April 10, 1951 R. F. DYER ET AL 2,548,523

PNEUMATIC RAPID TRAVERSE FOR WINDING TEXTILE YARNS ON CONES AND TUBES

Filed Oct. 12, 1949 2 Sheets-Sheet 1

FIG. 1.

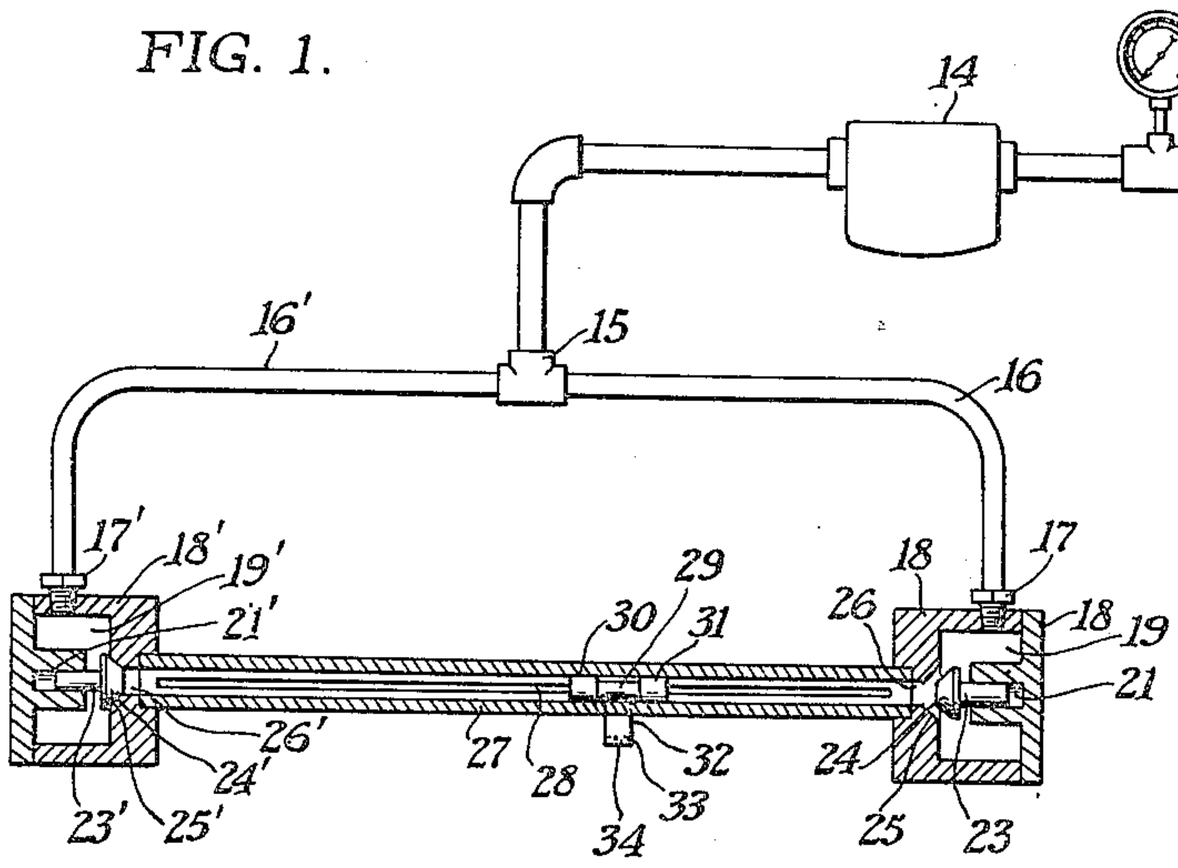


FIG. 8.

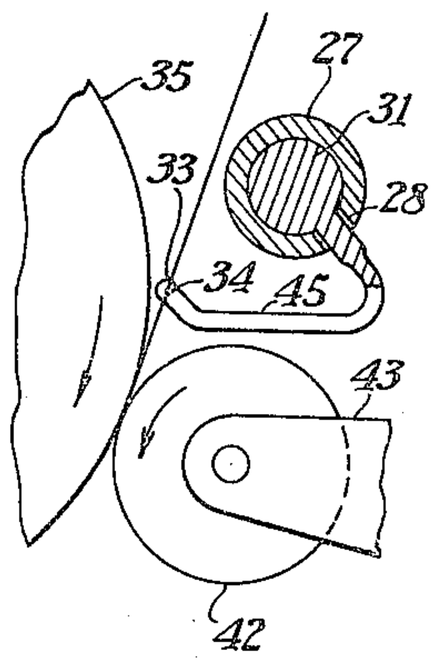
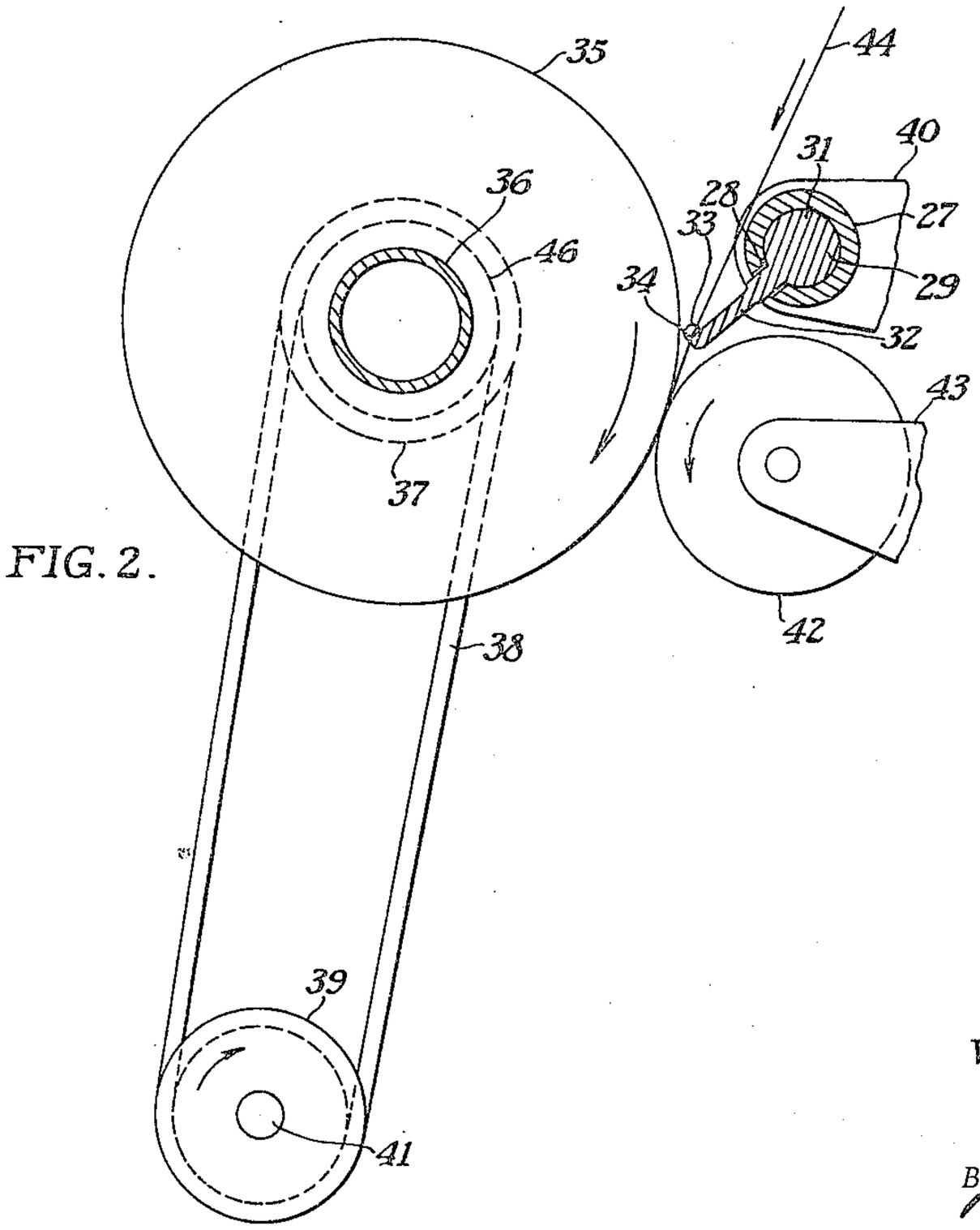


FIG. 2.



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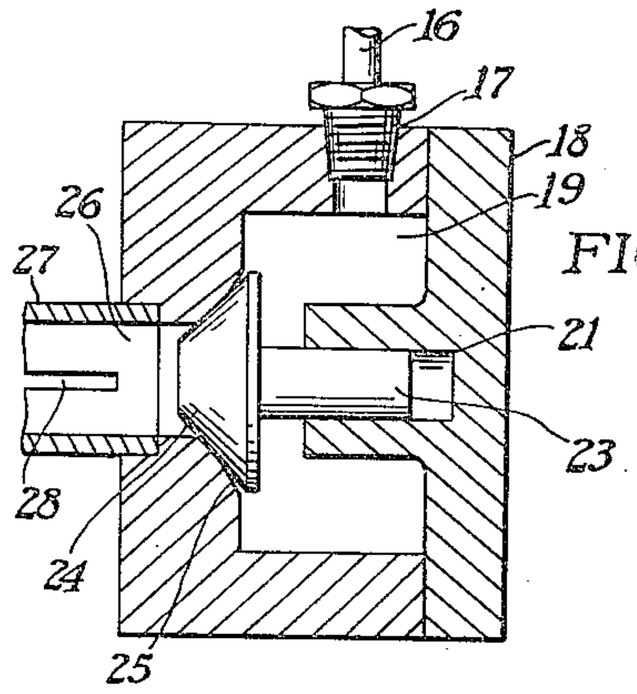


FIG. 3.

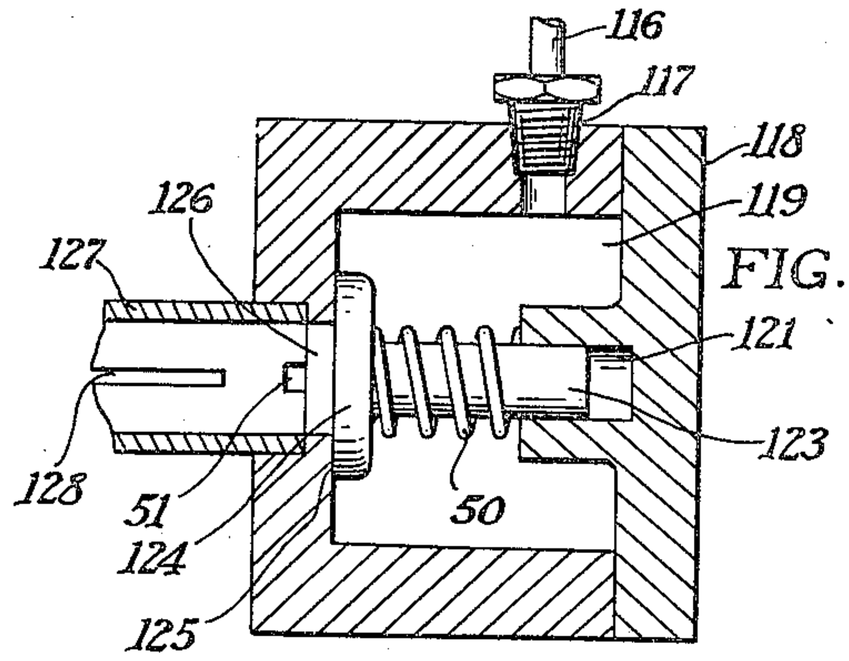


FIG. 4.

FIG. 5.

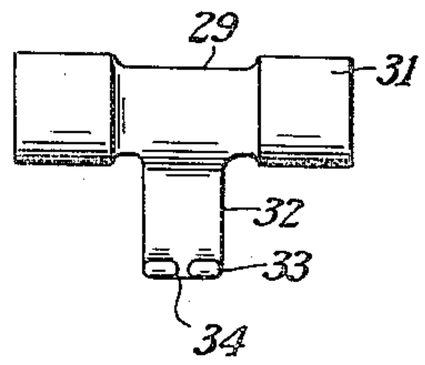


FIG. 6.

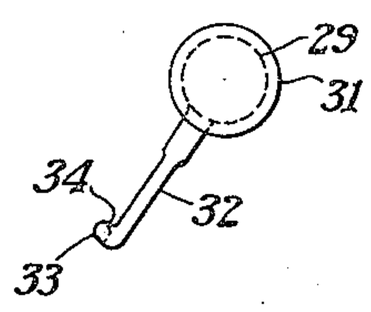
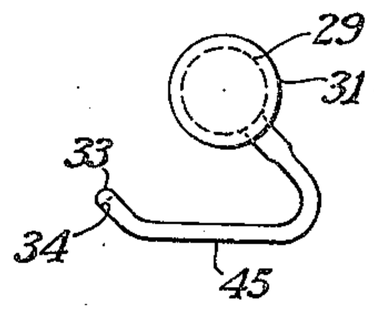


FIG. 7.



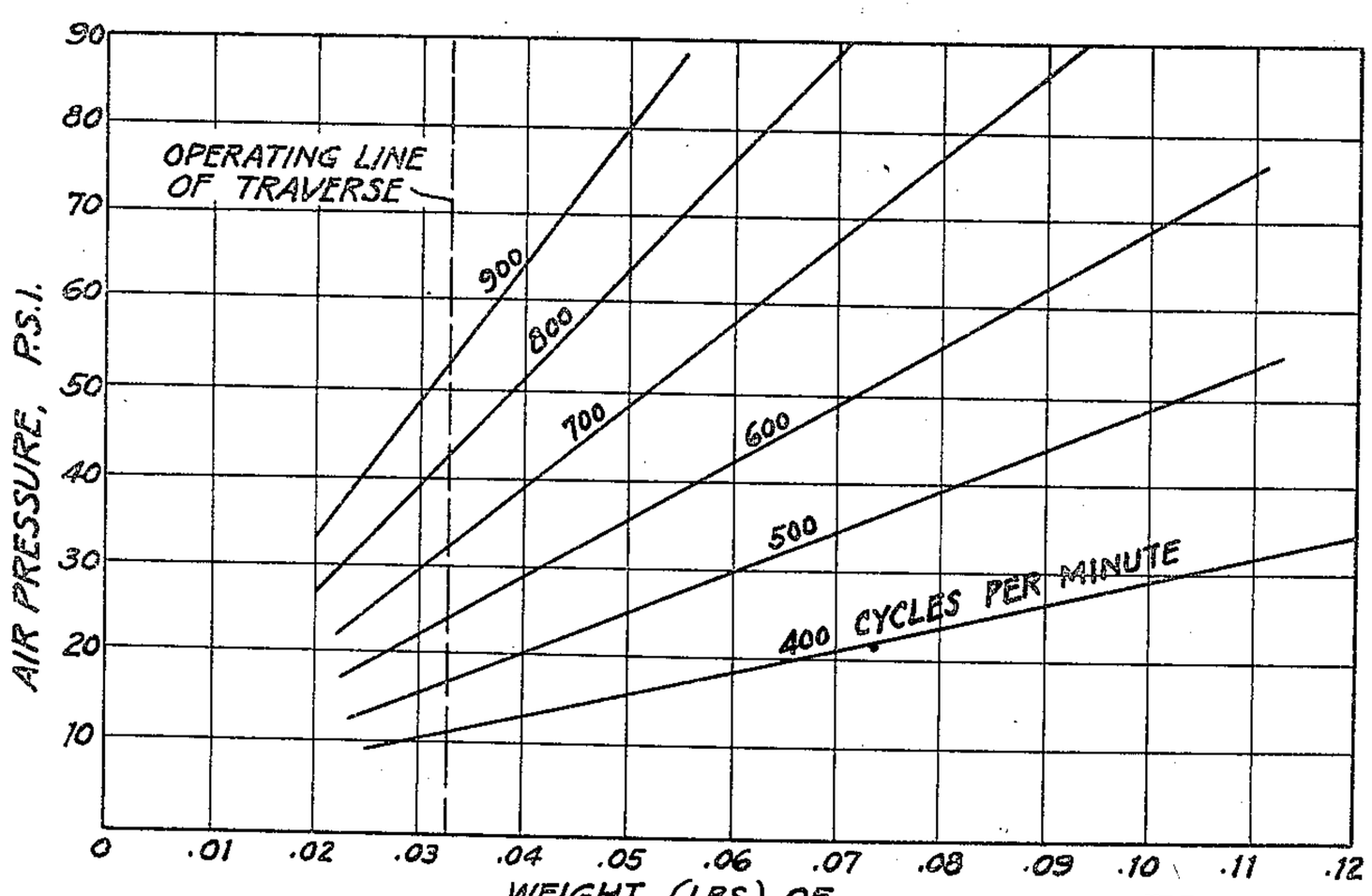


FIG. 9.

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2,548,523

PNEUMATIC RAPID TRAVERSE FOR WINDING TEXTILE YARNS ON CONES AND TUBES

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Application October 12, 1949, Serial No. 121,024

12 Claims. (Cl. 242—158)

1

This invention relates to winding machines having a high speed traversing mechanism for winding textile yarns and the like on cones and tubes, and more particularly to a winding machine having a pneumatically-operated traverse mechanism which is capable of much higher traverse cyclic speeds than heretofore attainable by other types of winding mechanisms.

In the textile industry yarn obtained by various processes is wound into packages on cones and tubes. An arrangement often employed consists of a mechanism for revolving the spindle carrying the package tube and a means of axially traversing a thread guide back and forth along the package. Such means may be a grooved guide roll having a cam follower, which acts as the yarn guide, traveling in the roll groove. The ratio between the package R. P. M. and the traverse cycles per minute is known as the wind ratio. This wind ratio should fall within certain limits to produce yarn packages of good appearance and quality. In practice the wind ratios are usually limited to values of less than 10 to 1 and most cones and tubes are wound with wind ratios of 5 to 1 or 6 to 1. Good design practice places a definite limit on the cam speed which varies somewhat with the materials and masses of the reciprocating parts employed. Cam traverse mechanisms now available are not recommended by their manufacturers for continuous and long service at traverse speeds of over 300 cycles per minute. Since the maximum cam speed is limited and the wind ratio is more or less fixed within limits, the spindle speed is also confined to certain relative limits. Thus, the winding speeds and production rates of the present employed coning and winding machines are definitely limited by the mechanical cam traverse.

An object, therefore, of the present invention is to provide an improved high speed winding mechanism for winding yarns on cones, tubes and the like.

Another object of the invention is to provide an improved high speed winding mechanism, the traverse of which operates pneumatically.

A still further object of the invention is the provision of a pneumatically-operated traverse mechanism which is capable of high traverse speeds, more uniform speeds, and quicker reversals than those traverse mechanisms of winding machines now available.

Other objects will be apparent hereinafter.

In accordance with the invention, the improved winding mechanism comprises in combination means for rotating the cone, tube or other member onto which the yarn is to be wound, and a pneumatically-operated traverse adjacent thereto which guides the yarn strand uniformly back and forth over the rotating member.

2

The pneumatic traverse comprises a traverse guide tube having an axial slit through which a thread guide extends. The thread guide is fixed to a piston which is adapted to move in the tube and longitudinally of the slit. At each end of the tube is a valve block containing a valve which opens when struck by the piston and closes after the piston leaves the close proximity of the valve. A source of compressed air is connected to the respective valve blocks and this force of air is exerted on the piston when one of the valves opens, the force being sufficient to drive the piston to the opposite end of the slit where the piston hits and opens the other valve. The piston is then instantly stopped by the air flowing out of the valve opening and is forced back along the slit and hits and opens the first-mentioned valve. This to and fro travel continues at the option of the operator. Since the thread guide is attached to the piston, the thread will rapidly traverse the rotating cone. A particular feature of the invention is the substantially immediate reversal at the ends of the package thereby preventing substantial build-up of yarn before reversal is complete, as often occurs in winding mechanisms heretofore employed.

The invention will be further understood by reference to the following detailed description and related drawings in which:

Fig. 1 is a view of a pneumatic traverse mechanism, partly in section, constructed in accordance with the present invention;

Fig. 2 is an end view, partly in section, showing the pneumatic-traverse cooperating with other elements of a yarn-winding machine;

Fig. 3 is a view partly in section showing features of a valve block having a balanced valve;

Fig. 4 is a view partly in section showing features of a valve block with a pressure release orifice and with a spring-operated valve;

Fig. 5 is a front view of the piston-thread guide assembly;

Fig. 6 is a sectional end view of Fig. 5;

Fig. 7 is a sectional end view of another design of a piston-thread guide assembly;

Fig. 8 is an end view, partly in section, showing the relation of the piston-thread guide of Fig. 7 to the winding mechanism; and

Fig. 9 is a graphical representation showing operating characteristics of the pneumatic traverse.

Referring to Fig. 1, a compressed air conduit 10 leading from a source of compressed air, not shown, conducts air at the desired pressure to the pneumatic traverse mechanism. In this air conduit 10 are positioned valve 11, pressure regulator 12, pressure gauge 13, and a damping chamber 14. At junction 15 compressed air is directed through pipes 16 and 16' and connections 17 and 17' to the respective valve blocks 18 and 18'.

It will be noted that both valve blocks 18 and 18' are identical and therefore only valve block 18 will be described in detail. The walls of valve block 18, one of which is not shown, enclose an air chamber 19 and one wall provides a valve stem guide 21 in which valve stem 23 is adapted to move back and forth in a horizontal plane. The valve head 24 is adapted to be seated in valve seat 25 which opens into a short open-ended barrel 26 positioned in the valve block wall opposite the valve head. Valve block 18' as stated above, has the same construction as valve block 18 and the primed numbers 18' to 25' represent similar parts just described with the non-primed numbers.

Positioned between and in fluid connection with the barrels 26 and 26' is an open-ended tube 27 having a horizontal slit 28 along its side. Inside the tube 27 is positioned a piston 29 having an extension 32 extending through slit 28, the end of which is turned over at 33 and provides a yarn guide slot 34 through which the yarn 44 being traversed onto the cone is passed, as is described more fully in connection with Fig. 2. Since it is desirable to keep frictional losses of piston energy to a minimum, it will be noted that only a small portion of the piston surface at 30 and 31 is in contact with the tube 27.

The operating cycle of the traverse is now described. The compressed air supply valve 11 is now opened and the pressure regulator 12 is manipulated to provide the desired operating air pressure as indicated by gauge 13. The damping chamber 14 serves to protect gauge 13 from rapid fluctuations of pressure. Air under the desired pressure is, therefore, permitted to fill the chambers 19 and 19' of the respective valve blocks 18 and 18'. Both valves 24 and 24' are seated and no air leaves the valve blocks at this time.

The piston 29 is then manually pulled all the way to the right end of the tube 27 and the piston 29 forces the adjacent valve to open. The valve then momentarily takes the position shown in valve block 18. The compressed air then rushes past the valve head 24 and into the barrel 26 wherein the piston 29 fits tightly. The compressed air forces the piston 29 out of the barrel 26, in the same manner as an air gun does a bullet from its barrel. The thrust on the piston 29 is sufficient to push the piston to the opposite end of tube 27 where it strikes valve head 24'. The momentum of the piston is great enough to knock open the valve 24'. The action on the piston is thus repeated in the opposite direction and the piston first comes to a sudden stop and then travels again through the tube 27 in the other direction and knocks open the valve 24, is again reversed, and so on.

The valve action may be further described in connection with Fig. 3, which is an enlargement of the right hand valve block of Fig. 1, the parts

of which bear similar numbers. It will be seen in Fig. 3 that when the valve 24 is closed, the area on which the high pressure air is acting is greater than the area on which the atmospheric air acts. This area difference, plus the pressure differential, holds the valve closed. When the piston enters the short barrel 26 and hits the end of the valve 24, the forces holding the valve closed are overcome and the valve is knocked open. However, very little air escapes from the valve block barrel 26 since the piston is a close, though free, fit in the barrel. Thus, the valve remains stationary in the open position, since the air pressures on it are in balance and the friction of the valve stem in the valve guide and valve inertia tend to hold the valve at rest.

The space between the piston and valve seat 25 is relatively small and a very small air volume fills this space. This high air pressure, however, acts on the piston to stop its motion and reverse its direction and to propel it toward the other end of the tube. The air flow required to move the piston to the end of the barrel is still small. However, as soon as the rear end of the piston clears the barrel end, the high pressure air flow greatly increases. This increased flow of air in the space between the valve seat and the valve produces a low pressure sufficient to overcome the inertia of the valve and valve stem friction, and the valve closes after the piston clears the valve block barrel. The force required to open the valves can be controlled by the physical properties of the valve and by the size of the bevel on the forward face of the valve head.

Figs. 5 and 6 show in detail a combination piston and thread guide. As previously mentioned, it is desirable in most cases to keep frictional losses of piston energy at a minimum, and only a small portion of the piston surface is in contact with the tube and tube slit. The piston 29 and thread guide 32 are preferably made in one piece. The projection is tipped with a hard material 33, such as stellite, to resist wear due to yarn friction. The hard tip is provided with a fine slot 34 to hold and guide the yarn onto the package as shown in Fig. 2.

Referring to Fig. 2 the combination in a winding machine of our pneumatic traverse is shown. In this figure a spindle 36 is shown carrying a tube 46 on which a yarn package 35 is being wound. The spindle is rotated by pulley 37, belt 38 and pulley 39 which is mounted on a shaft 41 which is connected to a motor, not shown.

The continuous strand of yarn 44 which may be drawn from a spinning cabinet, or other source, not shown, is passed through the slot 33 of the piston-thread guide member 29 and around the package. As shown in this drawing the traverse mechanism is supported on arm 40 and the other numbered parts correspond to those described in connection with Fig. 1. Idler roll 42 mounted on support member 43 aids in supporting the package during winding. As above described, the rapid traversal of the thread guide will evenly wind the yarn on the package.

Again referring to Figs. 1 and 2, it will be noted that slit 28 points generally toward the yarn package being wound. Accordingly when the piston 29 is driven back and forth by the air flowing through the respective valves 24 and 24', the air tends to escape through the slit 28 and blows on the package. Under certain high pressures this alternate blowing may disadvanta-

geously affect the uniformity of the winding operation. In such an event the arrangement shown in Figs. 7 and 8 may be employed. As is apparent in Fig. 8 the traverse mechanism is arranged so that the slit **28** points away from the yarn package **35** being wound. The piston-thread guide, a section of which is shown at **31**, has a curved arm **45** which extends through the slit **28** and toward the package **35**. This places the end of the guide, shown at **33**, in substantially the same relative position as that shown in Fig. 2. Because the slit **28** points away from the package **35**, the air escaping from the slit will not blow directly on the package and hence will not disturb the uniform winding of the yarn on the package. While in Figs. 2 and 8 two positions of the slit are shown, it is, of course, apparent to one skilled in the art that the slit **28** could be positioned at other places on the circumference of the tube **27** in which case the thread guide arm would be of a desired contour so that the thread guide slot **34** would be in the required relationship respecting the package. A further way of preventing this disadvantageous blowing of the yarn as it is wound on the package will be described in connection with the valve block shown in Fig. 4.

In Fig. 4 there is shown a spring-operated valve which differs from the balanced valves of Figs. 1 and 3 in that the force of a spring **50** is used to close or assist in closing the valve after it has been opened by the piston. It will be understood from this drawing that the three digit numbers of Fig. 4 denote the same parts as do the two digit numbers of Fig. 3, that is, **124** and **24** represent the valve heads of the respective drawings, etc. Since the pressure relations described for the balanced valve are present in the spring-operated valve, it follows that the spring-operated valve will close faster. This reduces the pressure acting on the piston since the high pressure air expands to move the piston out of the barrel. The efficiency of use of the air is greater in the spring-operated valve, but the reversal of the piston is done at a slower rate for a given supply of air pressure. Since, in general, rapid reversal of a thread guide is desired for winding, the preferred practice is to employ the balanced valve as shown in Fig. 3. As shown in Fig. 4, the face of the valve **124** may be flat instead of conical.

As mentioned above, another arrangement to prevent air exhausting through slit **128** from disadvantageously blowing on the yarn package is also shown in Fig. 4. This includes the provision of an exhaust aperture **51** in the barrel **126** of the valve block. The exhaust aperture **51** prevents the air from exhausting toward the yarn package. The piston **29** receives its main energy from the air in the barrel **125** and as the piston moves out of the barrel **126**, it uncovers the exhaust aperture **51** and the air exhausts out of the barrel and hence does not flow out of the later opened path through slit **128**.

Fig. 9 shows a group of operating curves for a pneumatic traverse having a barrel diameter of 0.375 inch and 0.250 inch length. The vertical dotted line on the graph represents the operating characteristics of a traverse having a piston assembly weighing .0325 pound.

The design of a pneumatic traverse is based on the basic formula of interior ballistics as given below:

$$\frac{MV^2}{2}=P_e\times A\times U$$

where

M=mass of piston assembly.
V=piston velocity at the muzzle of the valve block barrel.
A=barrel cross-section in square inches.
U=length of barrel in inches.
P_e=mean pressure in barrel in pounds per square inch.

Other relations used are the standard relations of time, distance, velocity, acceleration, force and mass.

It should be noted that the traverse is not capable of doing any more work than is indicated by the kinetic energy of the piston as it leaves the barrel less the kinetic energy required to overcome friction, and to open the valve at the other end of the traverse stroke. Also, as more work is done by the piston, its speed drop-off from the start to finish of one traverse will increase.

It will be recognized that to attain high traverse speeds, the mass of the traversing parts must be held at very low values in order that the forces generated at reversal of the traverse will not be destructive, or that some method of driving the thread-guide mechanism be employed in which these forces are not destructive. The guiding surfaces of a cam traverse, for example, are very vulnerable to these high forces, however, and breakage and wear is excessive at traverse speeds of more than 300 cycles per minute. Herein lies the advantage of the pneumatic traverse, for it is possible to make the thread guide and piston very compact and wear takes place at points that do not critically affect the winding operation.

While the pneumatic traverse has been described herein as applied to the textile industry, it it believed that the mechanism itself is new and novel and has possibilities for application in other fields of industry.

The pneumatic traverse as applied to the textile industry makes possible winding of large packages of yarn at speeds far in excess of present common practice. It is simple to construct and has low initial cost as well as low operating cost due to its efficient use of energy. The pneumatic traverse of the invention has been operated to wind yarn on packages at speeds as high as 1400 cycles per minute.

What we claim is:

1. In a rapid traverse winding apparatus for yarn, and the like, the combination of a rotatable winding-spindle on which a yarn winding member is mounted for rotation, a pneumatically operated yarn guide mechanism positioned adjacent thereto and adapted to guide the yarn uniformly back and forth along the axis of the rotating member thereby permitting the yarn to be wound in uniform convolutions on the member, said yarn guide mechanism comprising in combination a yarn guide, a piston attached thereto, a tube in which the piston reciprocates, said tube having a longitudinal slit in the wall thereof through which the yarn guide extends and reciprocates with the piston, a valve block assembly mounted on one end of the tube having a valve chamber, a valve therein adapted to fluidly connect the valve chamber with the tube, means for supplying compressed air to said valve member, a similar valve block assembly positioned at the opposite end of the tube, said compressed air normally tending to hold the valves closed, the valves in the respective blocks being adapted to open and close alternately, said valves when in alternate open position, permitting

the compressed air to flow from the chamber to the tube and to force the piston to and fro in the tube and to cause the reciprocation of the yarn guide associated therewith.

2. In a rapid traverse winding apparatus for yarn, and the like, the combination of a rotatable winding-spindle on which a yarn winding member is mounted for rotation, a pneumatically operated yarn guide mechanism positioned adjacent thereto and adapted to guide the yarn uniformly back and forth along the axis of the rotating member thereby permitting the yarn to be wound in uniform convolutions on the member, said yarn guide mechanism comprising in combination a yarn guide, a piston attached thereto, a tube in which the piston reciprocates, the tube having a longitudinal slit in the wall thereof through which the yarn guide extends and reciprocates with the piston, a valve block assembly mounted on one end of the tube having a valve chamber, a valve therein adapted to fluidly connect the valve chamber with the tube, means for supplying compressed air to said valve chamber, a similar valve block assembly positioned at the opposite end of the tube, said compressed air normally tending to hold the valves closed, the valves in the respective blocks being adapted to open and close alternately, said valves when in alternate open position permitting the compressed air to force the piston to and fro in the tube and to cause the reciprocation of the yarn guide associated therewith and means for alternately opening and closing the respective valves at self-determined intervals.

3. In a rapid traverse winding apparatus for yarn, and the like, the combination of a rotatable winding-spindle on which a yarn winding member is mounted for rotation, a pneumatically operated yarn guide mechanism positioned adjacent thereto and adapted to guide the yarn uniformly back and forth along the axis of the rotating member thereby permitting the yarn to be wound in uniform convolutions on the member, said yarn guide mechanism comprising in combination a yarn guide, a piston attached thereto, a tube in which the piston reciprocates, the tube having a longitudinal slit in the wall thereof through which the yarn guide extends and reciprocates with the piston, a valve block assembly mounted on one end of the tube and having a valve chamber, a valve therein adapted to fluidly connect the valve chamber with the tube, means for supplying compressed air to said valve chamber, a similar valve block assembly positioned at the opposite end of the tube, said compressed air normally tending to hold the valves closed, means for alternately opening and closing the valves, and means for reciprocating the piston to and fro in the tube and to cause the reciprocation of the yarn guide associated therewith.

4. In a rapid traverse winding apparatus for yarn, and the like, the combination of a rotatable winding-spindle on which a yarn winding member is mounted for rotation, a pneumatically operated yarn guide mechanism positioned adjacent thereto and adapted to guide the yarn uniformly back and forth along the axis of the rotating member thereby permitting the yarn to be wound in uniform convolutions on the member, said yarn guide mechanism comprising in combination a yarn guide, a piston attached thereto, a tube in which the piston reciprocates, said tube having a longitudinal slit in the wall thereof through which the yarn guide extends and reciprocates with the piston, a valve block assembly mounted on one end of the tube having a valve chamber, a valve therein adapted to fluidly connect the valve chamber with the tube, means for supplying compressed air to said valve chamber, a similar valve block assembly positioned at the opposite end of the tube, said compressed air normally tending to hold the valves closed, the valves in the respective blocks being adapted to open and close alternately thereby permitting the compressed air to force the piston to and fro in the tube and to cause the reciprocation of the yarn guide associated therewith.

5. In a rapid traverse winding apparatus for yarn, and the like, the combination of a rotatable winding-spindle on which a yarn winding member is mounted for rotation, a pneumatically operated yarn guide mechanism positioned adjacent thereto and adapted to guide the yarn uniformly back and forth along the axis of the rotating member thereby permitting the yarn to be wound in uniform convolutions on the member, said yarn guide mechanism comprising in combination a yarn guide, a piston attached thereto, a tube in which the piston reciprocates, said tube having a longitudinal slit in the wall thereof through which the yarn guide extends and reciprocates with the piston, a valve block assembly mounted on one end of the tube, comprising a valve chamber, said chamber having an aperture in one wall thereof adapted to connect the tube with the chamber, a valve positioned in the chamber adapted to open and close said aperture, means for supplying compressed air to said valve chamber, a similar valve block assembly positioned at the opposite end of the tube, said compressed air normally tending to hold the valves closed, the valves in the respective blocks being adapted to open and close alternately thereby permitting the compressed air to force the piston to and fro in the tube and to cause the reciprocation of the yarn guide associated therewith.

6. In a rapid traverse winding apparatus for yarn, and the like, the combination of a rotatable winding-spindle on which a yarn winding member is mounted for rotation, a pneumatically operated yarn guide mechanism positioned adjacent thereto and adapted to guide the yarn uniformly back and forth along the axis of the rotating member thereby permitting the yarn to be wound in uniform convolutions on the member, said yarn guide mechanism comprising in combination a yarn guide, a piston attached thereto, a tube in which the piston reciprocates, said tube having a longitudinal slit in the wall thereof through which the yarn guide extends and reciprocates with the piston, a valve block assembly mounted on one end of the tube, comprising a valve chamber, said chamber having an aperture in one wall thereof adapted to connect the tube with the chamber, the aperture being of a similar diameter as that of the tube, a valve positioned in the chamber adapted to open and close said aperture, means for supplying compressed air to said valve chamber, a similar valve block assembly positioned at the opposite end of the tube, said compressed air normally tending to hold the valves closed, the valves in the respective blocks being adapted to open and close alternately thereby permitting the compressed air to force the piston to and fro in the tube and to cause the reciprocation of the yarn guide associated therewith.

7. In a rapid traverse winding apparatus for yarn, and the like, the combination of a rotatable winding-spindle on which a yarn winding member is mounted for rotation, a pneumatically operated yarn guide mechanism positioned adjacent thereto and adapted to guide the yarn uniformly back and forth along the axis of the rotating member

thereby permitting the yarn to be wound in uniform convolutions on the member, said yarn guide mechanism comprising in combination a yarn guide, a piston attached thereto, a tube in which the piston reciprocates, said tube having a longitudinal slit in the wall thereof through which the yarn guide extends and reciprocates with the piston, a valve block assembly mounted on one end of the tube, comprising a valve member, said chamber having an aperture in one wall thereof adapted to connect the tube with the chamber, the aperture being of a similar diameter as that of the tube, a pressure relief vent being directed away from the yarn winding member, a valve positioned in the chamber adapted to open and close said aperture, means for supplying compressed air to said valve chamber, a similar valve block assembly positioned at the opposite end of the tube, said compressed air normally tending to hold the valves closed, the valves in the respective blocks being adapted to open and close alternately thereby permitting the compressed air to force the piston to and fro in the tube and to cause the reciprocation of the yarn guide associated therewith.

8. In a rapid traverse winding apparatus for yarn, and the like, the combination of a rotatable winding-spindle on which a yarn winding member is mounted for rotation, a pneumatically operated yarn guide mechanism positioned adjacent thereto and adapted to guide the yarn uniformly back and forth along the axis of the rotating member thereby permitting the yarn to be wound in uniform convolutions on the member, said yarn guide mechanism comprising in combination a yarn guide, a piston attached thereto, a tube in which the piston reciprocates, said tube having a longitudinal slit in the wall thereof through which the yarn guide extends and reciprocates with the piston, a valve block assembly mounted on one end of the tube, comprising a valve chamber, said chamber having an aperture in one wall thereof adapted to connect the tube with the chamber, a spring operated valve positioned in the chamber adapted to open and close said aperture, means for supplying compressed air to said valve chamber, a similar valve block assembly positioned at the opposite end of the tube, said compressed air normally tending to cooperate with the springs of the valves to hold the valves closed, the valves in the respective blocks being adapted to open and close alternately thereby permitting the compressed air to force the piston to and fro in the tube and to cause the reciprocation of the yarn guide associated therewith.

9. In a rapid traverse winding apparatus for yarn, and the like, the combination of a rotatable winding-spindle on which a yarn winding member is mounted for rotation, a pneumatically operated yarn guide mechanism positioned adjacent thereto and adapted to guide the yarn uniformly back and forth along the axis of the rotating member thereby permitting the yarn to be wound in uniform convolutions on the member, said yarn guide mechanism comprising in combination a yarn guide, a piston attached thereto, a tube in which the piston reciprocates, said tube having a longitudinal slit in the wall thereof through which the yarn guide extends and reciprocates with the piston, a valve block assembly mounted on one end of the tube, comprising a valve chamber, said chamber having an aperture in one wall thereof adapted to connect the tube with the chamber, a valve positioned in the chamber adapted to open and close said aperture, means

for supplying compressed air to said valve chamber, a similar valve block assembly positioned at the opposite end of the tube, said compressed air normally tending to hold the valves closed, the valves in the respective blocks being adapted to open alternately when struck by the moving piston thereby permitting the compressed air to flow into the tube and change the direction of movement of the piston in the tube, and subsequently to close the open valve before the return of the piston.

10. In a rapid traverse winding apparatus for yarn, and the like, the combination of a rotatable winding-spindle on which a yarn winding member is mounted for rotation, a pneumatically operated yarn guide mechanism positioned adjacent thereto and adapted to guide the yarn uniformly back and forth along the axis of the rotating member thereby permitting the yarn to be wound in uniform convolutions on the member, said yarn guide mechanism comprising in combination a yarn guide, a piston attached thereto, a tube in which the piston reciprocates, said tube having a longitudinal slit in the wall thereof through which the yarn guide extends and reciprocates with the piston, a valve block assembly mounted on one end of the tube, comprising a valve chamber, said chamber having an aperture in one wall thereof adapted to connect the tube with the chamber, a valve positioned in the chamber adapted to open and close said aperture, means for supplying compressed air to said valve chamber, a similar valve block assembly positioned at the opposite end of the tube, said compressed air normally tending to hold the valves closed, the valves in the respective blocks being adapted to open alternately when struck by the moving piston thereby permitting the compressed air to flow into the tube and change the direction of movement of the piston and subsequently to close the open valve before the piston strikes and opens the other valve.

11. In a rapid traverse winding apparatus for yarn, and the like, the combination of a rotatable winding-spindle on which a yarn winding member is mounted for rotation, a pneumatically operated yarn guide mechanism positioned adjacent thereto and adapted to guide the yarn uniformly back and forth along the axis of the rotating member thereby permitting the yarn to be wound in uniform convolutions on the member, said yarn guide mechanism comprising in combination a yarn guide, a piston attached thereto, a tube in which the piston reciprocates, said tube having a longitudinal slit in the wall thereof through which the yarn guide extends and reciprocates with the piston, a valve block assembly mounted on one end of the tube, comprising a valve chamber, said chamber having an aperture on one wall thereof adapted to connect the tube with the chamber, a valve positioned in the chamber adapted to open and close said aperture, means for supplying compressed air to said valve chamber, a similar valve block assembly positioned at the opposite end of the tube, said compressed air normally tending to hold the valves closed, the valves in the respective blocks being adapted to open alternately thereby permitting the compressed air to flow into the tube and change the direction of movement of the piston in the tube, and subsequently to close the open valve as the piston leaves the aperture.

12. In a rapid traverse winding apparatus for yarn, and the like, the combination of a rotatable winding-spindle on which a yarn winding mem-

ber is mounted for rotation, a pneumatically operated yarn guide mechanism positioned adjacent thereto and adapted to guide the yarn uniformly back and forth along the axis of the rotating member thereby permitting the yarn to be wound in uniform convolutions on the member, said yarn guide mechanism comprising in combination a yarn guide, a piston attached thereto, a tube in which the piston reciprocates, said tube having a longitudinal slit in the wall thereof through which the yarn guide extends and reciprocates with the piston, said slot being directed away from the winding member, a valve block assembly mounted on one end of the tube, comprising a valve chamber, said chamber having an aperture on one wall thereof adapted to connect the tube with the chamber, a valve positioned in the chamber adapted to open and close said aperture, means for supplying compressed air to said valve chamber, a similar valve block

assembly positioned at the opposite end of the tube, said compressed air normally tending to hold the valves closed, the valves in the respective blocks being adapted to open alternately when struck by the moving piston thereby permitting the compressed air to flow into the tube and change the direction of movement of the piston in the tube, and subsequently to close the open valve before the return of the piston.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
1,641,300	Spencer	Sept. 6, 1927