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MULTI-STAGE HYDRAULIC JACK

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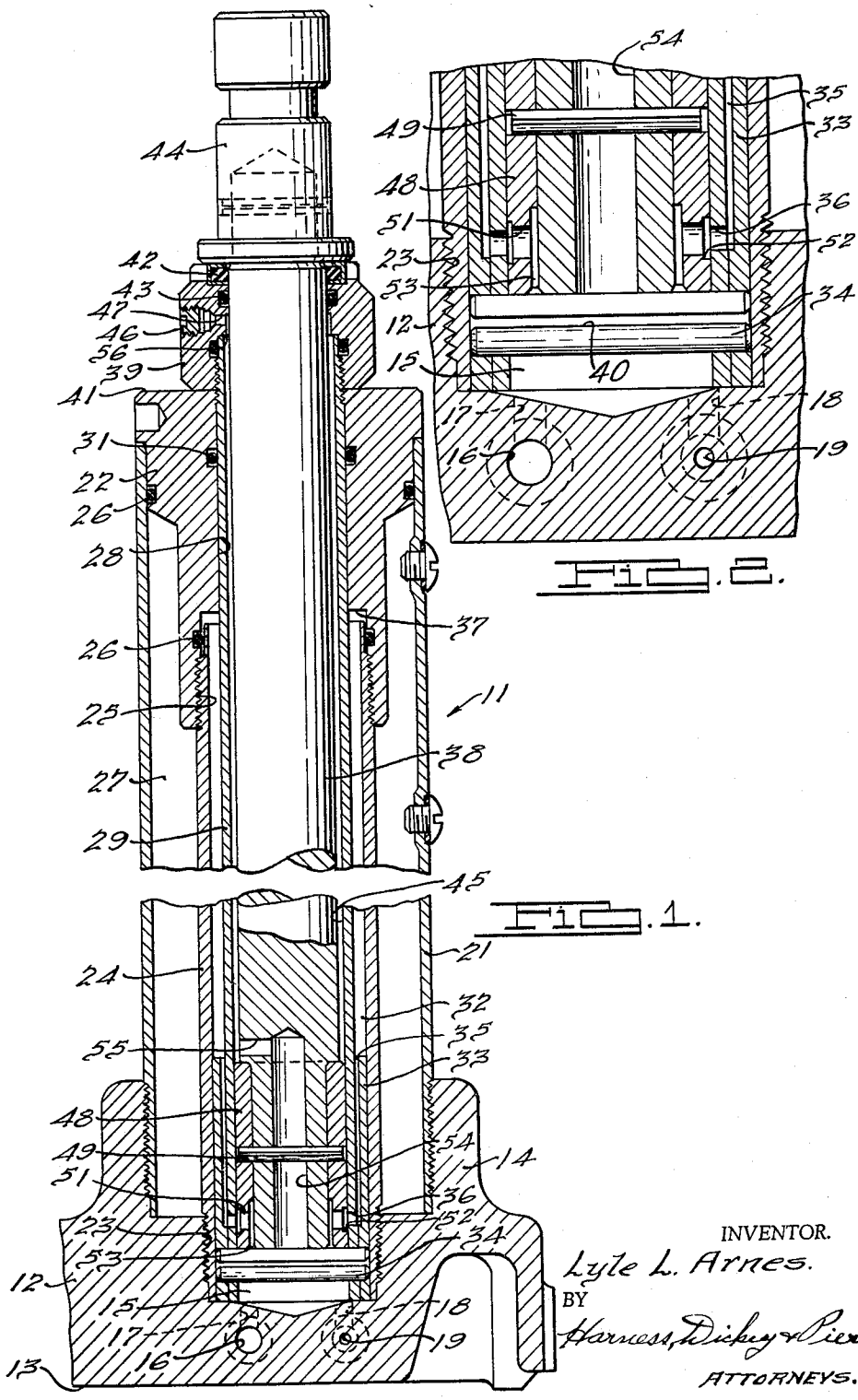


FIG. 2.

FIG. 1.

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MULTI-STAGE HYDRAULIC JACK

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This invention relates to hydraulic jacks, and more particularly to multi-stage jacks which have two or more telescoping ram sections. A typical use of this jack is a substitute for the unit 151 of U.S. Patent 2,837,222.

It is an object of the invention to provide an improved multi-stage hydraulic jack which minimizes fluid leakage problems and may be inexpensively constructed using tubular elements which require a minimum amount of machining and may be quickly and easily assembled.

It is another object to provide an improved multi-stage hydraulic jack construction of the above nature which is sturdy and efficient in operation and may be used with various types of pump arrangements and in any desired number of stages.

Other objects, features and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing.

In the drawing:

Figure 1 is a cross-sectional view in elevation, with parts broken away, showing a multi-stage hydraulic jack constructed according to the present invention, the parts being shown in their collapsed position; and

Figure 2 is an enlarged fragmentary view of a lower portion of the jack showing more clearly the fluid-conducting passages.

In general terms, the illustrated embodiment of the invention comprises a jack having a base, a cylinder mounted on the base, and a plurality of ram sections telescopically mounted within the cylinder. Two ram sections are shown in the illustrated embodiment, the first or outer section comprising a tubular member having a cylindrical guide sleeve secured to the lower end thereof by radially extending pins. The guide sleeve is slidably mounted within the cylinder while the first stage ram passes through a cap member secured to the outer end of the cylinder. An annular space is provided between a major portion of the guide sleeve and the first ram, this space being open to the annular space which exists between the outer ram and cylinder. Radial passages are formed in the lower portion of the outer ram which connect with the space between the outer ram and its guide sleeve. The inner ram section comprises a cylindrical member the upper end of which is slidably mounted in a gland nut carried by the upper end of the outer ram. A guide sleeve is fixed to the lower end of the inner ram and is slidably mounted in the outer ram. The annular space between the inner and outer rams is connected with the pressure chamber by an axial passage formed in the lower end of the inner ram, the upper end of this passage being connected with a radial passage leading to the annular space between the two rams. Radial ports are also formed in the lower portion of the inner guide sleeve, these ports being aligned with the radial ports in the outer ram when the inner ram is fully collapsed within the outer ram. An annular space formed between the lower end of the inner guide sleeve and the inner ram connects the radial ports in the inner guide sleeve with the pressure chamber.

Referring more particularly to the drawing, the jack is generally indicated at 11 and comprises a base 12 having a lower ground-engaging surface 13 and an upper boss 14. Although base 12 is only partially shown, it will be understood that it may support a pump arrangement (not shown) by means of which fluid under pressure enters pressure chamber 15 of the base by means of passageways 16 and 17. A release valve arrangement (not shown) may also be carried by base 12, so that fluid is released from chamber 15 through passages 18 and 19. It should be understood that the particular pump arrangement and release valve mechanism in themselves do not form part of the present invention, and that they could be incorporated as part of base 12 or mounted separately.

A cylindrical reservoir casing 21 is threadably mounted in boss 14 and extends upwardly therefrom, a cap member 22 being secured to the upper end of casing 21. A threaded portion 23 is formed centrally of boss 14 and extends downwardly into base 12, a cylinder 24 being threadably mounted in threaded portion 23 and extending upwardly therefrom. The upper end of cylinder 24 is mounted in a downwardly extended threaded portion 25 of end cap 22. Seals 26 are provided between end cap 22 and casing 21 and cylinder 24 respectively. These parts together form an annular reservoir chamber 27 which may be connected to the pump by appropriate passageways (not shown).

A guide bore 28 is centrally provided in end cap 22, and a tubular outer ram section 29 is slidably mounted in this bore, a seal 31 being provided in the bore and engageable with the outer surface of ram 29. Ram 29 is of somewhat smaller diameter than cylinder 24 so that an annular space 32 is provided between these two members. The lower end of ram 29 carries a guide sleeve 33, this sleeve being of tubular shape and having its lower edge substantially coincident with the lower edge of ram 29. A radially extending pin 34 of rolled sheet metal having a gap 40 passes through appropriate apertures in the lower ends of ram 29 and sleeve 33, securing these two members together for movement in unison. The lower portion of sleeve 33 has an inner diameter which is approximately the same as the outer diameter of ram 29, but a major portion of the inner diameter of sleeve 33 above pin 34 is relieved to provide an annular space, indicated at 35, between sleeve 33 and ram 29, this space communicating with space 32. A plurality of radial ports 36 are formed in the lower portion of ram 29 and serve to communicate the lower portion of space 35 with the inside of ram 29. An annular shoulder 37 is formed on end cap 22 immediately above its connection with cylinder 24, this surface being engageable by the upper edge of sleeve 33 when the jack is raised to limit the upper position of the outer ram.

An inner ram section 38 is disposed within ram section 29, ram 38 comprising a cylindrical member of approximately the same length as ram 29. A gland nut 39 is threadably mounted on the upper end of ram 29, this nut being engageable with the upper surface 41 of end cap 22 in the lower position of ram 29. Nut 39 carries a wiper ring 42 and an annular seal 43, ram 38 extending through these elements and carrying a bushing 44 at its upper end which may be connected to a load engaging element (not shown). An annular space 45 is provided between rams 29 and 38, and an air vent plug 46 is provided in nut 39 and is connected with space 45 by a passage 47.

A guide sleeve 48 is secured to the lower end of ram 38, the lower edge of this sleeve being approximately in the same plane as the lower surface of ram 38, so

that these surfaces are engageable with pin 34 in the lower position of ram 38. Sleeve 48 is secured to ram 38 by a radially extending pin 49, this pin extending through appropriate apertures in the ram and guide sleeve. A plurality of radially extending apertures 51 are provided in the lower portion of sleeve 48, these apertures being at approximately the same level as apertures 36 when both rams are telescoped. A circumferential connecting channel or groove 52 is provided on the outer surface of sleeve 48 so that, with ram 38 collapsed within ram 29, ports 36 and 51 will be in communication regardless of the relative angular positions of the ram sections. An annular recess 53 is provided on the inner surface of guide sleeve 48, this recess connecting ports 51 with pressure chamber 15. An axial passage 54 is also provided in the lower end of ram 38, this passage connecting chamber 15 with annular space 45 by means of a radial passage 55 formed in ram 38 immediately above sleeve 48. An annular shoulder 56 is provided on gland nut 39 immediately above its connection with outer ram 29, this shoulder forming a stop for guide sleeve 48 in the upper position of ram 38.

In operation, assuming an initial condition in which the jack is collapsed as shown in the figure and annular spaces 32 and 45 are filled with fluid, application of fluid pressure to passage 16 will cause ram sections 29 and 38 to be raised. During this movement, fluid within annular space 32 will flow through passage 35, ports 36 and ports 51 to passage 53, thus leaving space 32 as the latter diminishes in size and entering chamber 15. When sleeve 33 engages shoulder 37, movement of ram section 29 will stop, and further application of fluid pressure to chamber 15 will cause ram section 38 to continue its upward movement. Fluid from annular space 45 will flow through passages 55 and 54 to chamber 15, this action continuing until the operator discontinues fluid flow from passage 16 to chamber 15, or when sleeve 48 engages shoulder 56.

Upon release of pressure in chamber 15, ram section 38 will slide downwardly within ram section 29, and as annular space 45 enlarges, fluid will flow from chamber 15 through passages 54 and 55 to chamber 45. When ram section 38 engages pin 34, both ram sections will continue downward movement together, with fluid flowing from chamber 15 through passages 53, 51, 36 and 35 to space 32. The main portion of fluid flowing from chamber 15 will of course exit through passages 18 and 19 to reservoir chamber 27.

It will thus be seen that a novel and improved multi-stage hydraulic jack has been provided which is of extremely inexpensive construction, and in which the passages necessary for proper fluid flow between the ram sections are formed in conjunction with tubular guide sleeves fixed to the ram sections. Because of the unique construction, tolerance and sealing problems are greatly reduced, thus lessening fabricating costs.

While it will be apparent that the preferred embodiment of the invention herein disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modifications, variations and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In a multi-stage hydraulic jack, a base, a cylinder mounted on said base and having a cylinder chamber, an outer ram section of tubular shape mounted within said cylinder and spaced inwardly therefrom, a tubular guide sleeve secured to the lower end of said outer ram section and slidably engaging said cylinder, an inner ram section disposed within said outer ram section and spaced inwardly therefrom, a tubular guide sleeve secured to the lower end of said inner ram section and slidably engaging said outer ram section, a passage between said outer ram section and its guide sleeve connecting with the space between said outer ram section and cylinder, a first radial passage in the lower end of said outer ram section connecting with said first-mentioned passage, a second radial passage in said inner ram section guide sleeve adapted to be connected with said first radial passage when the inner ram section is collapsed within the outer ram section, and a passage between said inner ram section and its guide sleeve connected with the cylinder chamber.

2. In a multi-stage hydraulic jack, a cylinder having a chamber, an outer ram section disposed within said cylinder and spaced inwardly therefrom, a first tubular guide sleeve fixed to the lower end of said outer ram section and slidably engaging said cylinder, an inner ram section disposed within said outer ram section and spaced inwardly therefrom, a second tubular guide sleeve slidably engaging said outer ram section, a radial pin securing said second guide sleeve to the lower end of said inner ram section, a radial passage in said inner ram section above said second guide sleeve leading from the space between said inner and outer ram sections, and an axial passage in said inner ram section extending past said pin and connecting said radial passage with the cylinder chamber.

3. In a multi-stage hydraulic ram, a cylinder having a chamber, an outer ram section disposed within said cylinder and spaced inwardly therefrom, a guide sleeve fixed to the lower end of said outer ram section and slidably engaging said cylinder, an inner ram section disposed within said outer ram section and spaced inwardly therefrom, a guide sleeve fixed to the lower end of said inner ram section and slidably engaging said outer ram section, an annular passage between said outer ram section and its guide sleeve, a radial passage in said outer ram section leading inwardly from the lower end of said annular passage, a second radial passage in the guide sleeve of said inner ram section, said radial passages being in connecting relation when the inner ram section is in its collapsed position within said outer ram section, an annular passage between the inner ram section and its guide sleeve connecting the inner end of said second radial passage with the cylinder chamber, and a passage in said inner ram section connecting said cylinder chamber with the space between said inner and outer ram sections.

4. In a multi-stage hydraulic ram, a cylinder, an outer ram section disposed within said cylinder and spaced inwardly therefrom, a guide sleeve fixed to the lower end of said outer ram section and slidably engaging said cylinder, an inner ram section disposed within said outer ram section and spaced inwardly therefrom, the means for securing said outer ram section to its guide sleeve comprising a radial pin, said pin serving to limit the collapsed position of said inner ram section within the outer ram section, a guide sleeve fixed to the lower end of said inner ram section and slidably engaging said outer ram section, an annular passage between said outer ram section and its guide sleeve, a radial passage in said outer ram section leading inwardly from the lower end of said annular passage, a second radial passage in the guide sleeve of said inner ram section, said radial passages being in connecting relation when the inner ram section is in its collapsed position within said outer ram section, an annular passage between the inner ram section and its guide sleeve connecting the inner end of said second radial passage with the cylinder chamber, and a passage in said inner ram section connecting said cylinder chamber with the space between said inner and outer ram sections.

5. In a multi-stage hydraulic ram, a cylinder having a chamber, an outer ram section disposed within said cylinder and spaced inwardly therefrom, a guide sleeve fixed to the lower end of said outer ram section and slidably engaging said cylinder, an annular passage formed between said outer ram section and guide sleeve connected with the space between the outer ram section and cylinder, a radial passage in the lower end of said outer ram sec-

tion connected with said annular passage, an inner ram section disposed within and spaced inwardly from said outer ram section, a guide sleeve fixed to the lower end of said inner ram section and slidably engaging said outer ram section, an annular groove in the outer surface of said inner ram section guide sleeve, said groove being aligned with said radial passage when the inner ram section is collapsed within the outer ram section, a radial passage in said inner ram section guide sleeve connected with said groove, and a passage formed between said inner ram section and its guide sleeve connecting said second radial passage with the cylinder chamber.

6. In a multi-stage hydraulic ram, a cylinder having a chamber, an outer ram section disposed within said cylinder and spaced inwardly therefrom, a guide sleeve fixed to the lower end of said outer ram section and slidably engaging said cylinder, a radial pin connecting said outer ram section and its guide sleeve, an annular passage between said outer ram section and guide sleeve connected with the space between the outer ram section and cylinder, a radial passage in the lower end of said outer ram section connected with said annular passage, an inner ram section disposed within and spaced inwardly from said outer ram section, a guide sleeve fixed to the lower end of said inner ram section and slidably engaging said outer ram section, said radial pin between the outer ram section and guide sleeve serving as a limit stop for the collapsed position of said inner ram section, an annular groove in the outer surface of said inner ram section guide sleeve, said groove being aligned with said radial passage when the inner ram section is collapsed within the outer ram section, a second radial passage in said inner ram section guide sleeve connected with said groove, an annular passage between said inner ram section and its guide sleeve connecting said second radial passage with the cylinder chamber, a radial passage in said inner ram section above its guide sleeve connected with the space between said inner and outer ram sections, and an axial passage in said inner ram section connecting said last-mentioned radial passage with said cylinder chamber.

7. In a multi-stage hydraulic jack, a base, a cylinder mounted on said base and having a cylinder chamber, an outer ram section of tubular shape mounted within said cylinder and spaced inwardly therefrom a tubular guide sleeve secured to the lower end of said outer ram section and having an outer surface slidably engaging said cylinder, an inner ram section disposed within said outer ram section and spaced inwardly therefrom, a second tubular guide sleeve secured to the lower end of said inner ram

section and having an outer surface slidably engaging the outer ram section, first passageway means connecting the space between said outer ram section and cylinder from a level immediately above said first-mentioned tubular guide sleeve with said cylinder chamber when said inner and outer ram sections are in their collapsed position with respect to each other, and second passageway means connecting the space between said inner and outer ram sections immediately above said second tubular sleeve with said cylinder chamber.

8. In a multi-stage hydraulic jack, a base, a cylinder mounted on said base and having a cylinder chamber, an outer ram section of tubular shape mounted within said cylinder and spaced inwardly therefrom a tubular guide sleeve secured to the lower end of said outer ram section and having an outer surface slidably engaging said cylinder, an inner ram section disposed within said outer ram section and spaced inwardly therefrom, means carried by the lower end of said inner ram section and slidably engaging said outer ram section, and passageway means leading from the space between said outer ram section and cylinder at a level immediately above said guide sleeve to said cylinder chamber.

9. In a multi-stage hydraulic jack, a base, a cylinder mounted on said base and having a cylinder chamber, an outer ram section of tubular shape mounted within said cylinder and spaced inwardly therefrom, a tubular guide sleeve secured to the lower end of said outer ram section and having an outer surface slidably engaging said cylinder, an inner ram section disposed within said outer ram section and spaced inwardly therefrom, means carried by the lower end of said inner ram section and slidably engaging said outer ram section, a passageway extending from the space between said outer ram section and cylinder immediately above said sleeve downwardly between the sleeve and outer ram section, and passageway means connecting said last-mentioned passageway with said cylinder chamber.

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