Feb. 5, 1952 R. E. CROSS 2,584,428

HYDRAULIC CYLINDER CONSTRUCTION AND MOUNTING ARRANGEMENT

Filed June 27, 1950 2 SHEETS—SHEET 1

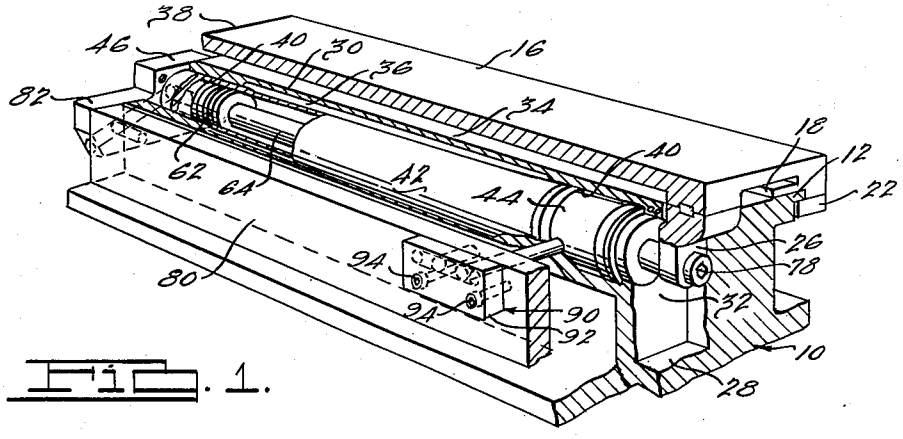


Fig. 1.

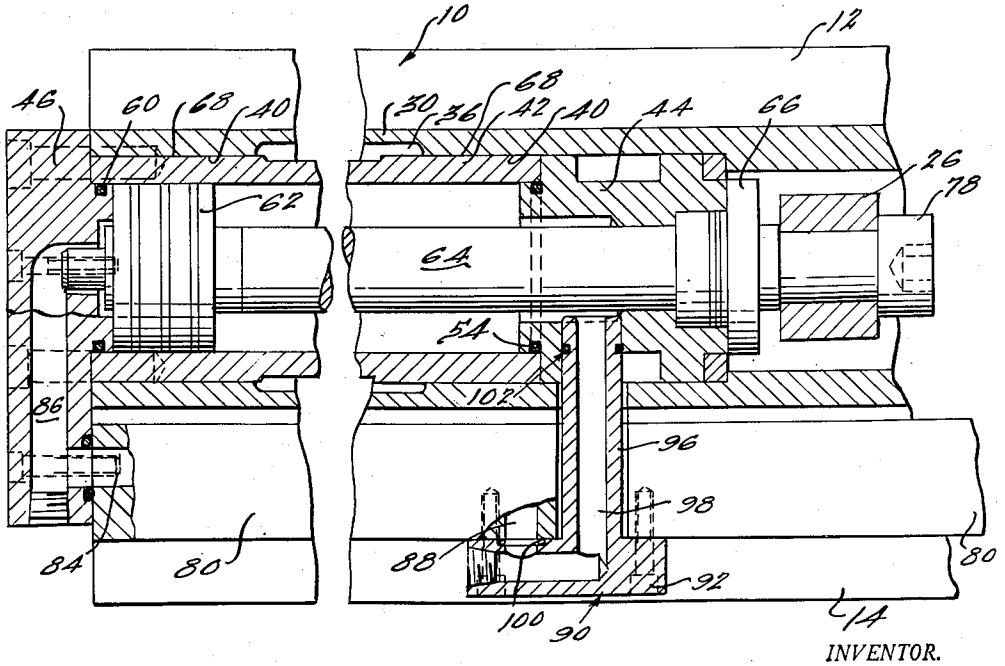


Fig. 2.

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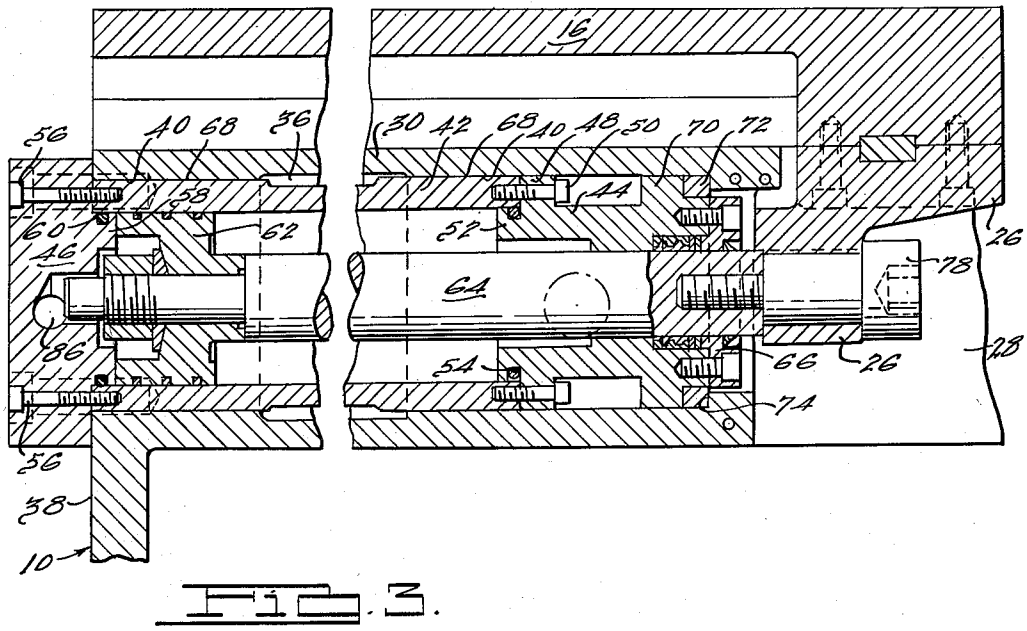


FIG. 3.

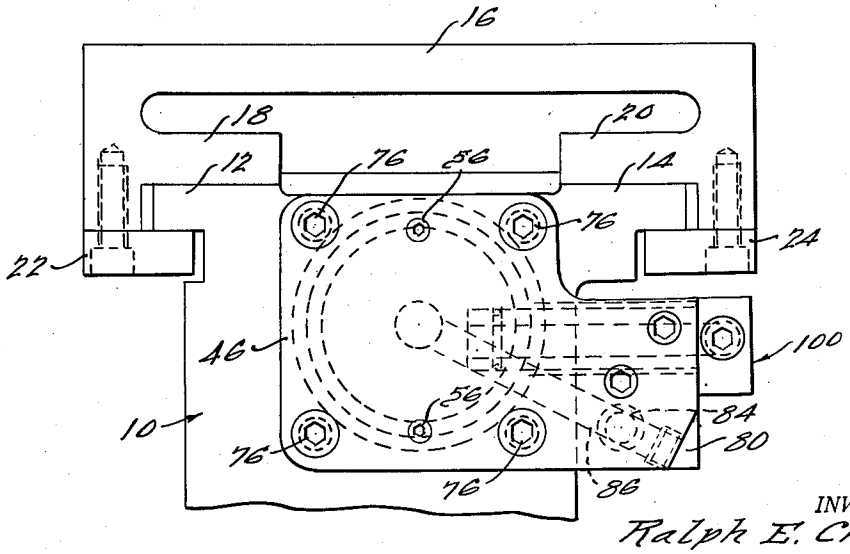


FIG. 4.

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UNITED STATES PATENT OFFICE

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HYDRAULIC CYLINDER CONSTRUCTION AND MOUNTING ARRANGEMENT

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14 Claims. (Cl. 121—45)

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This invention relates broadly to hydraulic cylinder mountings.

More particularly the invention is concerned with a hydraulic cylinder mounting adapted to be incorporated in a machine tool of the type having a base provided with laterally spaced parallel ways so as to actuate a saddle slidable on the ways.

An important object of the present invention is to provide a novel hydraulic cylinder construction and mounting arrangement which, when mounted in a machine tool, occupies a minimum amount of space and thus reduces the distance between the centerline of the cylinder and the way surfaces to minimize the mechanical couple existing in the bracket which connects the cylinder to the saddle.

Another object of the invention is to provide a novel cylinder construction and mounting arrangement of the above-mentioned character wherein the cylinder assembly is mounted in a bore between the ways so as to assure a more rigid and accurate way construction.

Still another object of the invention is to provide a novel cylinder construction and mounting arrangement of the above-mentioned character wherein the cylinder assembly is removable as a unit for replacement or repair of parts without removing the saddle from the base.

Another object of the invention is to provide a cylinder construction and mounting arrangement of the above-mentioned character having novel means for supplying hydraulic liquid to the cylinder which eliminates piping and attendant threaded connection conventionally employed.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the drawings forming a part of this specification and wherein like numerals are employed to designate like parts throughout the same:

Fig. 1 is a perspective view of a machine-tool base having a saddle thereon and a novel cylinder construction and mounting arrangement embodying the invention incorporated therein for moving the saddle longitudinally on the base, parts thereof being broken away and shown in section for clearness of illustration;

Fig. 2 is a plan view of the base showing the cylinder assembly partially in section;

Fig. 3 is a vertical sectional view of the entire assembly; and

Fig. 4 is an end elevational view illustrating particularly the manner in which the cylinder

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assembly is removable as a unit from the base and the manner in which the hydraulic liquid is supplied to the base.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of the invention, the numeral 10 designates a machine tool base of generally conventional construction having a pair of laterally spaced, longitudinal, parallel ways 12 and 14. Surmounting the base 10 is a saddle 16 having runners 18 and 20 mounted on and longitudinally slidable along ways 12 and 14 respectively. Retaining strips 22 and 24 carried by the saddle 16 extend under the ways 12 and 14 according to conventional practice to hold the saddle on the base 10. Bolted or otherwise detachedly fastened to the forward end of the saddle 16 is a depending bracket 26 which travels in a longitudinal groove or way 28 provided in the base 10. The bracket 26 is adapted for attachment to an actuator for moving the saddle 16 back and forth on the base 10.

In conventional practice, the base 10 is formed between the ways 12 and 14 with an elongated hollow trough in which a fluid motor is mounted for connection with the bracket 26. This construction has the disadvantage, however, that the fluid motor is rendered inaccessible by the saddle so that the latter must be disassembled from the base 10 in order to remove the motor for replacement or repair of parts. Thus servicing of the fluid motor is a major operation requiring dismantling of substantially the entire machine. As a consequence, maintenance costs are high, and the machine is out of service for an inordinate length of time. In addition to the above, the conventional construction requires that the ways be relatively high in order to provide proper clearance for the fluid motor. As a consequence the ways exhibit a tendency to spread under load so as to bind or otherwise adversely affect movement of the saddle 16. Also, the excessive height of the ways requires that the bracket 26 be relatively long so that the mechanical couple between the fluid motor and the saddle is correspondingly large.

According to the present invention the fluid motor is uniquely constructed and mounted on the base 10 so as to be removable as a unit from one end of the base without removing the saddle 16. The fluid motor assembly is associated with the base so as to strengthen and reinforce the ways and to maintain the vertical distance between the centerline of the motor cylinder and the ways 12 and 14 at a minimum. In this manner, spreading of the ways under load is pre-

vented and the mechanical couple in bracket 26 is reduced as much as possible.

To this end, the base 10 is formed with a generally cylindrical shell 30 which extends longitudinally thereof and is located substantially midway between and parallel to the ways 12 and 14. The shell 30 is integrally connected to the ways 12 and 14 by vertical transverse webs 32 at the ends thereof and by a transverse web 34 which extends horizontally between the shell and the ways. This construction provides a horizontal, longitudinal bore 36 in the body 10 which opens through the rearward end 38 of the base 10 and is adapted to receive the fluid motor which operates the saddle 16. The bore is provided at opposite ends thereof with finished cylindrical internal surfaces 40 which provide supporting bearings for the cylindrical shell of the motor.

The fluid motor here shown is in the form of an elongated cylinder and comprises a cylindrical wall 42 closed at the forward end by a cylinder head 44 and at the rearward end thereof by a cylinder cap 46. Preferably the cylindrical wall portion 42 is kept to a minimum diameter and the wall is of only sufficient thickness to retain the pressure of fluid therein. The cylinder head 44 has an external radial flange 48 which abuts the forward end of the wall 42 and is fastened thereto by an annular series of screws 50. Also, the cylinder head 44 is formed with a central embossment 52 which extends into and snugly fits the cylindrical wall 42 to serve as a retainer for an O ring 54 which seals the joint between the head 44 and the wall 42. As perhaps best shown in Fig. 3, the cylindrical wall 42 extends flush with the rearward end 38 of housing 10, and the cap 46 extends laterally across and in abutting engagement with both the end of the cylinder wall and the housing 10. Screws 56 hold the cap 44 attached to the cylindrical wall 42. Also, the cap 46 is similarly formed with a central embossment 58 which extends into the cylindrical wall 42 and forms a retainer for an O ring 60 which seals the joint between the wall and the cap. Within the cylindrical wall 42 is a piston 62 having a piston rod 64 which extends forwardly through the cylinder head 44 for attachment to the bracket 26. The head 44 is provided with the usual stuffing box assembly 66 which seals the joint between the head 44 and piston rod 64 without preventing longitudinal sliding movement of the rod.

From the foregoing it will be readily apparent that the fluid motor can be inserted into the bore 36 through the open rearward or outer end thereof. At opposite ends thereof the cylindrical wall 42 is formed with finished external surfaces 68 which snugly fit the internal machined surfaces 40 of the bore 36. Also, the cylinder head 44 is formed with a forward radial flange 70, and the peripheral surfaces of both flanges 48 and 70 are machined to snugly fit the forward internal surface 40. A ring 72 mounted on the cylinder head 44 ahead of flange 70 seats rearwardly against the flange and abuts an internal radial shoulder 74 provided at the inner end of bore 36. Thus, the ring 72, in effect, seats the fluid motor axially forwardly against the base casting 10. In addition, the ring 72 is dimensioned to position the rearward end of cylinder wall 42 flush with the rear face of the base casting as suggested above. The entire fluid motor assembly is held solidly attached to the base casting by four relatively large screws 76 and the projecting forward end of piston rod 64 is attached to bracket 26 by a screw 78.

It will thus be apparent that the relatively large screws 76 hold pressure developed in the cylinder 42 during operation of the motor. Small screws 50 and 56 need be only large enough to hold the parts of the motor assembled. They are not of sufficient size to resist the internal forces of the cylinder. Thus, forward thrust against the head 44 is taken by the internal shoulder 74 of the base casting, and rearward thrust against the cap 46 is taken by large retaining screws 76 which engage the base casting. This construction permits the external diameter of cylinder 42 to be held to a minimum and permits the vertical dimension between the centerline of the fluid motor and the top of ways 12 and 14 to be held to a minimum. As a result, the mechanical couple in bracket 26 also is held to a minimum. If the cylinder 42 were made large enough to receive bolts of a size to withstand internal forces created within the cylinder, the external diameter of the cylinder would have to be considerably larger and the recited advantages achieved by the instant construction would be lost.

In addition to the above, a novel means is provided for supplying fluid to the cylinder at opposite sides of piston 62, which means eliminates conventional piping and threaded connections heretofore employed. According to the present invention, a manifold 80 is bolted or otherwise fastened to one side of the base 10. As perhaps best shown in Fig. 1, the manifold 80 is relatively elongated and it extends longitudinally on the base with one end thereof abutting a portion 82 of the cylinder cap 46 which projects laterally of the base 10. Fluid under pressure is delivered to manifold 80 in any suitable manner and, if necessary or desirable, it may be equipped with the usual metering valves for controlling the rate of flow of the fluid through the manifold. In any event, the manifold 80 is provided with a passage 84 which registers with and delivers hydraulic fluid to one end of a U-shaped passage 86 in the cap 46. The other end of passage 86 opens into the cylinder behind piston 62. Also, the manifold 80 is provided with a passage 88 for delivering fluid to the cylinder ahead of piston 86. To this end a hydraulic connector 90 is mounted on the manifold 80 adjacent the forward end thereof for conducting hydraulic liquid from the passage 88 to the fluid motor. More particularly the connector 90 has a generally rectangular head portion 92 which is held solidly against the manifold 80 by screws 94. Integrally formed on the head portion 92 is a lateral cylindrical extension 96 which extends through registering openings provided in the manifold 80, base 10, and cylinder head 44. A generally U-shaped passage 98 is provided in the connector 90. One end of the passage 98 registers with the manifold passage 88. The other end of passage 98 extends through the cylindrical extension 96 and opens into the fluid motor through the head 44, as shown in Fig. 2. An O ring 100 seals the joint between the connector and the manifold, and an O ring 102 seals the joint between the cylindrical extension 96 and the cylinder head 44.

In order to disassemble the fluid motor it is merely necessary to remove the four screws 76 which fasten the cylinder cap 46 to the base 10, the screw 78 which fastens the piston rod to the bracket 26, and the two screws 94 which

fasten the hydraulic connector 90 to the base. The connector can then be pulled outwardly to disengage cylindrical portion 96 from the cylinder head 64 and the fluid motor as a unit can be pulled from the open rearward end of bore 36 for servicing or for other reasons. Manifestly, this can be done without removing the saddle 16 from the base 10 and without disturbing hydraulic circuits which supply the fluid motor. If the number of installations or other factors warrant, one or more fluid motors can be maintained on hand so that a stock motor can be substituted for the one removed from the machine. If this is done the machine need be out of service for only a very short time.

Manifestly, the fluid motor can be reassembled on the machine as easily and quickly as it can be removed. The motor unit is merely inserted into bore 36 through the open rearward end thereof to the position shown in the drawing, and the hydraulic connector 90 is interengaged with the head 64. The cap 46 and the connector 90 are then bolted securely in place, and piston rod 66 is fastened to the bracket 26. This completes the assembly and also establishes the hydraulic circuit which services the motor.

Having thus described the invention, I claim:

1. A cylinder mounting arrangement for actuating machine tool saddles comprising a machine tool base having a longitudinal bore, a saddle slidable on said base, a cylinder supported at opposite ends thereof in said bore, closures for the ends of the cylinder, one of said closures extending laterally of the cylinder and being fastened solidly to the base, an internal axial seat in the bore for the other of said closures, a piston mounted for reciprocation in said cylinder, a piston rod connected to and movable with said piston extending exteriorly of said cylinder and connected to said saddle, means for introducing hydraulic liquid into the cylinder at one side of the piston through one of said closures, and means for introducing hydraulic liquid into the cylinder at the other side of the piston through the other of said closures including a hydraulic connector member having an outer head portion connected to the base and an inward extension disposed in interlocking engagement with said other closure.

2. In a machine tool, a base having a longitudinal bore therein, a saddle mounted for reciprocation on said base, a fluid motor having a cylinder removably mounted in said bore, a piston mounted for reciprocation in the cylinder and a piston rod attached to the saddle, means fastening one end of the cylinder to the base, a hydraulic connector fastened to the base and interlocking with the other end of the cylinder preventing withdrawal thereof from the bore, and means for introducing hydraulic liquid into the cylinder at opposite sides of the piston through said fastening means and said hydraulic connector.

3. A hydraulic cylinder mounting for machine tools of the type having a base provided with laterally spaced, parallel, upstanding ways and a saddle slidable on said ways comprising an elongated cylindrical shell disposed between and parallel to said ways, transverse webs connecting said shell to said ways and co-operating with said shell to prevent spreading of the ways under load, and a fluid motor assembly in and removable as a unit from one end of the shell, said fluid motor assembly including a piston rod operatively connected to said saddle.

4. A hydraulic cylinder mounting for machine tools of the type having a base provided with laterally spaced, upstanding ways and a saddle slidable on said ways comprising an elongated cylindrical shell disposed between and parallel to said ways and opening through one end of the base, transverse webs connecting said shell to said ways and co-operating with said shell to prevent spreading of the ways under load, and a fluid motor assembly in and removable as a unit from the open end of the shell, said fluid motor assembly including means detachably connecting the assembly to the base at the open end of the shell and means detachably connecting the piston rod of the assembly to the saddle.

5. A hydraulic cylinder mounting for machine tools of the type having a base provided with laterally spaced, parallel, upstanding ways and a saddle slidable on said ways comprising an elongated, cylindrical shell disposed between and parallel to said ways, finished internal bearing surfaces at opposite ends of said shell, transverse integral webs between said shell and said ways and interconnecting the ways to prevent spreading thereof under load, and a fluid motor assembly in and removable as a unit from one end of the shell, said fluid motor assembly including an outer cylinder member having finished external cylindrical surfaces snugly fitting the finished internal surfaces of the shell, and a piston rod extending from the cylinder and detachably fastened to said saddle.

6. A hydraulic cylinder mounting for machine tools of the type having a base provided with laterally spaced, parallel, upstanding ways and a saddle slidable on said ways comprising an elongated cylindrical shell disposed between and parallel to said ways, transverse webs connecting said shell to said ways and co-operating with said shell to prevent spreading of the ways under load, a fluid motor assembly in and removable as a unit from one end of the shell, said assembly including an outer cylinder member and a piston rod extending from the cylinder member, a radial shoulder seating the inner end of the cylinder, means detachably fastening the other end of the cylinder to said base and holding the inner end thereof solidly engaged with said seat, and means detachably fastening the piston rod to said saddle.

7. A hydraulic cylinder mounting for machine tools of the type having a base provided with laterally spaced, parallel, upstanding ways and a saddle slidable on said ways comprising an elongated cylindrical shell disposed between and parallel to said ways and opening through one end of the base, transverse webs connecting said shell to said ways and co-operating with said shell to prevent spreading of the ways under load, an internal shoulder at the inner end of said shell, a fluid motor assembly in the shell engaging solidly against said shoulder and removable as a unit from the open end of the shell, means operatively and detachably connecting said fluid motor to said saddle, and means detachably fastening said fluid motor to said base with the inner end thereof pressed solidly against said shoulder.

8. A hydraulic cylinder mounting for machine tools of the type having a base provided with laterally spaced, parallel, upstanding ways and a saddle slidable on said ways comprising an elongated cylindrical shell disposed between and parallel to said ways and opening through one end of the base, an internal shoulder at the inner end of said shell, a fluid motor assembly in the shell engaging solidly against said shoulder and remov-

able as a unit from the open end of the shell, means operatively and detachably connecting said fluid motor to said saddle, and means detachably fastening said fluid motor to said base with the inner end thereof pressed solidly against said shoulder.

9. A hydraulic cylinder mounting for machine tools of the type having a base provided with laterally spaced, parallel, upstanding ways and a saddle slidable on said ways comprising an elongated cylindrical shell disposed between and parallel to said ways, a fluid motor assembly in and removable as a unit from one end of said shell, an internal shoulder in the shell seating one end of the fluid motor assembly, and a cylinder cap at the opposite end of the fluid motor assembly, said cap having laterally extending flange portions disposed externally of and detachably connected to the base, and means detachably operatively connecting said fluid motor assembly to the saddle so that operation of said assembly moves the saddle on said ways.

10. A hydraulic cylinder mounting for machine tools comprising a base provided with laterally spaced, parallel, upstanding ways, a saddle slidable on said ways, an elongated cylindrical shell disposed between and parallel to said ways, a fluid motor assembly in and removable as a unit from one end of the shell, said fluid motor assembly including an outer cylinder member and a piston rod extending from the inner end of the cylinder, a fixed radial shoulder in the shell seating the inner end of the cylinder, a cylinder cap fastened to and closing the outer end of the cylinder, said cap seated against the end of the cylinder to which it is fastened and extending laterally of the cylinder, means detachably fastening the laterally extending portion of the cap solidily to the base whereby said fastening means resists internal pressures in the cylinder and holds the latter solidly assembled in the shell, and means detachably fastening the piston rod to said saddle.

11. A hydraulic cylinder mounting for machine tools of the type having a base provided with laterally spaced, parallel ways and a saddle slidable on said ways comprising a longitudinal bore between and parallel to said ways and opening at one end thereof exteriorly of the base, an internal radial shoulder at the inner end of the bore, a fluid motor assembly in and removable as a unit from the open end of the bore, said assembly including an outer cylinder portion seating endwise against said shoulder and a piston rod operatively connected to said saddle, and a cylinder cap on and fastened to the outer end of the cylinder, said cap extending laterally of the cylinder and detachably fastened to said base.

12. A hydraulic cylinder mounting for machine tools comprising a base provided with laterally spaced, parallel ways, a saddle slidable on said ways, a longitudinal bore between and parallel to said ways opening through the base at one end thereof, internal cylindrical, finished surfaces at opposite ends of said bore, an internal shoulder at the inner end of said bore, a depending bracket on the saddle behind the inner end of said bore, a fluid motor assembly in and removable as a unit through the open end of the bore, said assembly including a cylinder having finished external cylindrical surfaces fitting snugly in the finished internal surfaces of the bore and seating endwise against said internal shoulder, said assembly also including a piston rod detachably connected to said bracket, a cylinder cap fastened to and closing the outer end of the cylinder, said cap having laterally extending portions, the latter being solidly fastened to the base whereby to hold said cylinder solidly against the shoulder and to sustain internal forces developed during operation of the motor.

13. A hydraulic cylinder mounting for machine tools of the type having a base provided with laterally spaced, parallel ways and a saddle slidable on said ways, a longitudinal bore in the base between and parallel to said ways, a fluid motor assembly in and removable as a unit from one end of the bore detachably and operatively connected to said saddle so that operation of said motor moves the saddle longitudinally on said ways, means detachably fastening said fluid motor assembly to said base, and means for delivering hydraulic liquid to said fluid motor assembly including a hydraulic connector detachably fastened to the base and having a tubular portion extending into the base for delivering fluid to said fluid motor.

14. A hydraulic cylinder mounting for machine tools comprising a base provided with laterally spaced, parallel ways, a saddle slidable on said ways, a longitudinal bore between and parallel to said ways having an end opening exteriorly of the base, an internal shoulder at the inner end of said bore, a fluid motor assembly in and removable as a unit through the open end of said bore, said assembly including a cylinder portion seating endwise against said shoulder, a piston rod operatively detachably fastened to said saddle, and a cylinder cap at the outer end of said cylinder overlying and detachably fastened to said base, and means for delivering hydraulic liquid to opposite ends of said cylinder including fluid passages in said cylinder cap communicating interiorly of said cylinder, and a hydraulic connector detachably fastened to the base, said connector having a tubular portion extending into the base and through a wall of said cylinder, the interior of said tubular portion comprising a fluid passage and said passage opening interiorly of the cylinder.

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