April 25, 1933. G. J. RUSSELL 1,905,510

CYLINDER CONSTRUCTION

Original Filed March 5, 1930

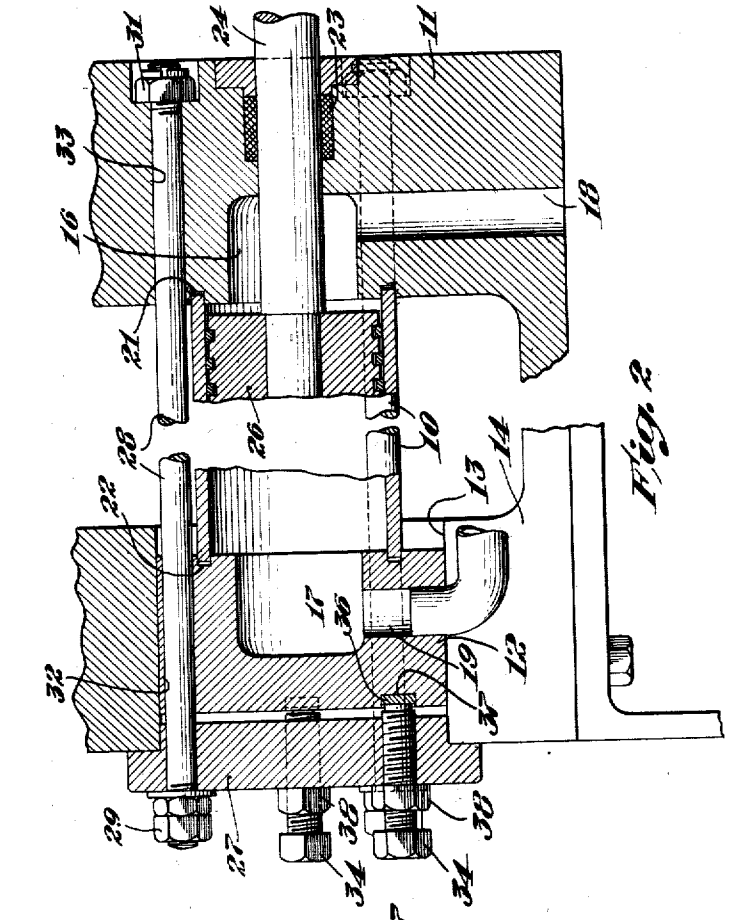


Fig. 2

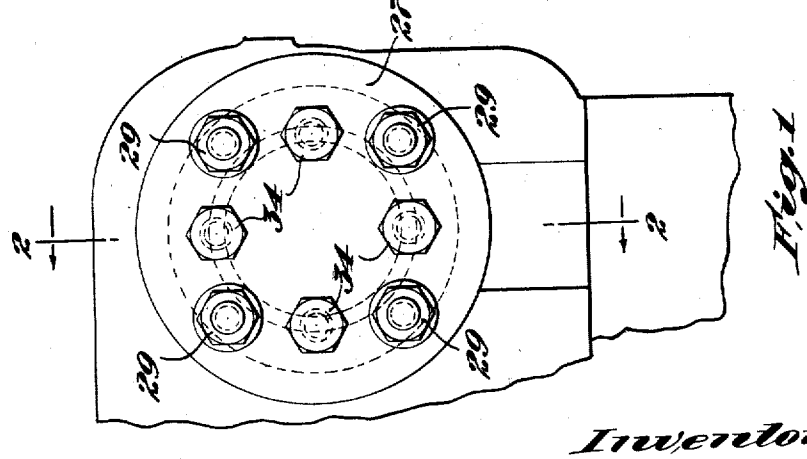


Fig. 1

Inventor
George J. Russell
by Roberts, Cushman & Woodberry.
Attys.

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UNITED STATES PATENT OFFICE

GEORGE J. RUSSELL, OF WALTHAM, MASSACHUSETTS

CYLINDER CONSTRUCTION

Original application filed March 5, 1930, Serial No. 433,490. Divided and this application filed April 11, 1931. Serial No. 529,398.

This invention relates to a cylinder construction particularly adapted for power cylinders for relatively heavy duty, such as hydraulically operated cylinders wherein the working stresses or reactions tend to produce a more or less sustained load on the cylinder head during substantially the entire working stroke of the piston. Cylinders of this kind frequently have a comparatively long stroke and in many types of apparatus, of which broaching machines are representative, it is desirable that the working stroke be relatively slow. When operating under these conditions the sustained application of maximum working pressure against the cylinder head construction, especially throughout a relatively long, slow stroke, has a greater tendency to deform or spring the head with the result that it is very difficult and often practically impossible to maintain the heads in fluid-tight relation with the cylinder wall.

Accordingly, one of the principal objects of the present invention is to overcome these undesirable features by providing an improved cylinder construction capable of holding the heads firmly in engagement with the cylinder wall in a manner materially to reduce and practically to do away with the tendency of such heads to bow or spring outwardly or otherwise to separate from the wall of the cylinder. Another object is to provide apparatus for these purposes having an improved construction and relative arrangement of parts.

In the drawing:

Fig. 1 is an end elevation of a cylinder construction; and

Fig. 2 is a section along the line 2—2 of Fig. 1 with parts broken away.

The features of the invention are illustrated as embodied in a broaching machine of the type disclosed in my copending application, Serial No. 433,490, filed March 5, 1930, of which this case is a division. As illustrated in the drawing a cylindrical wall member 10 is interposed between a relatively fixed transverse support member 11 which functions as a fixed head, and a movable head 12 which is slidably received and supported within a cylindrical passage guideway 13 in a relatively fixed transverse support or abutment member 14. The fixed and movable heads have fluid chambers 16, 17 and ports 18, 19 formed therein. These heads also have opposed annular recesses 21, 22 adapted to register with and to receive the end portions and the cylindrical wall members. The fixed head is provided with a gland and packing 23 for the piston rod 24, the latter being connected to a piston 26 in the usual manner. A substantially rigid member in the form of a backing or equalizing plate 27 has its forward edge recessed to fit within and against the fixed abutment member 14 and in the end of the passage with which the movable abutment cooperates. This backing plate is held on its seat by a number of longitudinally disposed tension members, such as the tie rods 28 on the threaded ends of which nuts 29, 31 are mounted to engage respectively the backing plate 27 and the fixed head or abutment member 11. These nuts may be countersunk in the fixed head as shown. The heads are provided with circumferentially spaced and longitudinally aligned passages 32, 33 in which the tension rods are disposed. Hence, these rods also serve to prevent rotary movement of the movable head.

The equalizing or backing plate 27 also carries a number of compression members shown in the form of adjusting screws 34 threaded through the plate and arranged to seat against hardened inserts 36 in recesses 37 disposed in the movable head at points directly opposite the transverse end surfaces of the cylindrical wall member 10. These compression members are adjustable through the equalizing plates and are fitted with lock or jam nuts 38 by which they may be affixed in adjusted positions. The tension members serve to transmit stresses from one end of the cylinder to the other during the working strokes of the piston and these stresses are transmitted through the compression members to the movable head at points directly opposite the end walls of the cylinder. It will be apparent that by properly adjusting the tension members and the compres-

sion members, the stresses may be more equally distributed throughout this portion of the apparatus so as to provide for more uniform and also more direct distribution of stresses about the movable head as well as about the ends of the cylinder.

When this cylinder construction is embodied in a machine, as in a broaching apparatus of the type referred to the strains produced during the working stroke are taken by the tension members 77 and the stresses so produced are distributed throughout the cylinder construction. These tension members therefore serve not only as tie rods to hold the cylinders in assembled relation but also function to distribute the working stresses. This makes it possible to use a much lighter frame for the machine and to provide a rugged durable construction without the use of side frame members or the like.

Furthermore the compression members being disposed to engage the movable head at points directly opposite the transverse end surface of the cylindrical wall apply a holding pressure directly against the head right over the gasket where this pressure is utilized to best advantage. As the backing or equalizing plate is of strong rigid construction and the tension members are connected thereto at points between and relatively closely adjacent the compression members the tendency to produce bending stresses in this rigid member is practically negligible. Moreover any such tendency which might develop is further resisted by the arrangement whereby the reduced forward end of this rigid member fits within and against the walls of the passage 13 while the squared shoulder formed by the rear or peripheral flange portion of this member is held firmly against the abutment member. This construction tends further to stiffen the rigid member and provides adequate reinforcement against bending such as might cause unequal stresses to develop or be imposed on different sides of the movable head. In this way it is assured the substantially equal and uniform pressure will be applied not only against the movable head, but between both heads and the transverse end surfaces of the cylindrical wall member. Also the movable head is guided for movement longitudinally of the cylinder by the passage 13 and the mode of applying the retaining pressure to this head relieves the latter from bending stresses and further avoids the common tendency for such heads to flex or spring when connected directly to tension members.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. The combination of a cylinder wall having a substantially annular end portion, a head fitting this end portion of the wall, relatively fixed abutment means adjacent the head, a member bearing against the abutment means and extending across the head in spaced relation thereto, means for holding this member rigidly against the abutment means, and means carried by the member and engageable with the head only at points substantially opposite the annular end portion of the cylinder wall for holding the head and the cylinder wall in fluid tight relation.

2. The combination of a cylinder wall having a substantially annular end portion, a head fitting this end portion of the wall, relatively fixed abutment means having an opening therethrough to receive the head, the latter being disposed in this opening, a member having a contour similar to and substantially fitting within the opening in spaced relation with respect to the head, means cooperating with the fixed abutment means for opposing movement of the member axially of the cylinder and relative to the abutment means, and means carried by the member and engageable with the head only at points substantially opposite the annular end portion of the cylinder wall for holding the head and the cylinder wall in fluid tight relation.

3. The combination of a cylinder wall having a substantially annular end portion, a head fitting this end portion of the wall, relatively fixed abutment means having an opening therethrough to receive the head, the latter being disposed in this opening, a member having a contour similar to and substantially fitting within the opening in spaced relation with respect to the head, a peripheral flange on this member overlying the opening and fitting against the abutment means, means for holding this flange in firm engagement with the abutment means, and means carried by the member and engageable with the head only at points substantially opposite the annular end portion of the cylinder wall for holding the latter parts in fluid-tight relation.

4. A cylinder construction comprising opposed heads, a cylindrical wall interposed therebetween, tension members connected to one of the heads and extending toward the other head, a substantially rigid member disposed across the latter head in spaced relation thereto, the tension members being connected to this substantially rigid member, and means for transmitting pressure between the latter head and the substantially rigid member only at points substantially opposite the adjacent transverse end surface of the cylindrical wall.

5. A cylinder construction comprising opposed heads, a cylindrical wall interposed

therebetween, tension members connected to one of the heads and extending toward the other head, a substantially rigid member disposed across the latter head in spaced relation thereto, the tension members being connected to this substantially rigid member, relatively fixed abutment means engaging the rigid member for limiting movement of this member toward the adjacent head, and means for transmitting pressure between this head and the rigid member only at points substantially opposite the adjacent transverse end surface of the cylindrical wall.

6. A cylinder construction comprising opposed heads, a cylindrical wall interposed therebetween, tension members connected to one of the heads and extending toward the other head, a substantially rigid member disposed across the latter head in spaced relation thereto, the tension members being connected to this substantially rigid member, relatively fixed abutment means engaging the rigid member for limiting movement of this member toward the adjacent head, and adjusting screws mounted in the rigid member and spaced to bear on the latter head only at points substantially opposite the adjacent transverse end surface of the cylindrical wall.

7. A cylinder construction comprising opposed heads, a cylindrical wall member interposed therebetween, tension members connected to one of the heads and extending toward the other head, a substantially rigid member disposed across the latter head in spaced relation thereto, the tension members being connected to this substantially rigid member, inserts in the latter head on the side thereof adjacent the rigid member, these inserts being disposed at points substantially opposite the adjacent transverse end surface of the cylindrical wall member, and adjusting screws mounted on the rigid member and bearing against the inserts for transmitting pressure between the rigid member and the latter head.

8. A cylinder construction comprising opposed heads, a cylindrical wall member interposed therebetween, tension members connected to one of the heads and extending toward the other head, the latter head having passages therethrough and the tension members being arranged to extend through these passages, relatively fixed abutment means having an opening therethrough, the latter head being disposed in this opening, a substantially rigid member having a reduced portion disposed within and substantially fitting the opening, this member also having a peripheral flange portion overlying the opening and bearing against the abutment means, means connecting the tension members to this substantially rigid member, and means for causing pressure to be transmitted between the rigid member and the adjacent head only at points substantially opposite the transverse end surface of the cylindrical wall member.

9. Apparatus of the class described comprising fixed and movable heads, a cylindrical member disposed between these heads, means for supporting the movable head for sliding movement longitudinally of the cylindrical member and for maintaining the movable head substantially in alignment with the cylindrical member during such sliding movement to facilitate adjustment, tension members connected to the fixed head, and equalizing means for transmitting stress between the tension members and movable head.

10. Apparatus of the class described comprising fixed and movable heads, a cylinder disposed between these heads, means for supporting the movable head for sliding movement longitudinally of the cylindrical member and for maintaining the movable head substantially in alignment with the cylindrical member during such sliding movement to facilitate adjustment, tension members connected to the fixed head, equalizing members connected to the tension members adjacent the movable head, and compression members for transmitting stresses from the equalizing members to the movable head.

11. Apparatus of the class described comprising fixed and movable heads, a cylindrical member disposed between the fixed and movable heads, tension members connected to the fixed head, a fixed abutment member having a passage in which the movable head is slidably supported, a substantially rigid member connected to the tension members and in engagement with the fixed abutment member, and compression members for transmitting stresses between the substantially rigid member and the movable head.

12. The combination as set forth in claim 16 wherein the movable head has passageways in which the tension members are disposed, whereby the tension members may prevent rotary movement of the movable head.

13. Apparatus of the class described comprising fixed and movable heads having opposed annnular recesses, a cylindrical member disposed between the heads and in the annular recesses thereof, means for slidably supporting the movable head while maintaining the latter substantially in alignment with the cylindrical member, tension members connected to the fixed head, and equalizing means for transmitting stresses between the tension members and the movable head.

14. A cylinder comprising relatively fixed and movable heads, a cylindrical member disposed between the heads, an equalizing

member disposed adjacent the movable head, tension members in engagement with the fixed head and with the equalizing member, means for transmitting stress between the equalizing member and the movable head, and a fixed abutment disposed between the fixed head and the equalizing member, the equalizing member having pressure transmitting engagement with the fixed abutment.

15. A cylinder comprising relatively fixed and movable heads, a cylindrical member disposed between the heads, an equalizing member disposed adjacent the movable head, tension members in engagement with the fixed head and with the equalizing member, compression members carried by the equalizing member and disposed opposite the end wall of the cylindrical member for transmitting stresses between the movable head and the equalizing member, and a fixed abutment disposed between the fixed head and the equalizing member, the equalizing member having pressure transmitting engagement with the fixed abutment.

Signed by me at Boston, Massachusetts, this 9th day of April, 1931.

GEORGE J. RUSSELL.

CERTIFICATE OF CORRECTION.

Patent No. 1,905,510. **April 25, 1933.**

GEORGE J. RUSSELL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 111, claim 12, for the numeral "16" read "11"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of May, A. D. 1933.

M. J. Moore.

(Seal) **Acting Commissioner of Patents.**

member disposed adjacent the movable head, tension members in engagement with the fixed head and with the equalizing member, means for transmitting stress between the equalizing member and the movable head, and a fixed abutment disposed between the fixed head and the equalizing member, the equalizing member having pressure transmitting engagement with the fixed abutment.

15. A cylinder comprising relatively fixed and movable heads, a cylindrical member disposed between the heads, an equalizing member disposed adjacent the movable head, tension members in engagement with the fixed head and with the equalizing member, compression members carried by the equalizing member and disposed opposite the end wall of the cylindrical member for transmitting stresses between the movable head and the equalizing member, and a fixed abutment disposed between the fixed head and the equalizing member, the equalizing member having pressure transmitting engagement with the fixed abutment.

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