ABSTRACT OF THE DISCLOSURE

A lens polishing machine that has a polishing element on an axially movable shaft secured to a pressure controlled diaphragm piston of a frictionless forward cylinder. A double-acting piston of a rearward cylinder has its connecting rod secured to the forward cylinder to control the position of the polishing element over a major distance, while the precision controlled diaphragm piston controls small incremental positions and maintains a predetermined pressure by the polishing element upon the work pieces. A ball bushing is eccentrically carried by the shaft and slidingly receives a guide pin secured to the forward cylinder.

This invention relates to pneumatic cylinders, and more particularly, to a pneumatic cylinder employed as a feed control means in a lens polishing machine.

One of the objects of the invention is to provide a polishing tool feed control in which a predetermined pressure may be precisely exerted upon work pieces being polished.

Another object of the invention is to provide such an arrangement having a minimum of friction loss.

A further object is to provide the tool with a support having a minimum of bending moment under operating conditions.

In one aspect of the invention the control arrangement includes an axially movable polishing tool shaft having piston means thereon which includes a flexible diaphragm connected between the shaft and its supporting cylinder. The supporting cylinder has connected to its rear portion a piston rod of a double acting cylinder, as well as a fluid passage communicatively connected just rearward of the diaphragm and having therein means for precisely controlling the pressure of fluid acting upon the piston means.

These and other objects, features and advantages will become apparent from the following description and accompanying drawings in which:

FIG. 1 is an elevational view partially broken away in section of a polishing tool arrangement embodying the principles of the invention.

FIG. 2 is a sectional view of the FIG. 1 arrangement with certain portions removed for clarity.

The support or yoke 11 (FIG. 1) of the lens polishing machine has spaced and aligned apertured legs 12 for appropriate drive connections to a means (not shown) for imparting a desired translatory motion to the yoke. The hub of the yoke support 11 is centrally formed to have mounted therein a pneumatic cylinder 13 of the control feed arrangement shown generally at 14. The rear portion of the axially movable shaft 15 is encompassed within cylinder 13 and the lower or forward portion of the shaft 15 is suitably formed with means for connecting or attaching a polishing element 16 (dotted lines) which contacts one or more lens blanks or work pieces (not shown) that are mounted in a predetermined manner upon a rotary work-holder.

A rearmost double-acting pneumatic cylinder 18 has longitudinally movable piston 19 operable between the two fluid control conduits 20, 21. The connecting rod 22 of piston 19 is threadedly secured to a central tapped recess 23 (FIG. 2) in the rear portion of cylinder 13.

Longitudinally spaced ball bushings 25, 26 (FIG. 2) are retained by appropriate rings 27, 28 in end chambers 29, 30 of three successive internal chambers within cylinder 13. The middle chamber 31 is separated from chamber 29 by an inwardly extending flange 32 which provides a forward stop for the skirt 33 of a piston arrangement 34 secured to shaft 15 and axially operable within chamber 31. Piston means 34 includes a flexible rolling diaphragm 35 which has its outer portions 36 appropriately secured in the sidewall of cylinder 13. Shaft 15 is slidably mounted in ball bushings 25, 26 and has an offset or eccentrically mounted ball bushing 38 secured in its rear portion for slidingly accommodating a guide pin 39 that is suitably secured to the interior rear wall of cylinder 13. Shaft 15 is accordingly recessed at 40 for receiving the forward portion of pin 39 when the piston means 34 is in a partially or fully retracted position.

Fluid passage means 41 is appropriately secured to a cylinder wall opening 42 for communicatively connecting with chamber 31 rearwardly of piston means 34. Conduit 41 is suitably valved at 43, the gauge 44 controlling the admission of fluid into the cylinder 13 behind the rolling diaphragm piston arrangement.

Thus, the aligned pneumatic cylinders are constructed in a manner that piston 19 of rear cylinder 18 feeds or controls the position of the polishing element 16 over a major distance and the pressure controlled diaphragm piston 34 of the frictionless forward cylinder 13 controls such position over small increments and insures exertion of a predetermined constant contact pressure by the polishing element upon the work pieces. This arrangement also permits use of a relatively short forward cylinder shaft 15 having a substantially reduced bending moment under operative conditions. The use of linear type ball bearings or ball bushings 25, 26, 38 as well as the rolling diaphragm piston 34 minimize the presence of friction in cylinder 13.

Various modifications, changes or alterations may be resorted to without departing from the scope of the invention as defined in the appended claims.

I claim:

1. A feed control for a polishing tool or the like to maintain precision pressure by said tool against work pieces being polished, comprising
an axially movable shaft having means for attaching a polishing element thereto,
a first cylinder encompassing a rear portion of said shaft,
a ball bushing eccentrically carried by said shaft rear portion,
piston means on said shaft and having a flexible diaphragm secured thereto, said diaphragm also being secured to a wall of said first cylinder,
fluid passage means communicatively connected to said first cylinder rearward of said diaphragm,
a second cylinder having an internal double-acting piston for movement intermediate longitudinally spaced fluid control means, said piston having a connecting rod secured to a rear portion of said first cylinder,
a guide pin secured to said first cylinder rear portion and slidingly received by said eccentric ball bushing, and
means in said passage for precisely controlling the pressure of fluid acting upon said piston means,
so constructed and arranged that operation of said second cylinder piston will control the position of the polishing element over a major distance, and the precision controlled piston means controls such position over small increments and insures exertion of a predetermined pressure by the polishing element upon work pieces.
2. The structure of claim 1 wherein said shaft has a length substantially less than that of said piston rod.

3. The arrangement of claim 1 in which said diaphragm is a rolling diaphragm and ball bushing means are disposed in said first cylinder for sliding engagement with said shaft.

4. In a polishing machine having a polishing element secured to an axially movable shaft for maintaining precision pressure against work pieces being polished, a first cylinder encompassing a rear portion of said shaft, a ball bushing eccentrically carried by said shaft rear portion, piston means on said shaft and having flexible diaphragm secured thereto, said diaphragm also being secured to a wall of said first cylinder, fluid passage means communicatively connected to said first cylinder rearward of said diaphragm, a second cylinder having an internal double-acting piston for movement intermediate longitudinally spaced fluid control means, said piston having a connecting rod secured to a rear portion of said first cylinder, a guide pin secured to said first cylinder rear portion and slidingly received by said eccentric ball bushing, and means in said passage means for precisely controlling the pressure of fluid acting upon said piston means, so constructed and arranged that operation of said second cylinder piston will control the position of the polishing element over a major distance, and the precision controlled piston means controls such position over small increments and insures exertion of a predetermined pressure by the polishing element upon work pieces.

5. The structure of claim 4 wherein said shaft has a length substantially less than that of said piston rod.

6. The arrangement of claim 4 in which said diaphragm is a rolling diaphragm and ball bushing means are disposed in said first cylinder for sliding engagement with said shaft.

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