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(54) **Loader apparatus for machine with a magnetic workpart driver.**

(57) A loader apparatus is provided for a machine having magnetic workpart driver means. The loader apparatus includes a support plate with an access opening to receive the driver means and a workpart track with a load portion and unload portion. The apparatus also includes an injector/ejector means slidably mounted on the support plate intersecting the load/unload track. The injector/ejector means conveys a workpart from the load portion of the track to the driver means and then back to the track for discharge through the unload portion. The track is located in non-overlapping relation to the driver means to reduce residual magnetic forces on the workpart during removal from the driver means and discharge out the unload portion of the track. A fluid passage is provided in communication with the track to emit a fluid stream into the track toward the unload portion thereof to facilitate workpart discharge.

LOADER APPARATUS FOR MACHINE MAGNETIC DRIVER

FIELD OF THE INVENTION

The present invention relates to machine tools and, in particular, to load/unload mechanisms for machine tools wherein magnetic or other attractive forces may be present between the workpart and workpart driver system, especially to internal grinding machines with magnetic workpart drivers.

BACKGROUND OF THE INVENTION

TECHNICAL BULLETIN dated June, 1970 by Bryant Grinder Corporation, Springfield, Vermont discloses a linear load tooling for high production internal grinding machines. The linear load tooling is a self-contained unit which can be set up away from the grinding machine when job change-over is required and which is attached or supported as a unit adjacent the workhead of the grinding machine.

This linear load tooling has proved satisfactory for loading and unloading bearing raceways of relatively large outer diameter. However, smaller O.D. raceways such as miniature raceways of 3/8 inch O.D., have not been readily accommodated in the load and unload tracks or chutes of the linear load tooling described. Further, ejection of the small diameter workpart has been difficult in that residual magnetism from the magnetic driver of the workhead tends to cause the workpart to "hang up" in the track, requiring manual removal and machine down time. The residual magnetic forces exerted on the workpart in the existing linear load tooling result from the load/unload track overlapping to a substantial extent the face of the magnetic driver. The small size and low weight of the workpart and residual magnetic forces exerted thereon make ejection of the workpart difficult.

Furthermore, the linear load tooling described in the aforesaid TECHNICAL BULLETIN includes a cylinder which actuates a workpart injector/ejector mechanism and a limit switch to control actuation of the cylinder. As mentioned above, the linear load tooling is self-contained and thus the cylinder and limit switch are attached with the other load tooling components and removed therewith as a unit for job change-over.

SUMMARY OF THE INVENTION

An object of the invention is to provide a loader apparatus or tooling especially useful for loading and unloading small size or miniature workparts on a grinding or other machine having a workpart driver wherein magnetic or other attractive forces may be present between the workpart and driver.

Another object of the invention is to provide such a loader apparatus in which the load/unload track or chute is located in non-overlapping relation to the outer dimension of the driver face so as to reduce attractive forces between the workpart and driver during ejection.

Another object of the invention is to provide such a loader apparatus with fluid means in a preferred embodiment for directing fluid against the workpart during ejection in the direction of the unload track to assist in workpart ejection.

Still another object of the invention is to mount a cylinder means and switch means for controlling the cylinder means on a carrier plate which is operatively associated with the machine with the cylinder plunger connected releasably to such a loader apparatus so that the cylinder means and switch means remain on the machine when the loader apparatus is changed to accommodate other size workparts.

In a typical working embodiment of the invention, the loader apparatus or tooling includes a support plate means having an access opening through which the magnetic driver of the machine workhead extends such that the driving face thereof can engage and drive (rotate) the workpart. The support plate means also includes a workpart load/unload track or chute extending thereacross in non-overlapping relation to the face of the workpart driver to substantially reduce any residual magnetic forces between the workpart and driver during ejection. Typically, the load/unload track is located above the outer diameter of a hollow cylindrical workpart driver. Preferably, a passage is provided with an open end opening into the track at an orientation to direct a fluid stream toward the unload portion thereof. The other end of the passage is connected to a source of fluid under pressure, such as air or coolant. Fluid emitted into the track or chute strikes the workpart being ejected to augment the action of gravity thereon in causing the workpart to roll down the unload portion of the track.

The loader apparatus or tooling also typically includes an injector/ejector mechanism slidably mounted on the support plate means transverse to the track for pushing a workpart from the load portion of the track to the driver face and then pushing the ground workpart back off the driver face to the track for discharge out the unload portion thereof with the assistance of the fluid stream. The injector/ejector mechanism is driven by the plunger of a cylinder means and controlled by switch means. Preferably, the cylinder means and switch means are carried on a carrier plate operatively associated with the machine. The plunger of the cylinder means is releasably connected to the injector/ejector mechanism to power same. When the loader tooling is replaced to accommodate a different size workpart, the support plate means is removed from the machine carrier plate, leaving the cylinder means and switch means with the machine.

These and other features, objects and advantages of the present invention will become more apparent to those skilled in the art by reference to the following drawings taken in conjunction with the description of preferred embodiments herebelow.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an elevation of the linear load tooling with selected tooling components removed to reveal the support plates.

Figure 2 is a similar elevation with tooling components attached in normal fashion but with the front cover plate removed.

Figure 3 is a cross-sectional view taken along line 3-3 of Fig. 1 with the workpart driver also shown.

Figure 4 is similar to Fig. 3 with the exception that portions of the workpart driver 14 are removed to show other features of the apparatus.

Figure 5 is an elevation of the sliding member.

Figure 6 is a fragmentary elevation of the outer tooling carrier plate and filler plate.

Figure 7 is an enlarged elevation showing the non-overlapping relation between the load/unload track and outer driver dimension.

Figure 8 is an elevation of the front cover plate.

DESCRIPTION OF PREFERRED EMBODIMENTS

Figs. 1-8 illustrate a linear loader tooling or apparatus constructed in accordance with the invention for use on a known centerless grinding machine, such as a Model

B Centalign[®] internal grinding machine manufactured by Bryant Grinder Corporation, Springfield, Vermont. The loader apparatus is used with other components such as the workhead, magnetic driver, grinding wheel, wheel feed mechanism, dresser, etc., employed on such grinding machines. Of course, the present invention is not limited to this particular type of grinding machine or, for that matter, to any particular type of machine tool wherein a workpart is rotated during machine operation.

Fig. 3 illustrates the loader apparatus 10 operatively associated with the workhead 12 and magnetic driver 14 of the centerless grinding machine of the type referred to above. The loader apparatus 10 and workhead 12 are mounted on a bed plate 16 of the machine. The magnetic workpart driver 14 is attached to the end of a rotatable spindle (not shown) in the workhead in known manner. The workpart driver has a cylindrical driving portion 17 with an annular end driving face 18 which engages the workpart W through magnetic flux effects as is well known and rotates the workpart during grinding of the inner diameter. A preferred workhead and magnetic driver for use with the loader tooling of the present invention is described in co-pending patent application entitled "Machine Workhead with Magnetic Driver" filed in the names of Larry Millay and Victor Dzewaltowski of common assignee herewith.

With reference to Fig. 4 which is the same as Fig. 3 with portions of the workpart driver removed (e.g., cylindrical portion 17) to show other details of the apparatus, the linear loader tooling or apparatus includes a machine carrier plate 20 having an upstanding portion 22 and a base portion 24 in a dovetail shape to be slidably received in slot 26 in the bed plate 16. A suitable clamp 28 is provided to retain the carrier plate 20 in final adjusted position adjacent the workhead 12, Fig. 2. As shown, the upstanding portion 22 includes an access opening 30 to receive the magnetic driver 14 extending from the

workhead. A support plate 23 is attached to plate 20 and is machined to provide a diagonal channel 32 on its front side (facing away from the workhead) extending at a 45° angle relative to horizontal in Fig. 1 and to provide a cross channel 34 extending from the left side of channel 32 for purposes to be described hereinafter.

Slidably received in channel 32 and cross channel 34 is a sliding member 36 shown in Fig. 4. The sliding member includes a pedestal 38 at one end to carry an ejector finger 40, Fig. 2, and is releasably connected at the opposite end to the plunger 42 of a pneumatic or other suitable cylinder as will be more fully explained herebelow. Between the ends of the sliding member is an elongated slot 46 providing access for the workpart driver 14 to the workpart. An elongated slot 47 is also provided at the end of the sliding member adjacent plunger 42 providing two tongues 39 which are screwed to spaced lands on block 100 by screws 51. A lateral flange 48 extends from the sliding member between the aforementioned ends and carries an interceptor finger 50, Fig. 2.

Overlying support plate 23 and sliding member 36 is an outer tooling carrier plate 52. Tooling carrier plate 52 is attached to plates 20 and 23 by means of bolts 54. Carrier plate 52 is machined to have grooves 56 adapted to adjustably receive bearing shoes 58 at a 90° orientation to one another. Furthermore, another groove 60 is provided at an angle bisecting the shoe grooves 56. In the bottom of groove 60 is an elongated through-slot 62 through which pedestal 38 extends and along which it slides during operation of the injector/ejector mechanism. A non-magnetic (phosphorus bronze alloy) backrail 64 is received in and extends across the carrier plate 52 and provides a surface over which the workparts are slid to the driver face. Of course, carrier plate 52 includes an access opening 76 coaxial with openings 30 and 33 in plates 20 and 23 for the same purpose of receiving the magnetic driver 14.

Fig. 2 shows the various loader tooling components referred to above attached to the sliding member 36 and carrier plate 52. In particular, bearing shoes 58 are attached in the grooves 56 and the guide blocks 66, 68, 70, 72, 74 are attached to carrier plate 52. It is apparent that guide block 66 is in spaced facing relation to guide blocks 68, 70 to define therebetween a load portion 76 of track 80. Guide block 72 in turn is in spaced facing relation to guide block 74 and interceptor finger 50 to define therebetween the unload portion 82 of track 80. A front cover plate 85, Fig. 8, is attached as by screws 87 received into threaded holes 91 on guide blocks 68, 70 and 72 to close off the load/unload track 80 on the front side, providing a passage for the workparts to roll through.

A load chute 84 is mounted on plate 20 and supplies workparts W to the load portion of track 80. An unload chute 86 is mounted on the machine base plate 89 and receives finish ground workparts from the unload portion of the track 80.

An important feature of the invention is that the bottom surface S of track 80 defined by guide blocks 70, 72 and interceptor finger 50 is located above the outer diameter or dimension D of the magnetic driver 14 so that there is no overlap therewith, Fig. 7. That is, when the workpart is received in track 80 for discharge, the outer diameter of the workpart does not overlap the outer diameter of the workpart driver when viewed in end elevation looking from the load/unload assembly toward the workhead 12. This non-overlapping relation between the track (workpart) and magnetic driver greatly reduces residual magnetic forces on the small, lightweight workpart as it is removed from the driver and discharged into the track 80 by ejector finger 40 for unloading down unload portion 82 of the track.

As shown most clearly in Fig. 1, the cylinder 44 and proximity switches 90, 92 are carried on an accessory

carrier plate 94 which is attached to the machine plate 20 by bolts 96. Of course, the proximity switches 90, 92 are designed to control actuation of the cylinder and extent of plunger movement as is well known. As shown in the Figure, the plunger 42 is releasably connected to a T-shaped block 100 slidably mounted in channel 32 by having a threaded end 97 received in threaded hole 98 in block 100. A set screw 99 is provided in block 100 as shown to lock the end 97. Attached in turn to the block 100 is an injector member 102 having an injector finger 104 at one end to push a workpart to the magnetic driver 14 and having a T-shape at the other end with the wings of the T-shape serving to actuate the proximity switch sensors 106. The injector member 102 is fastened to block 100 by screws 103.

It will be apparent to those skilled in the art that movement of the plunger 42 out of the cylinder 44 will cause the sliding member 36 to move diagonally toward the right in channel 32 (in Fig. 2). As a result, injector finger 104, ejector finger 40 and interceptor finger 50 will all move in unison in the same direction. Such movement will cause a workpart to be conveyed to the magnetic driver face 18 and be supported by bearing shoes 58. When the plunger 42 moves into the cylinder, the injector finger 104 and ejector finger 40 move diagonally to the left in the Figure to push a ground workpart off the driver 14 back to the track 80. At the same time, the interceptor finger 50 moves diagonally left into the unload portion 82 of the track to allow the ejected workpart to roll partially down the unload portion to make room for the next "green" workpart in the load portion to align itself between the injector finger and ejector finger. Once the next workpart is so aligned, the plunger 42 moves out of the cylinder to cause the injector finger to push the workpart to the magnetic driver 14, repeating the load/unload cycle. Of course, the interceptor finger 50 will move diagonally to the right in the Figure and allow the ground workpart to roll down the remainder of

the track unload portion 82 into discharge (unload) chute 86.

The non-overlapping relation mentioned above between the track 80 and magnetic driver outer diameter D reduces residual magnetic forces on the workpart as it is conveyed back to track 80 and as it rolls partially along the unload portion 82 thereof as restricted by interceptor finger 50. To further assist this partial discharge of the workpart along the unload portion 82 of the track, a fluid stream or jet (not shown) is emitted into the unload portion 82 of the track so as to strike the ground workpart upon return to the track by the ejector finger 50 and as it begins to roll down unload portion 82. Rolling of the workpart into the unload track portion against the interceptor finger is thus facilitated. The fluid stream is emitted from an orifice or opening 120 in filler plate 122, see Fig. 4, and received in counterbore 124 in carrier plate 52, Fig. 1. The orifice 120 is at the end of a passage 126 extending through plate 122 as shown best in Fig. 1. The passage 126 communicates with a passage 130 extending in the support plate 23, in particular at junction 128. Passage 130 communicates with another passage 132 in the machine carrier plate 20 at junction 134. The passage 132 extends to a fitting 136 which is connected to a suitable source of pressurized gas, air, coolant or other fluid 138. Of course, switch means are provided to control injection of the fluid into the track when the ground workpart is returned thereto by ejector finger 40. And, filler plate 122 includes a central aperture 140 to receive the magnetic workpart driver 14 whose annular driving face 18 is substantially coplanar with the filler plate 122 as well as non-magnetic back rail 64 received in the tooling carrier plate 52, Fig. 1. A semi-circular notch 142 is provided on the circumference of the filler plate 122 and in conjunction with hole 150 in plate 52 is adapted to receive an alignment pin on screw 152 to insure passages 126 and 130 are in proper fluid flow communication at junction 128.

Although the load/unload apparatus of the invention has been described hereinabove with reference to a machine workhead having a magnetic workpart drive, it is equally applicable to a machine workhead using a conventional non-magnetic pressure-clamp workpart driving arrangement. The apparatus of the invention may find use in such an arrangement when for example the workpart itself carries residual magnetism acquired from a previous operation on the workpart and wherein magnetic or other attractive forces between this workpart and pressure clamp driver interfere or interrupt normal ejection of the workpart.

While the invention has been described by a detailed description of certain specific and preferred embodiments, it is understood that various modifications and changes can be made in any of them within the scope of the appended claims which are intended to also include equivalents of such embodiments.

I Claim

1. In an apparatus of the type wherein workparts are fed to and removed from a workpart driver means of a given outer dimension, the combination of a support plate means having an access opening adapted to receive the driver means and a workpart load/unload track extending across the support plate means in non-overlapping relation to the outer dimension of the workpart driver means and having a load portion and unload portion, and an injector/ejector means slidably mounted on said support plate means to convey a workpart from the load portion of the track to the workpart driver means and then back to the track for discharge through the unload portion thereof, whereby said non-overlapping relation between the track and workpart driver means reduces any attractive forces between the workpart and workpart driver means to facilitate removal of the workpart from the driver means and discharge through the unload portion of the track.

2. In an apparatus of the type wherein workparts are fed to and removed from a magnetic workpart driver means of a given outer dimension, the combination of a support plate means having an access opening adapted to receive the magnetic driver means and a workpart load/unload track extending across the support plate means in non-overlapping relation to the outer dimension of the workpart driver means and having a load portion and unload portion, and an injector/ejector means slidably mounted on said support plate means to convey a workpart from the load portion of the track to the workpart driver means and then back to the track for discharge through the unload portion thereof, whereby said non-overlapping relation between the track and workpart driver means reduces magnetic forces between the workpart and driver means to facilitate removal of the workpart from the driver means and discharge through the unload portion of the track.

3. The apparatus of claim 2 wherein the workpart injector/ejector means comprises a slide means on the support plate means and having an injector means for pushing a workpart from the load portion of the track to the driver means and an ejector means for pushing a workpart from the driver means to the track for discharge through the unload portion.

4. The apparatus of claim 3 wherein a cylinder means with a plunger and a switch means for controlling the cylinder means are mounted on the apparatus and the plunger is releasably connected to the slide means to move same across the support plate means so that the support plate means and injector/ejector means can be removed from the apparatus while the cylinder and switch means remain on the apparatus.

5. The apparatus of claim 1 or 2 which further includes a fluid passage having one end connected to a source of fluid pressure and having another open end in communication with said track, said open end being oriented to direct fluid into the track to facilitate workpart discharge through the unload portion.

6. The loader apparatus of claim 5 wherein said fluid passage is oriented to direct fluid into the unload portion of the track.

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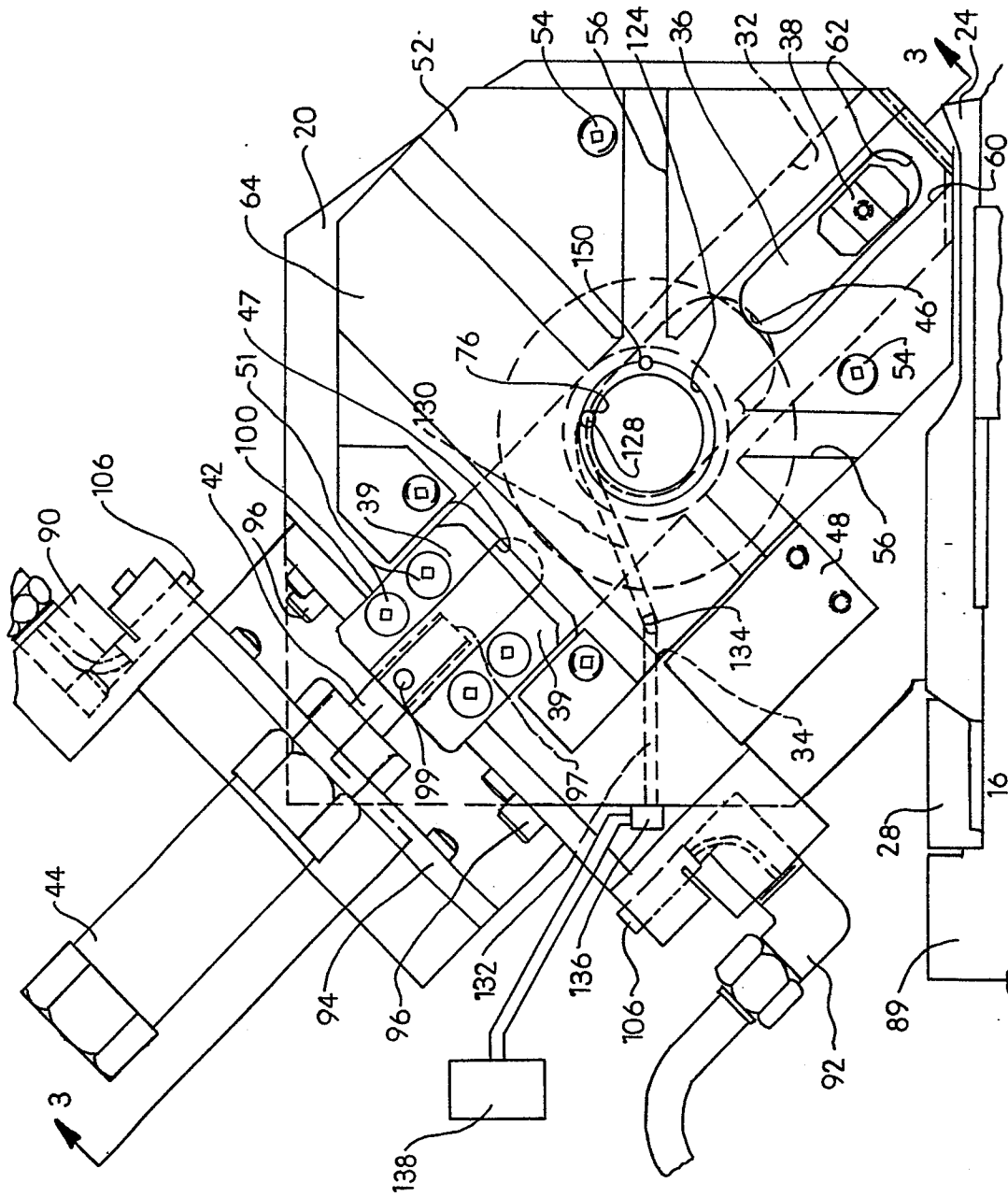
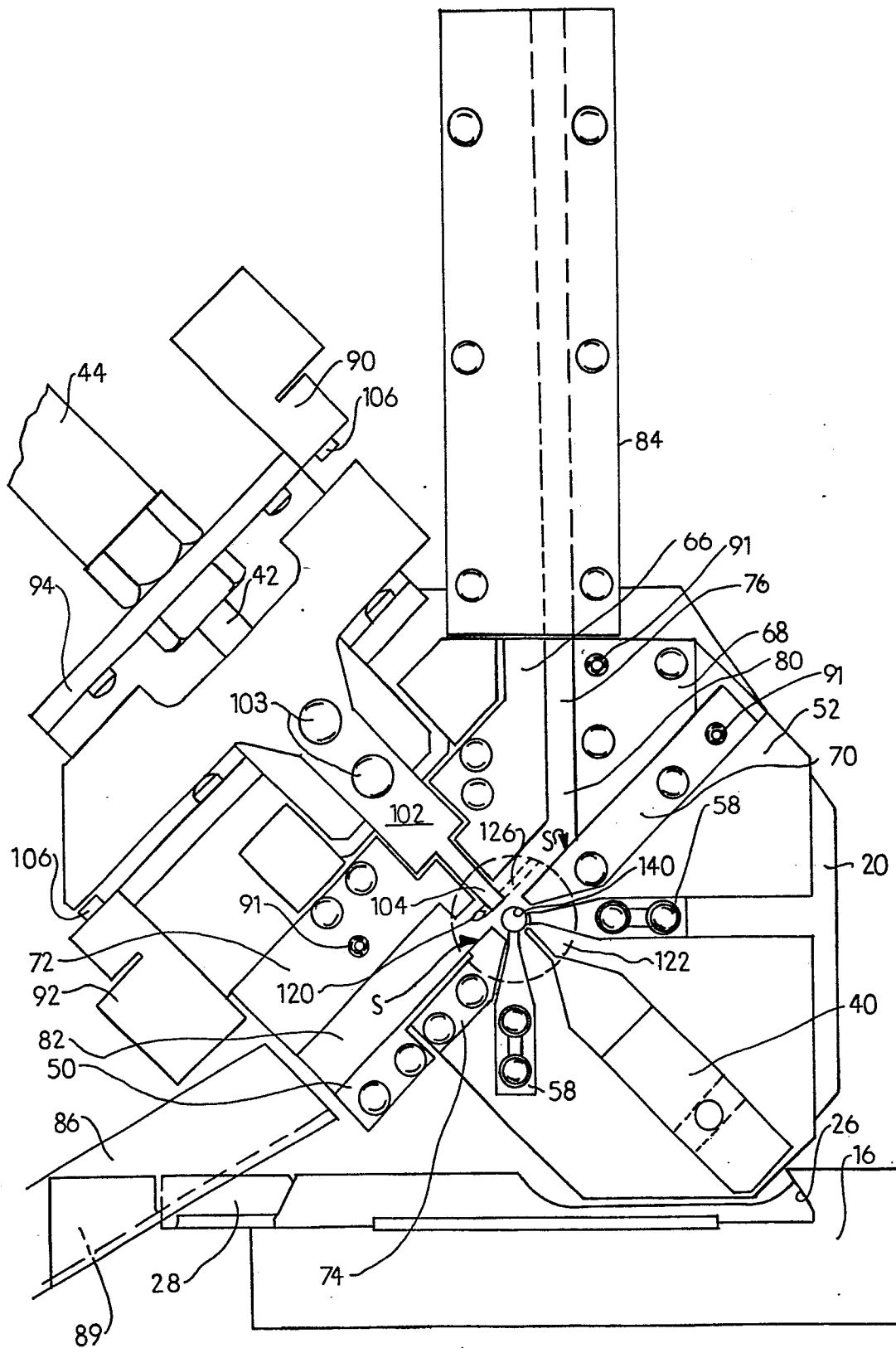
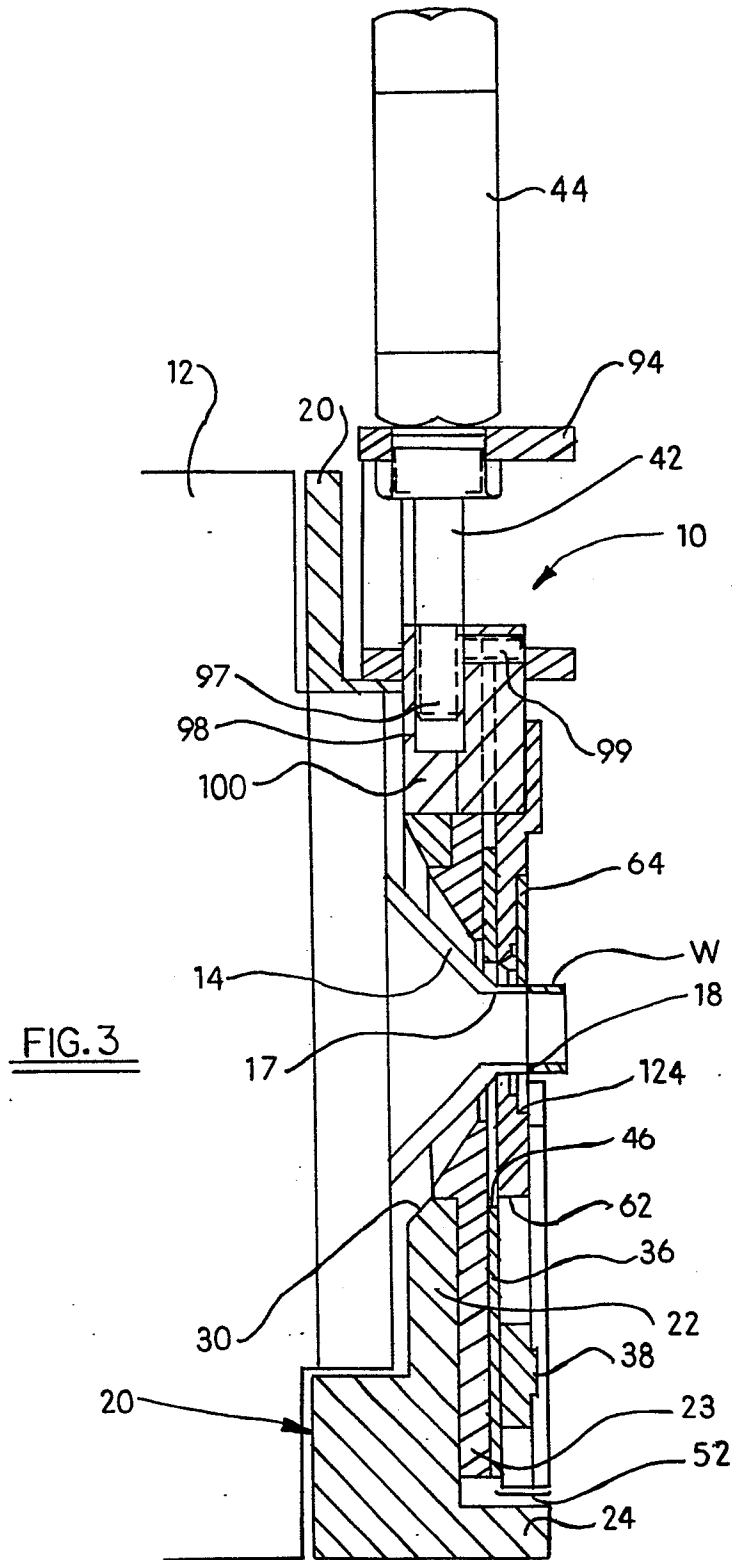


FIG. 1

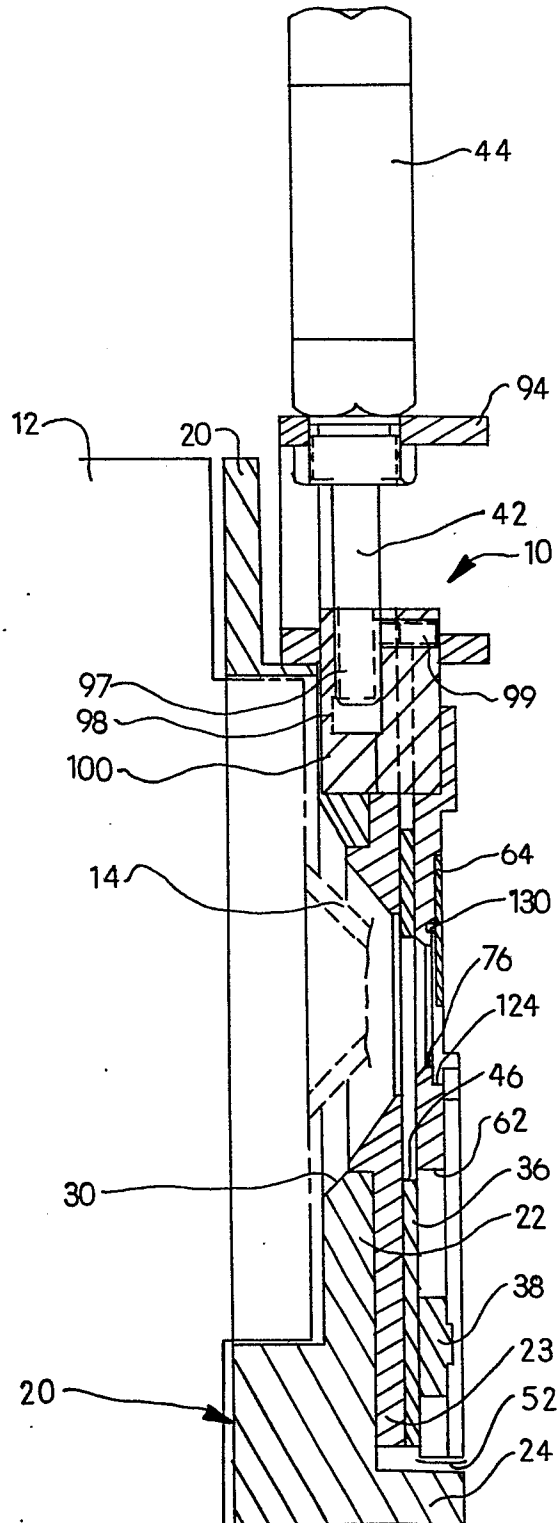
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FIG. 2

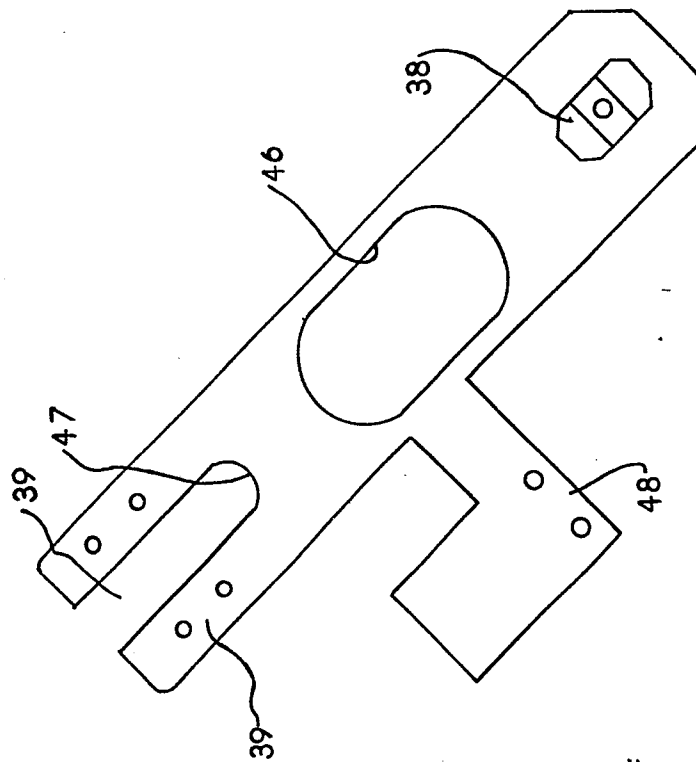
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FIG. 4

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FIG. 5

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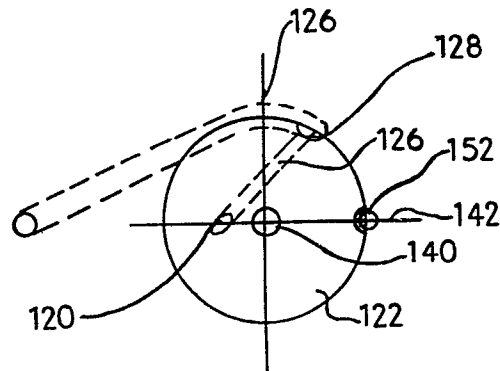


FIG. 6

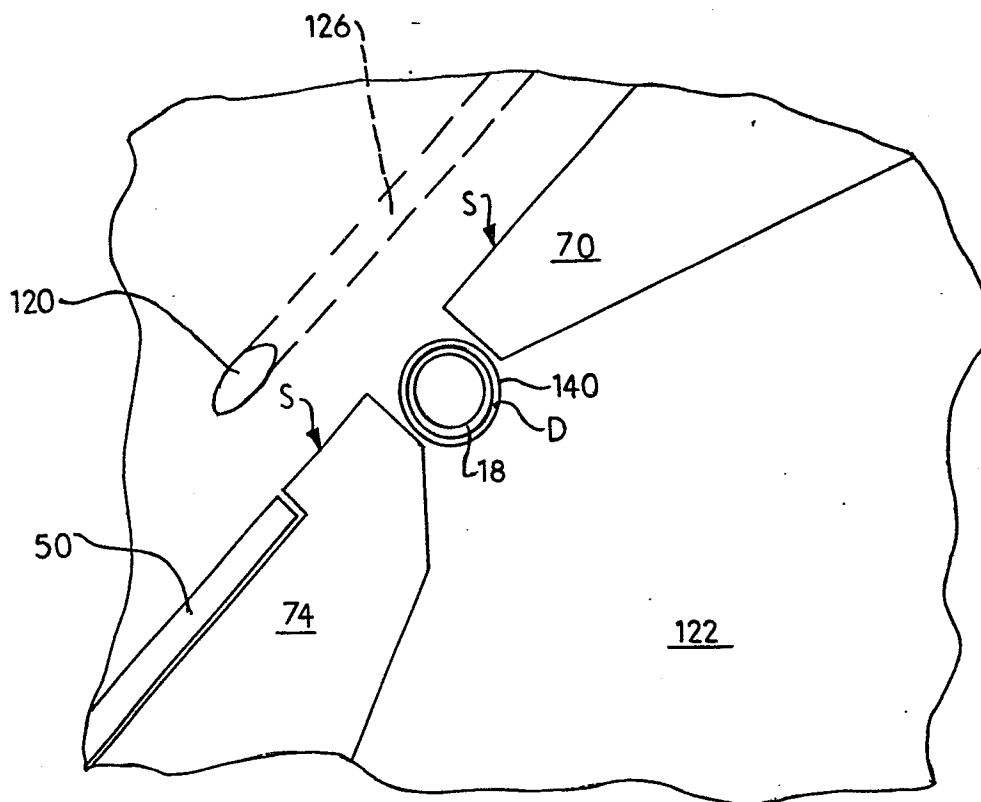


FIG. 7

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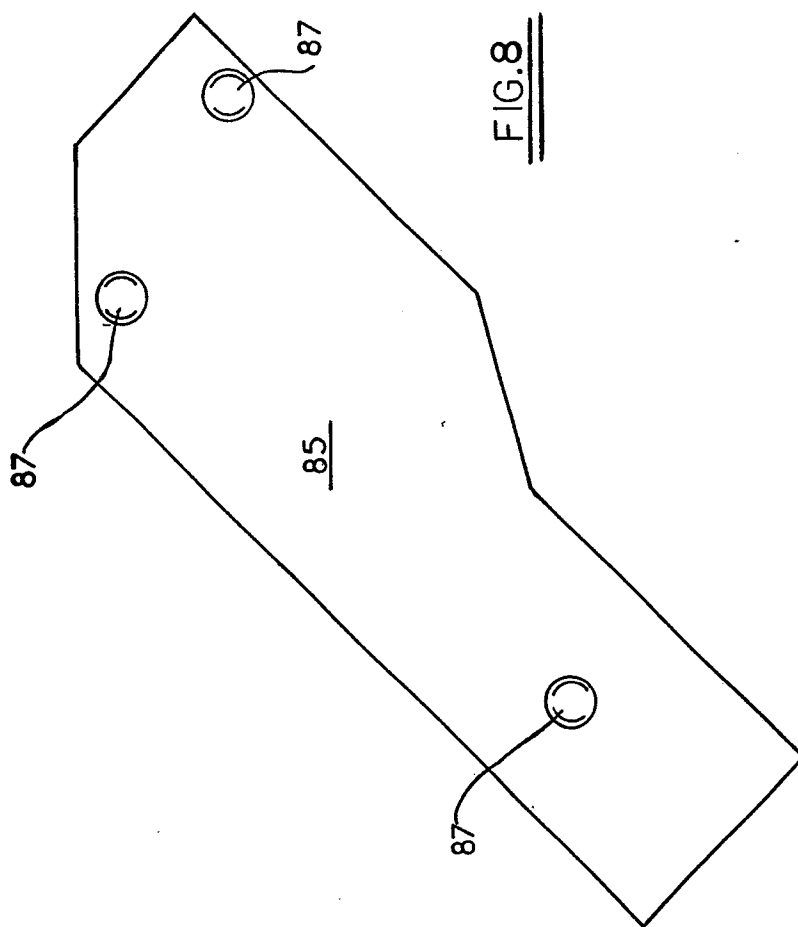


FIG. 8