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ADJUSTABLE HYDRAULIC CONNECTING MEMBER

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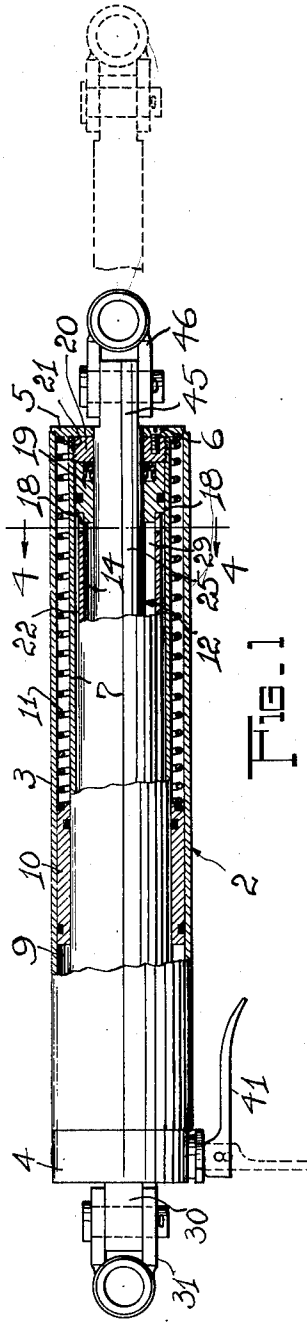


FIG. 1

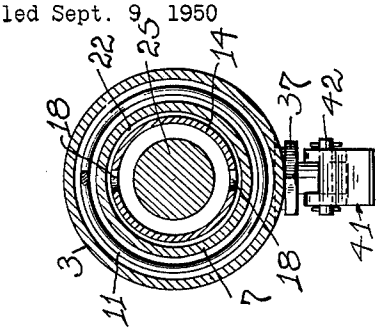


FIG. 4

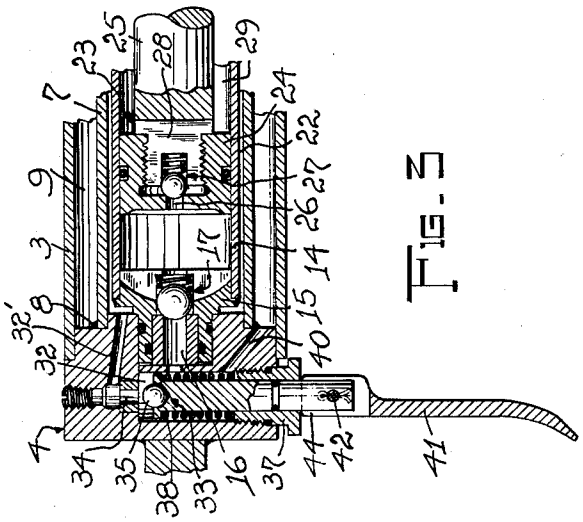


FIG. 3

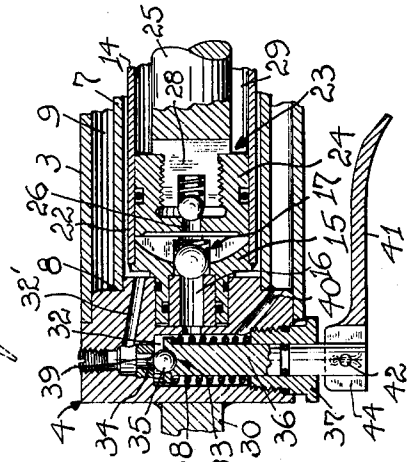


FIG. 2

INVENTOR.
JOHN A. KANUCH
BY
Gustav A. Wolff.
ATT.

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ADJUSTABLE HYDRAULIC CONNECTING MEMBER

John A. Kanuch, South Euclid, Ohio, assignor to Great Lakes Manufacturing Corporation, Cleveland, Ohio, a corporation of Ohio

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4 Claims. (Cl. 188—96)

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This invention relates to longitudinally adjustable connecting members such as used for properly coupling different devices with each other.

The primary object of the invention is the provision of a hydraulic, longitudinally adjustable, connecting member including cooperating, axially shiftable, intersleeved members arranged to permit axial adjustment of the overall length of the connecting member to the specific purpose for which it is to be used and manually operable valve means arranged to effect hydraulic interlocking of the intersleeved members in any adjusted position.

Another object of the invention is the provision of a hydraulic, longitudinally adjustable connecting member including a cylinder piston member and valve controlled passage means arranged to effect unidirectional flow of liquid through said cylinder piston member when the piston of such member is shifted in the cylinder to axially adjust the overall length of the connecting member and control the flow of liquid through said passage means to effect selective hydraulic locking of the piston in adjusted position in the cylinder.

A further object of the invention is the provision of a hydraulic, longitudinally adjustable, connecting member including a cylinder piston member having check valve controlled passage means arranged to effect unidirectional flow of liquid through said cylinder piston member when the piston is reciprocated in the cylinder and including other valve controlled passage means connecting the opposite ends of the cylinder with each other, the latter passage means being controlled by manually operable valve means to permit selective hydraulic locking of the piston in the cylinder.

Still another object of the invention is the provision of a hydraulic, longitudinally adjustable connecting member including a cylinder piston member with check valve-controlled passage means arranged to effect unidirectional flow of liquid through said cylinder piston member when the piston of said cylinder piston member is reciprocated, other passage means connecting the opposite ends of the cylinder with each other, manually operable valve means in said latter passage means effecting selective hydraulic locking of the piston in the cylinder and a collapsible liquid reservoir arranged to feed liquid into the said cylinder piston member when the piston is shifted in one direction to increase the overall length of the connecting member and to receive liquid when the piston is shifted in the opposite

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direction to decrease the overall length of the connecting member.

A still further object of the invention is the provision of a hydraulic, longitudinally adjustable connecting member of the type described above in which the manually operable valve means is controlled with a spring seated valve element for automatic relief action of such valve means under excessive pressures caused by shocks, thermal expansion of the liquid, etc.

Still further objects and novel features of construction, combination and relation of parts by which the objects in view have been attained, will appear and are set forth in detail in the course of the following specification.

The drawing accompanying and forming part of the specification illustrates certain practical embodiments of the invention, but it will be apparent as the specification proceeds that the structure may be modified and changed in various ways without departure from the true spirit and broad scope of the invention.

In the drawings:

Fig. 1 is a longitudinal sectional view partly in elevation through a hydraulic, longitudinally adjustable connecting member constructed in accordance with the invention;

Fig. 2 is an enlarged fragmentary longitudinal sectional view of the connecting member shown in Fig. 1, the view showing the manually controlled valve in closed position;

Fig. 3 is a sectional view similar to Fig. 2 showing the manually controlled valve in open position; and

Fig. 4 is a cross-sectional view on line 4—4 of Fig. 1.

Referring now more particularly to the exemplified form of the hydraulic connecting member shown in the drawing, reference numeral 2 denotes a cylindrically shaped housing embodying a cylindrical tube 3 fluid-tightly closed at its one end by a valve supporting head portion 4. The other end of cylindrical tube 3 is closed by a head plate 5 secured by screws 6 to a cylindrical tube 7 of smaller diameter than tube 3, which tube 7 is in concentrical relation with respect to tube 3 welded at 8 to head portion 4. The cylindrical tubes 3 and 7 form a ring-shaped reservoir 9 slidably mounting a ring-shaped piston 10 forced by a compression spring 11 toward valve supporting head portion 4 for a purpose later to be described.

The cylindrical tube 7 which forms the inner wall of reservoir 9 encircles a cylinder piston arrangement 12 axially aligned with respect to tube

7. This cylinder piston arrangement embodies a cylinder member 14 smaller in diameter than tube 7, which cylinder member at its one end is held in axial alignment in tube 7 by passaged, valved head member 15 fluid-tightly engaged with cylinder member 14. The head member 15 has its axial passage 16 controlled by a check valve 17 to permit liquid to be fed into cylinder member 14 and prevent escape of liquid from said cylinder member. The other end of cylinder member 14 is slotted at 18 and seated in a shouldered sleeve member 19 fluid-tightly engaged with tube 7 and held in position by a ring-shaped nut member 20 threadedly engaged with the threaded end 21 of tube 7. The cylinder member 14 being of smaller diameter than tube 7 forms with said tube an elongated, ring-shaped passage 22 in open communication with the bore of cylinder member 14 through slots 18. Cylinder piston arrangement 12 furthermore embodies a piston member 23 with a piston 24 and a piston rod 25. The piston 24 includes an axial passage 26 controlled by a check valve 27 which permits liquid to be fed through passage 26 and the slotted end 28 of piston rod 25 into the ring-shaped space 29 between piston rod 25 and the inner wall of cylinder member 14 and prevents escape of liquid from the ring-shaped space 29 through passage 26 into cylinder member 14, all for a purpose later to be described.

Valve supporting head portion 4, the extension 30 of which pivotally supports a ring-shaped member 31 for readily attaching this end of the connecting member to a device, includes a valve chamber 32 mounting a spring-pressed valve 33 arranged to control a passage 34 effecting through a passage 32' in head portion 4 communication between valve chamber 32 and the elongated ring-shaped passage 22. The valve 33 embodies a ball valve 35 carried by a spring-pressed supporting member 36 axially shiftably mounted in a tubular screw member 37 which is threadedly connected with head portion 4, a compression spring 38 yieldingly forcing supporting member 36 and ball valve 35 toward a valve seat 39. Seating of ball valve 35 on valve seat 39 cuts off communication between ring-shaped passage 22 and valve chamber 32, the latter chamber being in this position of ball valve 35 only in communication with reservoir 9 through a passage 40. To effect communication between valve chamber 32 and ring-shaped passage 22, supporting member 36 is shifted against the tension of spring 38 by a lever 41 pivoted at 42 to the outwardly extended end portion 43 of supporting member 36. This lever includes a cam-shaped end portion 44 adapted to engage the screw member 37 when the lever is shifted from Fig. 2 position to Fig. 3 position and then effects axial shifting of the supporting member 36 against the tension of spring 38, thereby effecting lifting of ball valve 35 from its valve seat 39.

Yielding mounting of ball valve supporting member 36 by compression spring 38, permits automatic shifting of such member against the tension of said spring under excessive pressures such as caused by shock and thermal expansion stresses and affords a simple and efficient means adapted to effect automatic release action of valve 33 when subjected to such stresses.

The thus described connecting member has pivotally attached to the outwardly extended end portion 45 of its piston rod 25 a ring-shaped member 46 for attaching this end of the connecting member to a device. When in use with valve 33

in closed position, the connecting member will readily resist axial movement of piston 24 with respect to cylinder 14. Thus when the connecting member resists extension, that is when tensile stresses are applied to the opposite ends of the connecting member, piston member 23 exerts pressure on the liquid in the ring-shaped space 29, slots 18, ring-shaped passage 22, passage 32' and valve-controlled passage 34. When the connecting member resists compression, that is, when compression forces are applied to the opposite ends of the connecting member, check valve 27 in piston member 23 is opened up so that pressure is exerted on the liquid in cylinder member 14, ring-shaped space 29, slots 18, ring-shaped passage 22, passage 32' and valve-controlled passage 34. In both cases all the liquid in reservoir 9 is inactive as this liquid is neither fed into cylinder piston arrangement nor discharged therefrom—valve 33 in closed position inactivating the liquid in reservoir 9.

When valve 33 is in open position (see Fig. 3) and tensile stresses are applied to the connecting member, the liquid in ring-shaped space 29 is transferred through slots 18, ring-shaped passage 22, passage 32', passage 34 and valve 33 into valve chamber 32 and hence through passage 16 and check valve 17 into cylinder 14, while at the same time liquid from reservoir 9 is forced through passage 40 into valve chamber 32 and hence through passage 16 and check valve 17 into cylinder 14. Such action results in practically unimpeded shifting of piston member 24 in cylinder 14.

When valve 33 is in open position and compression forces are applied to the connecting member, check valve 27 in piston member 23 is opened up and liquid from cylinder member 14 is forced through passage 26, ring-shaped space 29, slots 18, ring-shaped passage 22, passage 32', passage 34 and valve 33 into valve chamber 32, hence through passage 40 into reservoir 9, while forcing the ring-shaped piston 10 yieldingly back against the tension of compression spring 11.

The described extensible hydraulic connecting member may readily and easily be extended and set to any desired length by opening up valve 33, pushing or pulling piston member 23 into the desired position and then closing valve 33.

As the flow of liquid in cylinder piston arrangement 12 is unidirectional, both for tensile and compression stresses, the connecting member can readily be bled of air by opening valve 33 with lever 41 and effecting reciprocatory movements of piston 24 in cylinder 14.

Having thus described my invention what I claim is:

1. An extensible hydraulic connecting member comprising a cylinder, a piston in said cylinder, a check-valve-controlled passage in said piston arranged to effect unidirectional flow of liquid through said cylinder and piston, check-valve-controlled passage means connecting the opposite ends of said cylinder with each other and forming with said cylinder and said piston a liquid-circulating, pressure-resisting system and a manually operable valve member arranged within said passage means and including a manually shiftably mounted valve, and shifting means for said valve adapted to permit and prevent circulation of liquid in the liquid circulating system of the hydraulic connecting member when adjusting the length thereof and locking such member in its adjusted position.

2. An extensible hydraulic connecting member as described in claim 1, wherein the valve of said

manually-operable, valve member is yieldingly shifted to closing position by compression spring means arranged in said valve member and permitting selective hydraulic locking of the piston in said cylinder and automatic release of the hydraulic locking of such piston by excessive pressures caused by shock and thermal expansion stresses.

3. An extensible hydraulic connecting member as described in claim 1, including a valve chamber having said manually operable valve member mounted therein, said valve chamber forming a part of said passage means and controlling liquid movements in said passage means, and a liquid reservoir in open communication with said valve chamber.

4. In an extensible hydraulic connecting member a cylinder-piston arrangement having check valve means effecting unidirectional flow of liquid therethrough, a tubular body concentrically encircling the cylinder-piston arrangement in spaced relation with respect thereto and forming therewith a ring-shaped passage encircling the cylinder-piston arrangement, passage means fluid-tightly connecting opposite ends of the

cylinder-piston arrangement with opposite ends of the ring-shaped passage and forming therewith a liquid circulating system, and a manually operable valve member in said passage means controlling the flow of liquid therethrough, said valve member including a shiftable valve, and shifting means adapted to shift the valve to open and close positions to permit and prevent circulation of liquid in said liquid circulating system for adjusting the length of the connecting member and locking the cylinder-piston arrangement in its adjusted position.

JOHN A. KANUCH.

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