Oct. 28, 1969 S. F. STRYKER 3,474,710

CYLINDER CONSTRUCTION USING ROLL PINS

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Fig. 1.

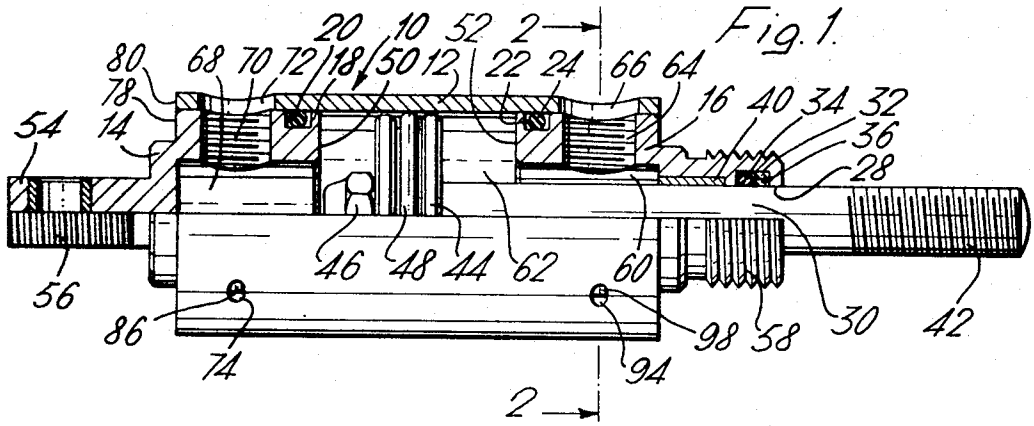



Fig. 2.

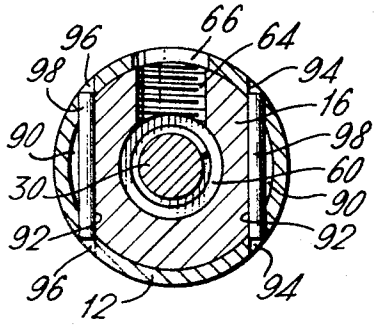



Fig. 4a.




Fig. 4b.



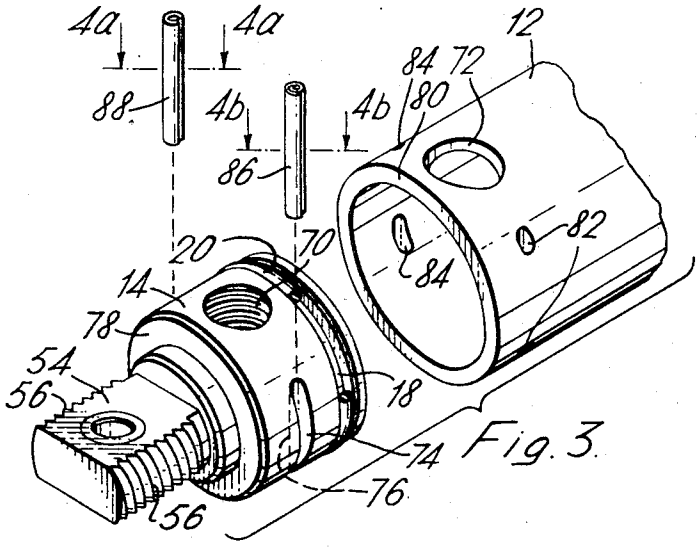




Fig. 3.

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# CYLINDER CONSTRUCTION USING ROLL PINS

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U.S. Cl. 92—128 6 Claims

## ABSTRACT OF THE DISCLOSURE

A fluid-operated work cylinder comprising a cylindrical body portion, cylinder heads telescopically fitted into the interior of opposite ends of the body portion, one being a blind-end cylinder head the other being a rod-end cylinder head. Each head has transverse rectilinear base chordal slots on diametrically opposite sides thereof and each end of the cylindrical body has two pairs of holes drilled in the body so as to enable each pair of holes to align with the base of a slot at opposite ends thereof when the heads are properly engaged telescopically within the ends of the cylindrical body. Expansible resilient roll pins are frictionally engaged respectively, each in each pair of holes and seated in the slot with which the said pair of holes is aligned.

## BACKGROUND OF THE INVENTION

The invention relates to so called work cylinders which are driven by air or hydraulic fluid to perform various functions requiring rectilinear movement. A typical hydraulic or pneumatic cylinder has a cylindrical body with a pair of cylinder heads at opposite ends thereof fastened to the body in some way. One of the heads has a blind end and the other head has an axial passageway so that a piston which reciprocates within the cylindrical body may be connected to a rod passing through the rod-end cylinder head. Fluid is admitted to one side of the piston and drives it in an opposite direction in order to achieve the rectilinear movement desired. Any work piece is connected to the rod to utilize this movement. At the end of the stroke the fluid is reversed by any suitable external valve arrangement and the piston driven in the opposite direction also performing work or returning the rod to an initial position.

This invention is directed primarily to a structure to render the work cylinder simple to assemble or disassemble; to eliminate external fastening means such as tie-rods, flanges, bolts and the like; and to result in a compact and economical work cylinder.

Specifically, the heads of the cylinder of the invention are generally of annular construction and telescopically engage in the ends of the cylindrical body. Rectilinear slots are cut in the heads and roll pins are driven through suitable perforations in the cylindrical body to keep everything in assembled condition.

## DESCRIPTION OF THE PRIOR ART

The heads of work cylinders are assembled by many well-known means. To some extent the form of this means depends upon the cylinder size and pressures to which it will be subjected. The invention herein will be described as used especially in medium and small size cylinders but under suitable circumstances it could be applied to larger work cylinders operating at higher pressures.

Cylinder heads in the past have been made with tie-rod connections extending the entire length of the cylindrical body and connecting the heads to one another so that the tie-rods are under tension. The cylinder ends are secured by bolts, screws, flanges and so on. All of these require manipulation and special tools for assembly and disassembly. All of these as a general rule are larger than the cylinder body diameter in occupied space due to the protrusion of bolts, tie-rods, square ends, etc.



The particular type of work cylinder with which the invention is concerned is one in which the maximum diameter of the cylindrical body determines the overall diameter of the work cylinder itself. Accordingly, the fastening means, whatever they may be, must secure the heads to the cylinder within the volume represented by the outer surface of the cylindrical body and perhaps some extensions thereof, axially endwise.

Several forms of cylinder are known which meet these general specifications. U.S. Patent 2,403,020 discloses a cylinder assembly in which the cylindrical body is crimped over the cylinder head. Aside from diffculties of maintaining seals, such work cylinders require special machinery to assemble the same and cannot be disassembled without destroying or substantially damaging the same. One type of cylinder which has no protrusions provides mating grooves on the interior of the cylindrical body ends and the exteriors of the cylinder heads. A malleable or flexible locking strip is driven into the cooperating slot but such structure requires rather complex machinery to manufacture the same and special tools to assemble or disassemble the same. Additionally, such cyilnders must have clear areas to provide for the cooperating grooves and the length of the cylinder is thereby increased over what it could be if the slots were not used. Patent 2,493,602 illustrates this type of structure.

Another form of work cylinder which is known, has the cylinder heads telescoped within the ends of the cylindrical body and grooves milled on the interior of the ends of the cylindrical body so that outwardly biased resilient split rings may be snapped in place to assemble the heads to the body. Problems are posed to provide structure which prevents axially inward movement of the heads and likewise special tools are required to assemble or disassemble such work cylinders. Additionally, any handling of the cylinders distorts the ends of the body making it difficult if not impossible thereafter to remove the split rings.

Another problem which besets manufacturers of some of the structures mentioned and additionally others, such as for example, those which use heads screwed in place, is alignment of the fluid ports in the heads with the cylindrical body to make connections into fluid lines a simple matter, as for example, with both connections on the same side of the work cylinder.

All of the problems indicated above are solved by the invention herein.

## SUMMARY OF THE INVENTION

The invention is characterized by the provision of a work cylinder in which the cylinder heads are simple annular structures readily turned on the lathe or screw machine, telescopically engaged within the ends of the cylindrical body and held in place by roll pins passing through perforations in the cylindrical body and entering slots formed in the cylinder heads.

The most important object of the invention is to provide a structure which is extremely simple and economical; which has no protruding parts; and which may be assembled or disassembled without the use of special or expensive tools; and yet which will provide a work cylinder that is highly efficient, occupies a very small space and is extremely reliable.

Other objects will become apparent as the invention is described hereinafter.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a view of the work cylinder constructed in accordance with the invention, the upper half of the drawing being a median sectional view, the lower

half being an elevational view, with the piston and piston rod being shown in elevation.

FIG. 2 is a sectional view taken generally along the line 2—2 of FIG. 1 and in the direction indicated.

FIG. 3 is a fragmentary perspective exploded view showing the left hand end of the cylinder of FIG. 1 prior to assembly and showing two different forms of roll pin.

FIGS. 4*a* and 4*b* are sectional views taken generally along the lines 4*a*, 4*a* and 4*b*, 4*b*, respectively, of FIG. 3 and in the directions indicated.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

The work cylinder constructed in accordance with the invention is designated generally by the reference character **10** and as seen it comprises a hollow cylindrical body **12**, a blind-end cylinder head **14** telescopically engaged in the left end of the cylindrical body **12**, and a rod-end cylinder head **16** telescopically engaged in the right end of the cylindrical body **12**. The blind-end cylinder head **14** is grooved at **18** and a suitable packing ring **20** is disposed within the groove **18** to retain the seal of the blind-end of the work cylinder **10**. Likewise, on its interior, the rod-end cylinder head **16** has a groove **22** within which there is disposed a packing member **24** to retain the seal of the rod end of the cylinder **10**.

The rod-end cylinder head **16** has a bore **28** to guide and permit reciprocation of the piston rod **30**, said bore having a groove **32** formed therein for packing, sealing and/or wiping members designated generally **34** and **36**. Anti-friction bearing member **40** may be provided in the bore **28** in addition.

The outer end of the piston rod **30** may be threaded as shown at **42** or provided with any other means to enable the rod to be coupled to a work piece. The interior end of the rod, that is the end which is on the interior of the cylindrical body **12**, has a piston **44** secured thereto by any suitable means such as the lock nut **46** engaging over a threaded end formed on the rod **30**. A packing member **48** prevents escape of fluid from one side of the piston **44** to the other. It will be seen that the total movement of the piston is between the inner faces **50** and **52** of the respective cylinder heads **14** and **16**.

The exterior end of the cylinder head **14** conveniently is provided with an eye **54** to enable this end of the work cylinder **10** to be secured relative to the work piece upon which the cylinder is operating. The eye **54** may be threaded as shown at **56** to provide an additional or alternate form of securement and likewise the exterior of the cylinder head **16** may be threaded for the same purpose as shown at **58**.

The cylinder head **16** has an interior annular cavity **60** communicating with the main chamber **62**, and a threaded socket **64** is provided to form a port for admission or exhaust of fluid during the operation of the work cylinder **10**. A passageway **66** formed as a perforation in the wall of the cylindrical body **12** aligns with the port **64** so that any suitable pipe fitting or fluid lines may be engaged into said port **64** in connecting the work cylinder **10** into a pressurized fluid system.

The same general structure is utilized with respect to the blind-end head **14** and the opposite end of the cylinder body **12**. Thus, there is a coaxial cavity **68** formed in head **14**, which in addition to connecting with aligned port **70** and passageway **72**, must be of such diameter and axial length as to clear the nut **46** during movement of the piston **44** and the rod **30**.

Inviting attention now to FIG. 3 which illustrates best the manner in which the work cylinder **10** is assembled, it will be seen that the blind-end cylinder head **14** has a slot cut as for example by milling on diametrically opposite sides thereof as shown at **74**. Only the one slot **74** is visible in FIG. 3, but an additional slot is provided. The slots **74** are cut by running a milling tool, for example, along the line defined by a plane normal to the axis of the head **14** which, as noted, is annular except for the eye part **54**. The line of movement of such cutter or milling tool is rectilinear and spaced from the axis so that the base **76** of the slot **74** is rectilinear, while the portion cut away is somewhat like a chord. Accordingly, such slots are described as rectilinear base chordal slots. When assembled, it is preferred that the axial end face **78** of the cylinder head **14** be substantially flush with the axial end **80** of the cylindrical body **12** thereby presenting a smooth end not likely to become bent or accumulate dirt or catch on any object. Thus telescopically secured together, passageway **72** will align with the threaded port **70**. A pair of perforations or holes are drilled in the cylindrical body **12** at **82**, and a like pair of perforations at **84**, on the opposite sides of the cylindrical body; the holes of each pair being aligned with one another along the identical line defined by the bases **76**, so that the holes at **82** will communicate with the base **76** of the slot **74** on one side, and the holes at **84** will communicate with the base of the opposite slot. In assembling the structure, when such alignment has been achieved, roll pins such as shown at **86** and **88** are driven into the holes **82** and **84** snugly and resiliently seating on the base **76** to lock the cylinder head **14** firmly in place in connection with the cylindrical body **12**.

The roll pins **86** and **88** normally would be of identical construction, but two are shown to illustrate that different forms are available. The roll pin **86** is also known as a spiral pin and it is formed of tightly spiralled sheet metal, usually spring steel. The roll pin **88** is formed of a single thickness of sheet metal rolled upon itself, such preferably being steel having substantial resilience. This type of pin when driven into an opening which is slightly smaller than its diameter will cause the pin to constrict or contract and exert a frictional resilient engagement with the hole. Since the holes **82** have their entrances somewhat large since they are drilled at an angle relative to the surface of the cylindrical body **12**, it is a simple matter to pilot the roll pins **86** or **88** and drive them home with a hammer or any other heavy object. To remove the roll pin and thereby enable disassembly of the cylinder head **14** from the cylindrical body **12** one merely inserts a sharp instrument, such as a nail set or even a nail, into the opening **82** and drives the roll pin out of the other hole of the pair.

FIG. 2 illustrates a section through the same structure as provided for the head **16**. The rectilinear base chordal slots equivalent to slots **74** are shown at **90** and in the sectional view it can be seen that the bases **92** of the slots **90** are straight lines and are chords of the circle defined at their location by the periphery of the cylinder head **16**. The openings **94** are the equivalent of the openings **82**, and the openings **96** are on the other side of the cylinder head. The roll pins **98** shown in FIG. 2 may be of any suitable construction such as those shown at **86** or **88** or perhaps even some other type of resilient pin capable of being frictionally engaged within the slots **90** by driving the same into place or removed by pushing the same out using a suitable sharp instrument.

It is an essential requirement of the structure that the roll pins be frictionally engaged in the slots and the perforations of the body **12** at the slot ends. Accordingly, the pins must be longer than the bases of the slots but not so long as to protrude beyond the surface of the body **12**.

It should be obvious that the structure is simple and economical. Not considering the packing members, which are required in any kind of cylinder, it will be seen that the structure of the invention comprises a piston and piston rod, four simple roll pins, two cylinder heads, and a cylindrical body. The cylinder heads are readily made on lathes or screw machines, requiring only simple drilling and tapping operations to complete them. Formation of the flat surfaces of the eye **54** is a simple milling operation. The cylindrical body **12** may be stock tubing easily drilled to provide the necessary perforations.

What it is desired to secure by Letters Patent of the United States is:

1. A fluid-operated work cylinder adapted to be connected into a pressurized fluid system for controlling operation of the said work cylinder, and said work cylinder comprising:

(A) a tubular cylindrical body having a first radial passageway therethrough adjacent one end thereof and a second radial passageway therethrough adjacent the opposite end thereof,

(B) a blind-end cylinder head telescopically and sealingly engaged into the interior of said one end of said body and having an exteriorily opening port communicating with a central cavity coaxially formed in said blind-end cylinder head and the cavity opening axially only to said interior,

(C) a rod-end cylinder head telescopically and sealingly engaged into the interior of the opposite end of said body and having a radially extending port connected with a central annular cavity coaxially formed in said rod-end cylinder head and the cavity opening axially only to the said interior of said second end, said radially extending port being aligned with said second passageway so as to provide communication to the exterior of said body,

(D) a piston rod axially, sealingly and reciprocally engaged in said rod-end cylinder head and having exterior means for coupling same to a work piece and an interior piston adapted to move between the heads within said body, and

(E) means for removably connecting the heads and the body in assembly, comprising:

(1) a pair of transverse rectilinear base chordal slots formed in each head, one slot of each pair on opposite diametrical sides of the respective head,

(2) perforations in the body, there being a pair for each slot, one of each pair aligned with the opposite ends of the base of the associated slot, and



(3) an expansible resilient roll pin frictionally engaged in the base of each slot, each pin being longer than the said base so that the ends thereof also frictionally engage the perforations of said body aligned with said slot.

2. The structure claimed in claim 1 in which said port of said blind-end cylinder head is radially disposed and said first passageway in the cylindrical body adjacent the blind-end cylinder head is aligned with the port thereof.

3. The structure claimed in claim 1 in which each head has a planar exterior axial surface substantially flush with the axial ends of said cylindrical body, respectively.

4. The structure claimed in claim 1 in which at least one head has an external coaxial threaded protrusion for securing said work cylinder to a suitable support.

5. The structure claimed in claim 2 in which the port and bases of the slots of each head are parallel so that there is a slot on opposite sides of each port.

6. The structure as claimed in claim 5 in which the passageways in said cylindrical body open to the same side of said body.


**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,598,714 | 9/1926 | Gray | 29—526 |
| 2,518,787 | 8/1950 | Huhtala | 92—164 |
| 2,985,140 | 5/1961 | Fagge | 92—168 X |
| 3,183,786 | 5/1965 | Defoe | 92—169 X |
| 3,286,797 | 11/1966 | Leibfritz et al. | 92—164 X |

FOREIGN PATENTS

| | | |
|---|---|---|
| 17,214 | 7/1929 | Australia. |
| 562,073 | 6/1944 | Great Britain. |



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U.S. Cl. X.R.

29—156.4, 526; 92—164, 165