulls, caused by excessive handling.

A primary objective of this invention is the provision of a pneumatic hosiery handling system for a battery of ladies' circular knitting machines in which knitted hosiery may be removed from each machine automatically and conveyed to a suitable remote location with a minimum of manual handling.

A further objective of this invention is to provide a hosiery handling apparatus in which there is a central pneumatic conveyor for automatically receiving and moving hosiery knit on a battery of circular knitting machines and for discharging the collected hosiery at a remotely located position.

It is a further objective of this invention to minimize the amount of manual handling and transporting of greige hosiery before looping or seaming in order to reduce the incidence of defects resulting from such handling.

Still another objective of this invention is to reduce the cost of hosiery production by enabling a single operator to supervise a greater number of knitting machines than he is now capable of supervising with decreased fatigue and effort than is now experienced.

Yet another object of this invention is to provide a pneumatic conveyor system in which stockings flowing in the main duct air stream will be deflected from individual entering branch lines leading from each knitting machine thereby avoiding the problem of clogging the system.

A still further objective of this invention is to provide a method of knitting, handling and conveying hosiery automatically from a battery of circular knitting machines to a remotely located station.

Other objectives and many of the attendant advantages of this invention will become more readily apparent for this system of pneumatically handling hosiery from the following detailed description of the invention taken in conjunction with the accompanying drawing in which like characters of reference designate corresponding parts throughout the several views, and wherein:

FIG. 1 is a partial side elevational view of a circular knitting machine shown in combination with a hosiery discharge conduit, with portons removed, and a central collecting duct, in transverse section;

FIG. 2 is a schematic top plan view of a battery of spaced-apart circular knitting machines, and illustrating only two such machines, shown in block form, having a pneumatic conveyor duct with branch lines leading from each machine to a common duct;

FIG. 3 is a front elevational view of FIG. 2 illustrating the duct arrangement connecting two circular knitting machines in outline form;

FIG. 4 is enlarged partial top plan view of the pneumatic conveyor duct with two branch conduit lines leading from two circular knitting machines and illustrating the flow of stockings through the duct under the influence of the flow of air therein; and

FIG. 5 is an enlarged partial perspective view illustrating the pneumatic conveyor of the present invention in combination with a mechanism for pulling hosiery down on a circular knitting machine.

Referring now to the drawings, there is illustrated in FIGS. 1 and 2 the lower portion or base 10 of a ladies' circular knitting machine of the type employed for knitting ladies' seamless hosiery, and for convenience, nonlimiting reference will be made to the model "KN" circular knitting machine manufactured and sold by Scott and Williams, Inc. of Laconia, New Hampshire. As the lower portion of the knitting machine is the only essential portion that need be described for a full and complete understanding of this invention, as the invention does not relate

to the actual knitting or knitting instrumentalities, brief reference will be made to one means only for removing hosiery during knitting in the downward direction and thereafter removing the knitted stockings from the machine by utilization of a conventional grab take-up mechanism 12. Such mechanism is a standard apparatus manufactured by Scott and Williams, Inc. and is more fully disclosed in U.S. Patents, Nos. 2,625,036 and 2,709,352. The grab take-up mechanism 12 is positioned axially with regard to the needle cylinder beneath the cylinder raising tube 13 and the cylindrical delivery tube 14 that is supported within the machine frame legs 15 and in axial alignment with the cylinder raising tube to receive a stocking therefrom during the knitting cycle. The delivery tube 14 is provided with an opening 15' in the cylindrical wall through which the flared-mouth hosiery-receiving inlet end 16 of the fabric take-up tube or conduit 17 is supported in the saddle of bracket 19 mounted on the wall of fabric take-down tube 14.

The fabric tube clamp, cylinder raising tube, bracket and related components are shown as they are conventionally employed on the Scott and Williams model KN circular knitting machine with the grab take-town device forming no part of this invention except as employed in combination with the apparatus and method for automatically removing and delivering hosiery to a remote location.

The carriage assembly 20 mounted on the lower rail support 21 is guidably supported for vertical movement along a pair of vertical guide rails 23, only one of which is shown in FIG. 5. A rotatable fabric cup 24 is mounted at the upper end of rod 25 for cooperative engagement with the fabric clamp 26 for releasably gripping a stocking welt therebetween as the welt is knitted and blown into clamping relation when the carriage assembly 20 is elevated through a pulley and cable arrangement (not shown) thereby raising the cup and clamp 24 and 26 to the proper position. The grab take-up mechanism will releasably engage the welt portion of a stocking being knit and draw the stocking downwardly so that upon completion of each successive stocking, the clamp and cup will be positioned in the location shown in FIG. 5 at which time the welt will be released automatically and through suitable actuating means, such as a micro-switch, a blast of air will be directed against the welt portion of the suspended stocking from the nozzle 29 on the end of the air line 30 that is supported on the frame rail 31 through the stanchion 32. The air line 30 projects into the tube 14 directly in line and in spaced relation with the flared-mouth of the fabric conduit inlet 16. The blast of air impinging against the stocking welt will force it into the fabric conduit 17 with sufficient force and velocity that the stocking will follow a path of travel through the conduit 17 to be discharged at the terminal end 33 thereof which projects into the interior of the manifold duct 35 having a diameter substantially larger than the diameter of the conduit 17. The blast of air for transferring the completed knitted stocking from the delivery tube 14 from out of its first directed path of travel into the fabric conduit 17 is normally an intermittent blast of air that may commence after the grab take-up mechanism has descended to the position shown in FIG. 5 and for a few seconds during which time the stocking is released from the cup and clamp.

It has been found desirable for optimum operating conditions to have each of the individual fabric ducts 17 irrespective of the conduit curvatures to have the outlet ends 33 and a section of the line adjacent thereto enter the manifold duct at an acute angle with the upstream side of the duct and for a portion of the conduit 17 extend into the interior of the duct 35 to form a projecting ferrule 36 which serves as a baffle and damper for the conduits 17 preventing stockings 37 flowing through the duct from conduits upstream re-entering downstream conduits. Furthermore, the baffle or ferrule 36 will protrude sufficiently into the duct 35 to have the main stream of air flowing under sufficient velocity head and volume in the duct 35 to cause an induced draft or suction in the conduits 17 thereby further inducing the flow of stockings into the main duct. Although the mitered ends 36 of the conduits are formed from the conduits 17 which have a circular cross-section, a suitable shield or plate may be mounted on the interior of the duct closely adjacent to the opening 33 which will serve substantially the same purpose. It has been preferred to employ clear plastic piping or duct-work so that an operator may visually determine whether any of the stockings clog either the branch conduits 17 or the manifold duct 35.

A centrifugal blower 38 having an electric motor for rotating the fan is mounted at one end 39 of the duct 35 with the other end 40, preferably located at a position remote from the battery of aligned spaced-apart circular knitting machines, and has a stocking deflector hood mounted thereon to divert the stockings being discharged through the discharge end 40 of the duct. The individual stockings being knitted on each of the machines is discharged into its respective conduit 17 and upon introduction into the duct 35 will be commingled with stockings from other knitting machines discharged into their respective conduits with the commingled stockings being deposited into a suitable receptacle or inspection table at the remote location. An inspector may then examine each of the stockings without the necessity of walking from one machine to another and examining the stockings at the machines. Suitable indicia may be knit into each of the stockings to designate the specific machine on which the stocking has been knit enabling an attendant to make any repairs to the specific machine knitting a defective stocking.

It has been found practical to employ the pneumatic hosiery conveyor and collection system for a battery of aligned circular knitting machines from approximately 25 to 35 in number. Although in FIGS. 2 and 3 the conduits 17 enter along the same side of the duct 35, it is satisfactory to have machines mounted on the opposite side discharge stockings into the duct 35 but the conduits 17 should be staggered to prevent a stocking being discharged into the opposite machine conduit outlet.

Although the application of the pneumatic conveyor and collecting system for hoisery has been described in conjunction with a grab take-up mechanism employed on Scott and Williams model KN machines, it may be employed very effectively with pneumatic or suction take-down systems. It will be appreciated, however, that either a blast of air may be employed for inducing a suction through the conduit 17 or sufficient suction may be developed through the main duct 35 to induce the flow of hosiery through the conduit 17. However, the requirement for increased tension during knitting may necessitate the utilization of a separate blower or fan adjacent to the knitting machine.

As the stocking is being knit it will be drawn downwardly until it is discharged from the knitting machine into a directed path of travel through the conduit 17 wherein individual stockings produced from each knitting machine will be discharged separately into its own conduit for travel along the conduit directed path into the duct 35 where the individual conduits will permit stockings from adjacent conduits from entering and the stockings will be commingled and discharged continuously as they flow through the duct 35.

Obviously many modifications and deviations may be made within the realm of mechanical equivalents in the types of conduits and take-down devices without departing from the spirit of this invention and such modifications ar econtempelated within the scope of the appended claims.

What is claimed is:

1. The method of continuously knitting and conveying

circular knit stockings knit on a plurality of aligned circular knitting machines comprising the steps of knitting stockings continuously on individual knitting machines independent of each other, drawing the stockings downwardly during knitting on each machine, subjecting each knitted stocking to a blast of air to convey the stocking along a first directed path of travel to a location spaced from the machine, discharging all knitted stockings from the first directed path of travel into a main air stream moving in a rectilinear direction which first directed path of travel is at an acute angle with the main air stream, at least partially baffling individual stockings entering the main air stream from stockings in the main air stream, commingling and conveying pneumatically all stockings entering the main air stream, and depositing and collecting the stockings at the end of travel in the main air stream.

2. The method of continuously knitting and conveying circular knit stockings knit on a plurality of aligned circular knitting machines comprising the steps of knitting stockings continuously on individual knitting machines each independent of the other, continuously drawing the stockings downwardly during knitting on each machine, subjecting each stocking upon knitting termination to a jet of air sufficient to convey the stocking along a predetermined path of travel to a location removed from the machine on which the stocking was knit, discharging knitted stockings from out of the several predetermined directed paths of travel into a single air stream flowing in a rectilinear direction by introducing the knitted stockings into the air stream at an acute angle in the direction of flow of the main air stream, partially baffling individual stockings from engaging the entire main air stream and from stockings being conveyed within the main air stream, commingling and conveying pneumatically all stockings entering the main air stream, and depositing the stockings at a remote location removed from the knitting machines terminating the flow of the stockings in the air stream.

3. A pneumatic conveyor for use in combination with

a series of circular knitting machines each of which is spaced apart from each other and each of which is provided with means for drawing a stocking during knitting down through a fabric takedown tube, a main stocking collecting duct, means generating a continuous flow of air through said duct urging stockings discharged into said duct to flow with the air to an end of the duct, an individual conduit connected to each machine take-down tube and the main stocking collecting duct to convey a completed knit stocking from the machine take-down tube to the main duct, each of said individual conduits entering the main duct at an acute angle in the direction of air flow therein, an air jet in the take-down tube for subjecting a knitted stocking to an air blast urging the stocking to flow through said individual machine conduit to the main duct wherein knitted stockings of the other machines are deposited and commingled while flowing through the main duct to a collection area where the stockings are discharged, said individual conduits project at least partially into the main duct air stream forming a baffle upstream thereby deflecting stockings discharging into the main duct further upstream in the duct precluding blockage and re-introduction of a stocking into an individual conduit and the air flow in the main duct reduces the air pressure in the individual conduits augmenting individual stocking flow from the air blast.

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