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[54] **WAD OR PLUG CONTROL FOR STUFFER-BOX CRIMPING APPARATUS**

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[56] **References Cited**

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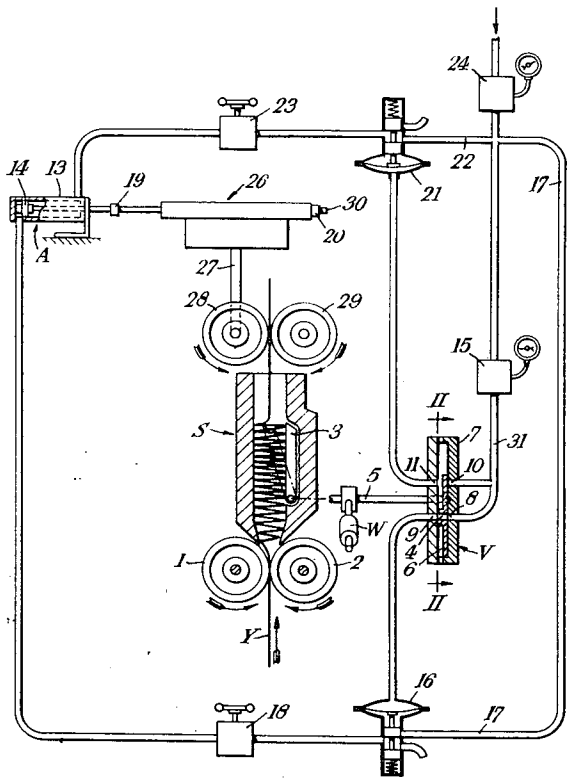
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[57] **ABSTRACT**

A variable drive for controlling the relative speeds at which textile material is fed to and is withdrawn from the chamber of a stuffer crimper.

A member senses the level of the core of crimped yarn within the chamber and actuates fluid operated control mechanism to vary the drive ratio so as to maintain the core at a desired level in the stuffer crimper.

4 Claims, 2 Drawing Figures



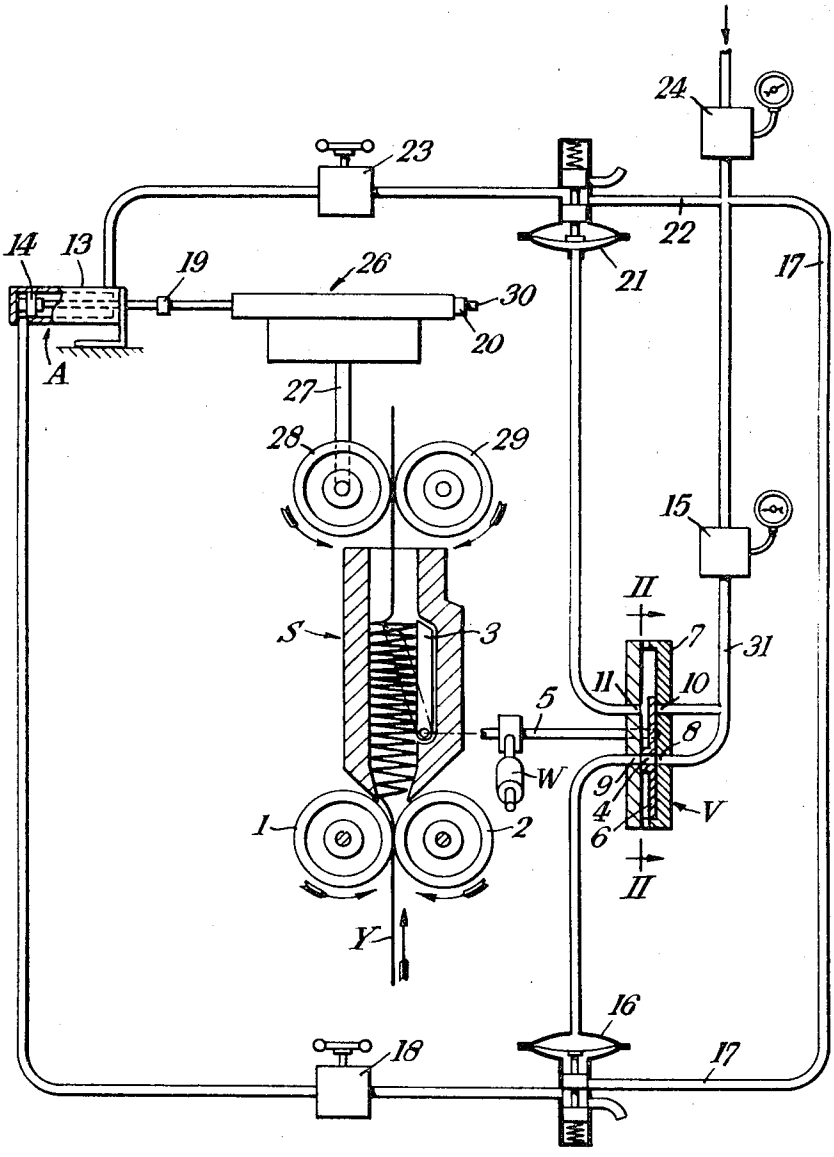


Fig. 1.

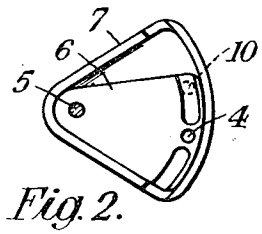


Fig. 2.

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WAD OR PLUG CONTROL FOR STUFFER-BOX CRIMPING APPARATUS

The present invention relates to stuffer-box crimping apparatus as used for producing crimped textile materials.

It is known in such apparatus to introduce filamentary material to a stuffing chamber by means of a pair of feed rollers and to withdraw material continuously from the other end of the stuffing chamber at a rate lower than the feed rate. In such apparatus various means have been used for measuring the height of the wad of material in the stuffer-box and controlling the feed or delivery in dependence upon the measured height to ensure that a continuous operation can satisfactorily be carried out.

An object of the present invention is to provide in a stuffer-box crimping apparatus an improved height control system to enable a continuous operation to be carried out.

According to the present invention there is provided stuffer-box crimping apparatus comprising a stuffing chamber, feed means for feeding material to be crimped into one end of the stuffing chamber, delivery means for delivering crimped material from the other end of the chamber, and control means for controlling the speed at which the material is fed to the chamber or is withdrawn from the chamber to control the position of the head of the wad of the material in the chamber, said control means comprising a movable member movable in response to a movement of the head of the wad of the material in the stuffing chamber and fluid-operated control means operated by movement of said movable member in one sense to adjust the speed of the feed means or the delivery means to cause an advancement of the head of the wad of the material in the stuffing chamber and by movement of the movable member in an opposite sense to adjust the speed of the feed means or the delivery means to cause a retraction of the head of the wad of the material in the stuffing chamber.

Preferably, the fluid-operated control means lie outside the stuffing chamber and not in fluid connection therewith.

In a preferred embodiment of the invention, said fluid-operated control means includes a pneumatically operated actuator having a movable element movable in one sense in response to air under pressure applied to a first inlet thereof and movable in an opposite sense in response to air under pressure applied to a second inlet thereof, said movable element is connected to a control input of a variable speed drive unit, the output shaft of which is connected to drive the feed means or the delivery means, and movement of said element is effective to vary the speed of said feed means or delivery means.

In the preferred embodiment of the invention said fluid-operated control means further comprises a first auxiliary control valve for controlling the supply of air under pressure from said first inlet of said pneumatically operated actuator and a second auxiliary control valve for controlling the supply of pressurized air from said second inlet of said pneumatically operated actuator, and said auxiliary valves are operated in response to air under pressure from a switching valve connected to and operated by the movable member.

One embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:-

FIG. 1 is a schematic diagram of a stuffer-box crimping apparatus according to the invention, and

FIG. 2 is a view taken on the line II—II in Fig. 1 of a part of the apparatus shown in Fig. 1.

Referring to Fig. 1 of the drawing, a continuous multifilament tow Y of a synthetic material is fed by feed rollers **1** and **2** to a stuffing chamber S in which the tow is compressed against a wad of material already in the chamber in the well known manner and from which it is withdrawn by delivery rollers **28** and **29** arranged to be driven at such a speed and in such a manner hereinafter to be described as to maintain the head of the wad of material in the stuffing chamber S at a predetermined level in the stuffing chamber.

At the position at which it is required to maintain the head of the wad of material, there is provided a pivotal member **3** upon which an advancement of the head of the wad of material assumes the position shown in full line in the drawing and upon a retraction of the head of the wad of material pivots into the chamber to take up a position as shown in broken line in the drawing.

The pivotal member **3** is fixedly mounted on the end of a horizontal shaft **5** which passes rearwardly through the wall of the stuffing chamber S and into a valve V which is further illustrated in Fig. **2** and which comprises a rotatable valve element **6** secured to the end of the shaft **5** and a stationary valve body **7**. In schematic Fig. **1**, it is to be understood that member **3** is shown in a position rotated 90° from its actual position relative to shaft **5**. Suffice it to say that in practice, member **3** rotates directly with shaft **5** about the axis of the latter. Two pressurized air supplies are used, one regulated by valve **24** providing a high pressure service and one regulated by valve **15** providing a low pressure service. Low pressure air from regulator **15** is fed via pipe **31** to two inlet ports **8** and **10** in the valve body **7** and the arrangement is such that movement of the pivotal member **3** between the position shown in full line in the drawing and the position shown in broken line causes a port **4** in the element **6** to connect the inlet port **8** with an outlet port **9** in the valve body **7**, or alternatively to connect the inlet port **10** with an outlet port **11** in the valve body **7**.

The outlet ports **9** and **11** are connected to two diaphragm operated valves **16** and **21** which function as step up relays by controlling the flow of high pressure air received from valve **24** to which they are connected by pipes **17** and **22**. These valves **16** and **21** control the supply of pressurized air to the ends of a cylinder of a pneumatic actuator A. The valve **16** in response to air under pressure from the outlet port **9** of the valve body **7** connects the left-hand end of the cylinder **13** of the actuator A to atmosphere via flow control valve **18** and valve **16**. Upon release the connection linking this end of the cylinder **13** with pressure line **17** is re-made. In the same way, the control valve **21** in response to pressurized air from the outlet port **11** of the body **7** connects the right-hand end of the cylinder **13** of the actuator A to atmosphere via the flow control valve **23** and valve **21**. Upon release the connection linking this end of the cylinder **13** of the actuator A with the pressure line **22** is remade.

The cylinder 13 of the actuator A is rigidly fixed to the machine frame and piston 14 is arranged for horizontal reciprocatory movement.

A shaft 30 is connected to a variable speed drive unit 26, the variable output shaft 27 of which is coupled to drive the delivery rollers 28 and 29. Stops 19 and 20 are provided on the shaft 30 to limit the extent of the traverse of the piston 14 in each direction.

In operation, when the head of the wad of material in the stuffing chamber S rises above the required level, it causes the pivotal member 3 to pivot to the position shown in full lines with the result that the rotary valve element 6 turns to the position shown in the drawing in which the port 4 connects the ports 8 and 9, with the port 11 being connected to atmosphere. Air under pressure is then applied to control valve 16 which is operated thereby to connect the left-hand end of the cylinder 13 of the actuator A to atmosphere via flow control valve 18 and valve 16, thus causing the piston 14 as viewed in the drawing to be displaced horizontally to the left in Fig. 1 and take up the position shown in the drawing at which it is brought to rest by the stop 20. Displacement of the piston 14 causes a predetermined increase in the speed of the output shaft 27 of the variable speed drive unit 26. The delivery rollers 28 and 29 are thereby speeded up and as a result of the increased delivery rate of the material from the stuffing chamber S the head of the wad of material begins to fall. As it does, pivotal member 3 advances into the chamber and the valve element 6 then moves so as to bring the port 4 out of alignment with the ports 8 and 9 and at the same time to provide a connection of the port 9 to atmosphere. As a result, the valve 16 releases and connects the left-hand end of the cylinder 13 to pressure line 17. The piston 14 of the actuator A is thereby immobilized in the position to which it has been moved and the increased delivery rate is maintained. As the level of the head of the wad of material falls still further, the pivotal member 3 advances further into the chamber and the shaft 5 turns the valve element 6 until a position is reached in which the port 4 in the valve element 6 connects the ports 10 and 11 of the valve body 7. Pressurized air is then supplied to the valve 21 which is operated, thereby connecting the right-hand end of the cylinder 13 to atmosphere via the flow control valve 23 and valve 21 and causing the piston 14 to move to the right and come to rest by engagement of the stop 19 with the end of unit 26. As a result the variable-speed output shaft 27 reduces in speed and there is then a corresponding reduction in the rate of delivery of the material from the stuffing chamber S. The head of the wad of material then begins to rise again, causing the pivotal member 3 to move gradually to the upright position shown in full line. During the initial stage of this movement the valve element 6 turns to a position in which the port 4 is out of alignment with ports 10 and 11 and the port 11 is connected to atmosphere. As a result the valve 21 releases, causing the right-hand end of the cylinder 13 to be connected to the pressure line 22 via the flow control valve 23. The piston 14 is thereby immobilized in this position and the reduction in delivery rate of the material from the chamber S is maintained until such time as the head of the wad of material brings the pivotal member 3 to a vertical position in which the port 4 in the valve element 6 again comes into alignment with the ports 8 and 9 in the valve body 7, whereupon the cycle of operation is repeated by an increase in the delivery rate of the material from the stuffing chamber S.

It will be seen that the pivotal member 3 is provided in region of the lower end of the stuffing chamber S and is loaded by a weight W to exert a predetermined pressure on the material being advanced into the lower end of the chamber by the feed rollers 1 and 2.

The stuffer-box crimping apparatus as hereinbefore described may be for example be employed for crimping a continuous multifilament tow of such synthetic materials as polyamides, polyester and polypropylene.

Stops 19 and 20 may be made adjustable along the shaft 30 to provide for the setting of different limiting higher and lower delivery roller speeds.

In the embodiment of the invention hereinbefore described with reference to the drawing, the control valves 18 and 23 have been so adjusted to pass air to atmosphere that the piston 14 moves at such a speed that it comes to the end of its excursion determined by the stop 19 or stop 20 before it is immobilized by he application of line pressure to both ends of the cylinder 13. If desired, however, the control valves 18 and 23 may be so set that the piston 14 moves very slowly, the movable member 3 in moving from its limiting position immobilizing the piston 14 before it is arrested by either stop 19 or stop 20. In this way, the rate of change of speed of the delivery rollers can be varied as well as the magnitude of the change of speed.

While in the preferred embodiment discussed above the level of the head of the wad is controlled by varying the speed of the delivery rollers 28 and 29, it is to be understood that the head of the wad might also be controlled by varying the speed of the feed rollers 1 and 2. Manifestly, it will be apparent to one skilled in the art that the desired result is accomplished by varying the relative speeds of the feed rollers and the delivery rollers and it is not critical which set of rollers is controlled.

What we claim as our invention and desire to secure by Letters Patent is:

1. Stuffer-box crimping apparatus comprising:
a stuffing chamber;
feed means for feeding material to be crimped into one end of the stuffing chamber;
delivery means for delivering crimped material from the other end of the chamber;
control means comprising a movable member disposed within the chamber for controlling the relative speeds at which the material is fed to the chamber and is withdrawn from the chamber to control the position of the head of the wad of the material in the chamber, said movable member being movable in response to movement of the head of the wad of the material in the stuffing chamber; and
a fluid-operated control mechanism operably connected to said movable member, said control mechanism being operable in response to movement of said movable member in one direction to adjust the relative speeds of the feed means and delivery means to cause an advancement of the head of the wad of the material in the stuffing chamber, and being also operable in response to

movement of the movable member in the opposite direction to adjust the relative speeds of the feed means and delivery means to cause a retraction of the head of the wad of the material in the stuffing chamber;

said fluid-operated control mechanism comprising a variable speed drive unit having a variable speed output element drivingly connected to at least one of said feed means and delivery means and a control input for varying the speed thereof, a pneumatically operated actuator including a movable element operably connected to said control input and movable in one direction in response to a change in pressure of air applied to a first inlet thereof and movable in an opposite direction in response to a change in pressure of air applied to a second inlet thereof, a first auxiliary control valve for directing air under pressure to said first inlet of said pneumatically operated actuator, a second auxiliary control valve for directing air under pressure to said second inlet of said pneumatically operated actuator, and a switching valve operably connected to the movable member and connected to said auxiliary valves for operating the latter, whereby movement of said movable member is effective to vary the relative speeds of said feed means and delivery means.

2. Apparatus according to claim 1 wherein said switching valve is operable to immobilize said movable element by operating the auxiliary valves to simultaneously apply air under pressure to both said first and second inlets, said switching valve being operable to actuate either auxiliary control valve to connect the corresponding one of said inlets to the atmosphere therethrough, whereby movement of said movable element is accomplished.

3. Apparatus according to claim 2 wherein said auxiliary valves include adjustment means for varying the rate at which air passes therethrough from said inlets to thereby vary the rate of change of relative speeds of said feed means and delivery means.

4. Apparatus according to claim 2 wherein said switching valve includes a movable control element, there being shaft means operably interconnecting said movable member and said movable control element for moving the latter toward a first position in response to movement of said movable member in said one direction and for moving the movable control element toward a second position in response to movement of said movable member in said opposite direction, said auxiliary control valves each having a control air pressure supply conduit, said movable control element including aperture means disposed for alignment with one of said supply conduits when said control element is in its first position and for alignment with the other of said supply conduits when said control element is in its second position whereby to selectively operate said auxiliary control valves in response to movement of said movable member in corresponding directions.

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