July 14, 1936. K. T. PENICK ET AL 2,047,520

FLUID OPERATED BLOW-OUT PREVENTER

Filed Oct. 11, 1935 6 Sheets-Sheet 1

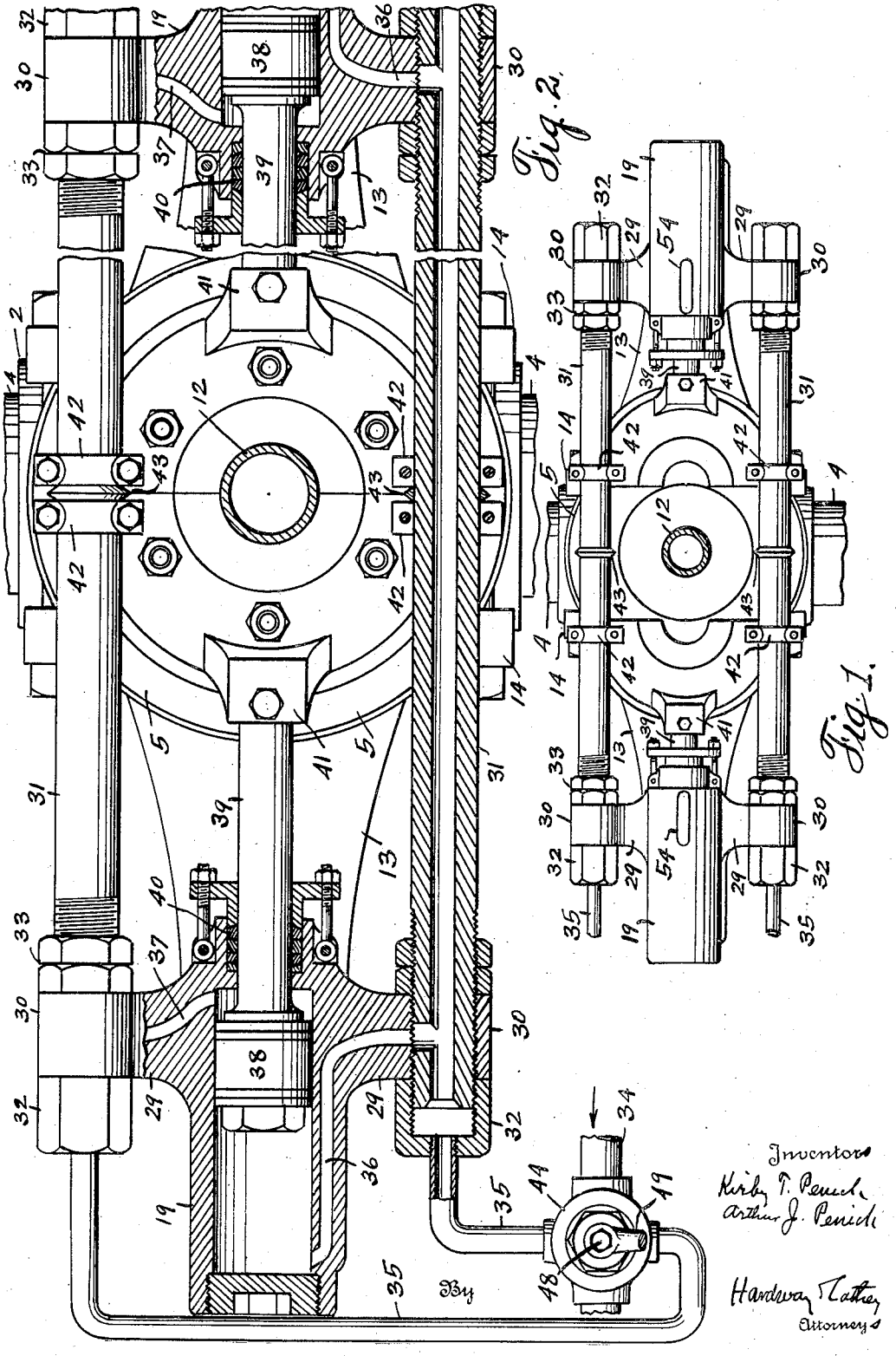


Fig. 2.

Fig. 1.

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FLUID OPERATED BLOW-OUT PREVENTER

Filed Oct. 11, 1935 6 Sheets-Sheet 2

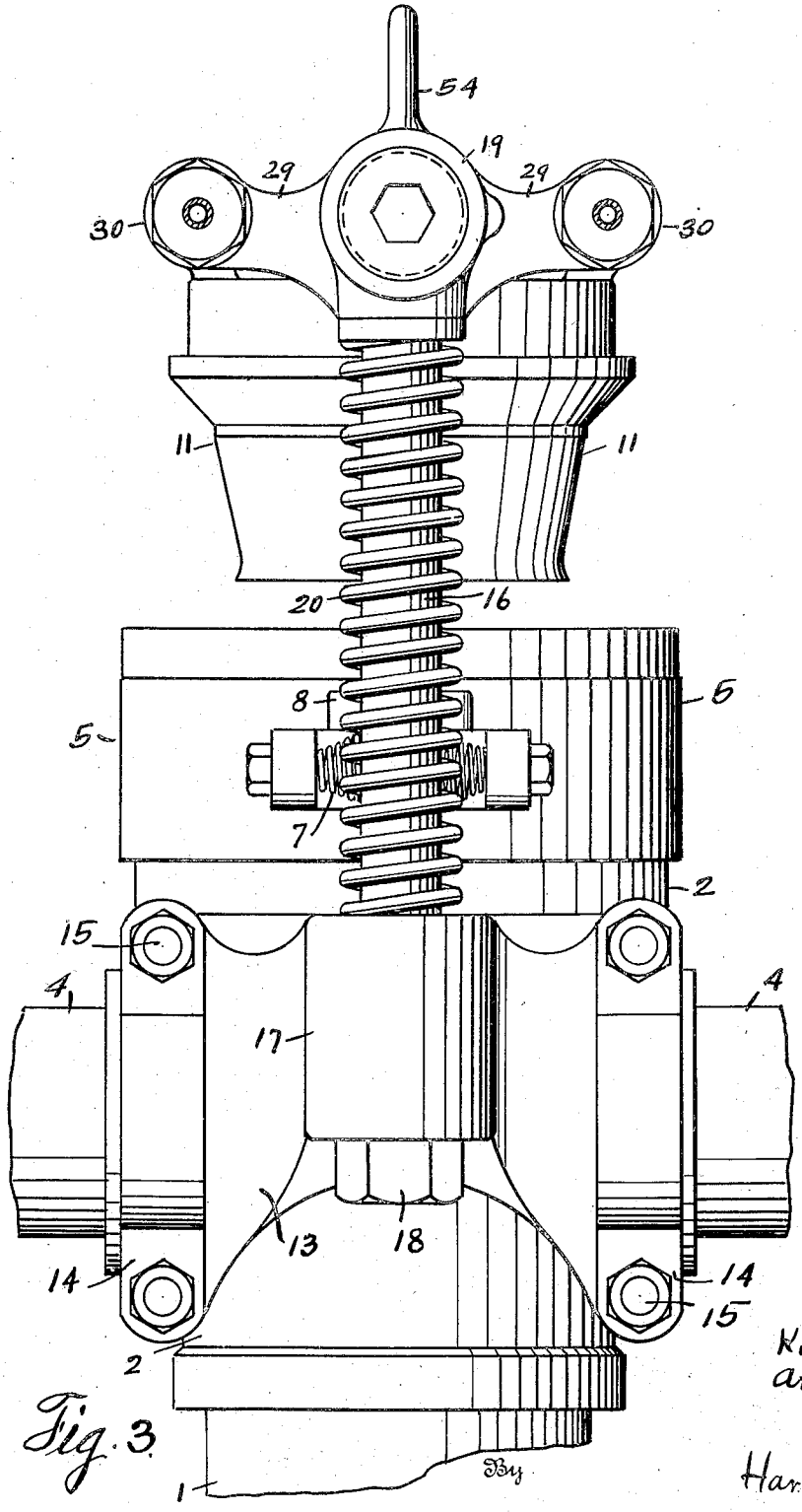


Fig. 3.

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FLUID OPERATED BLOW-OUT PREVENTER

Filed Oct. 11, 1935 6 Sheets-Sheet 3

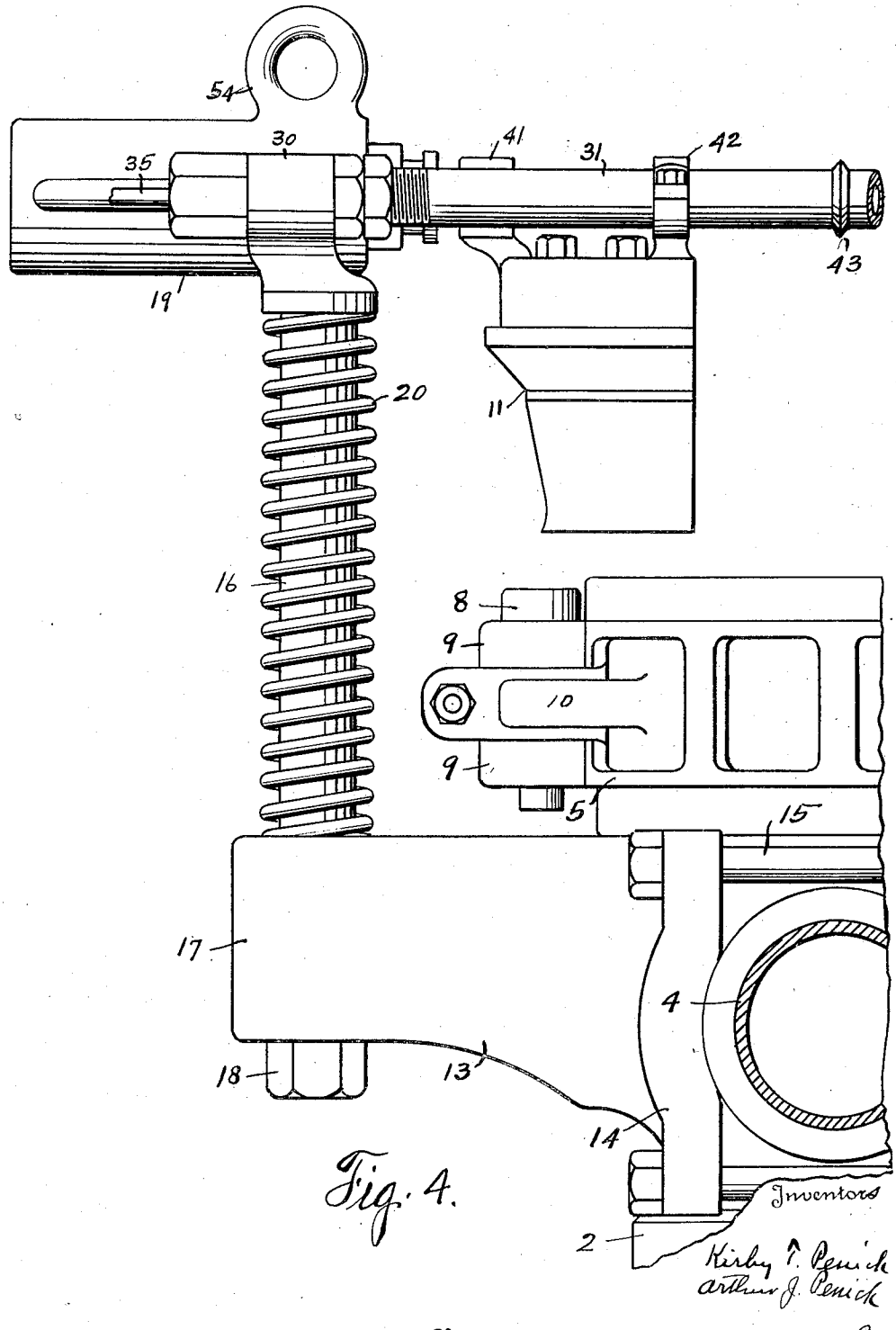


Fig. 4.

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FLUID OPERATED BLOW-OUT PREVENTER

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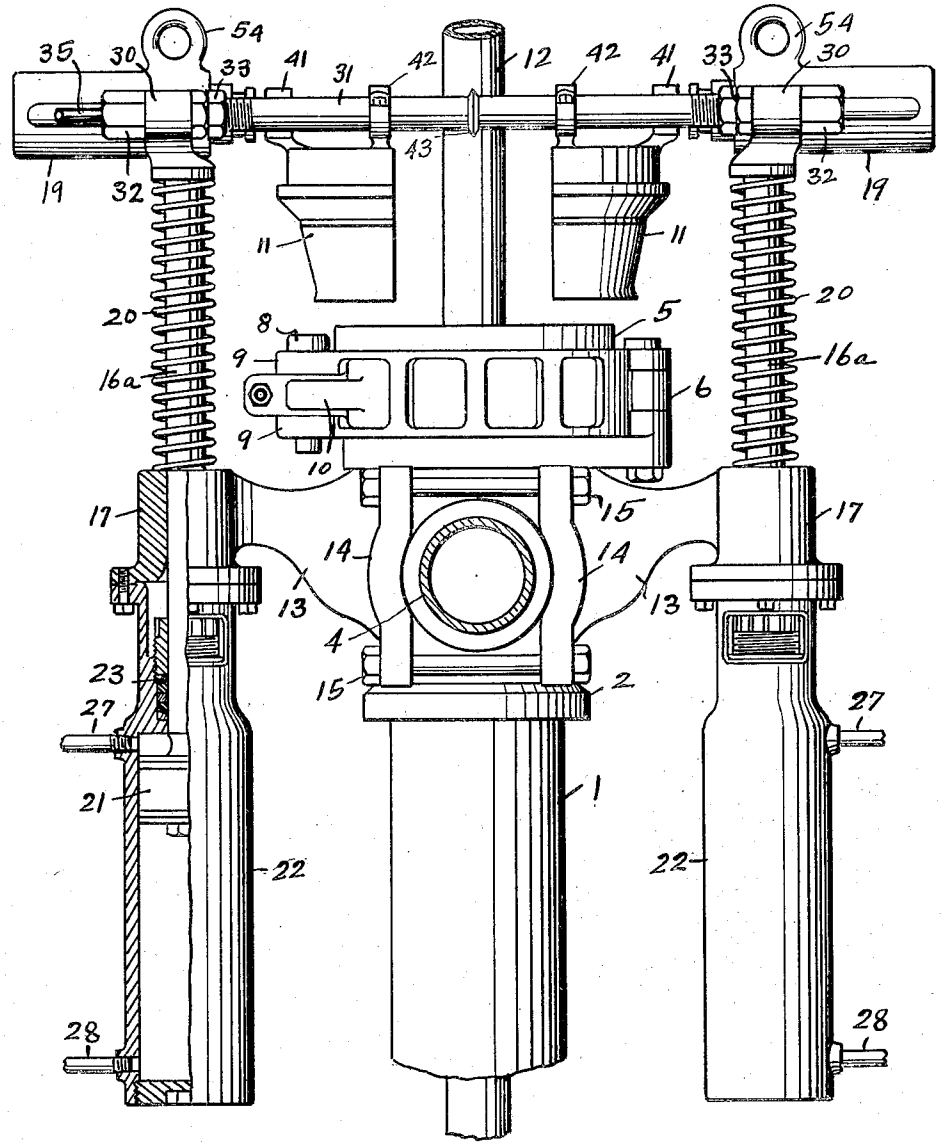


Fig. 5.

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FLUID OPERATED BLOW-OUT PREVENTER

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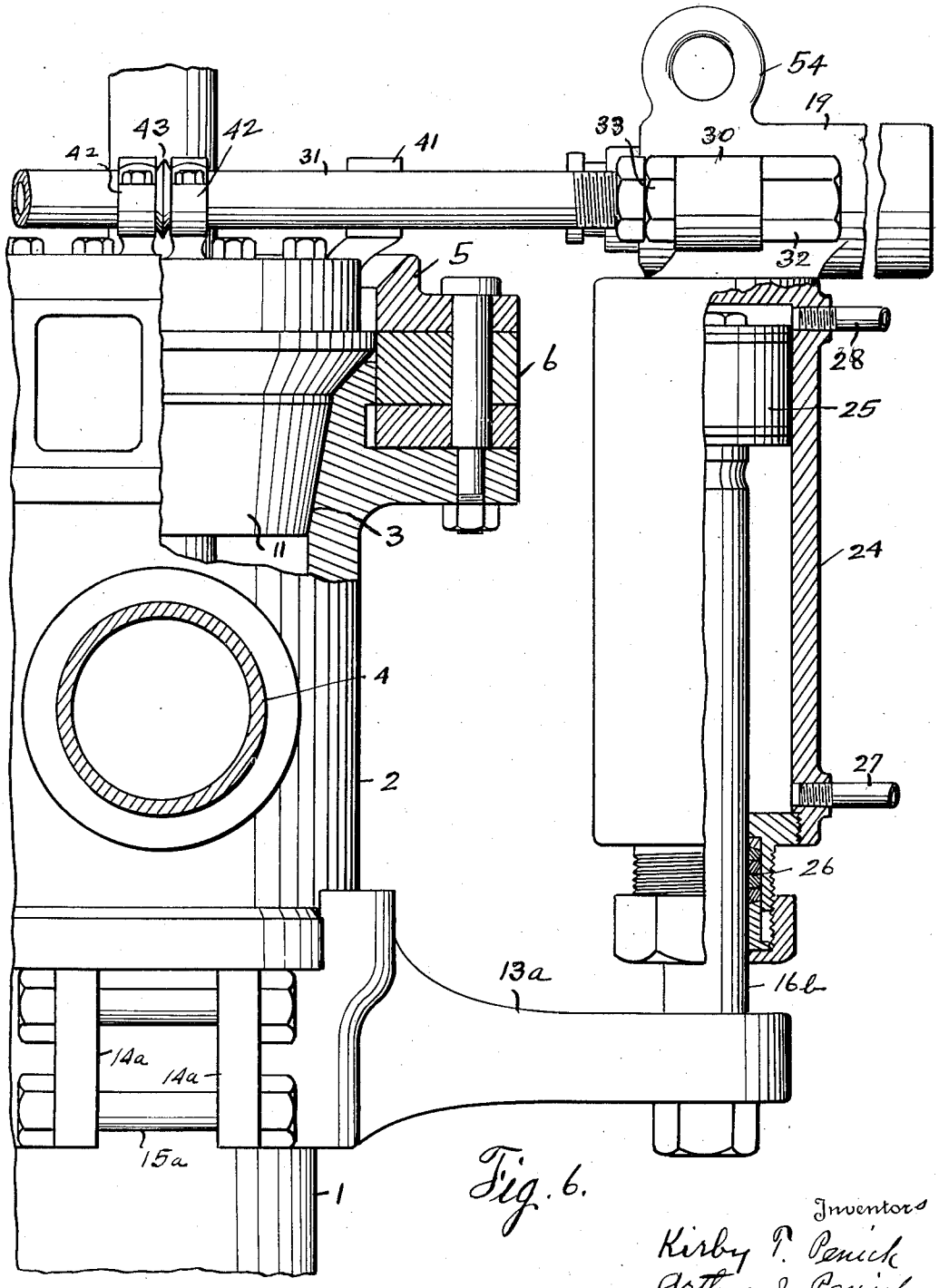


Fig. 6.

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FLUID OPERATED BLOW-OUT PREVENTER

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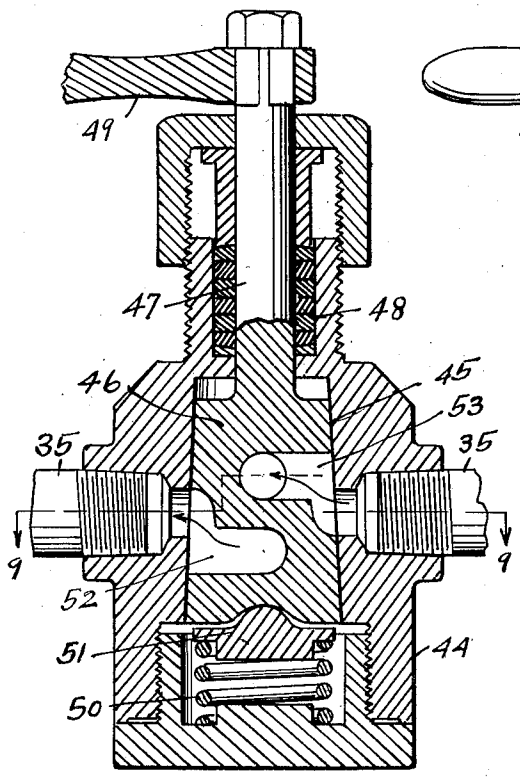


Fig. 7.

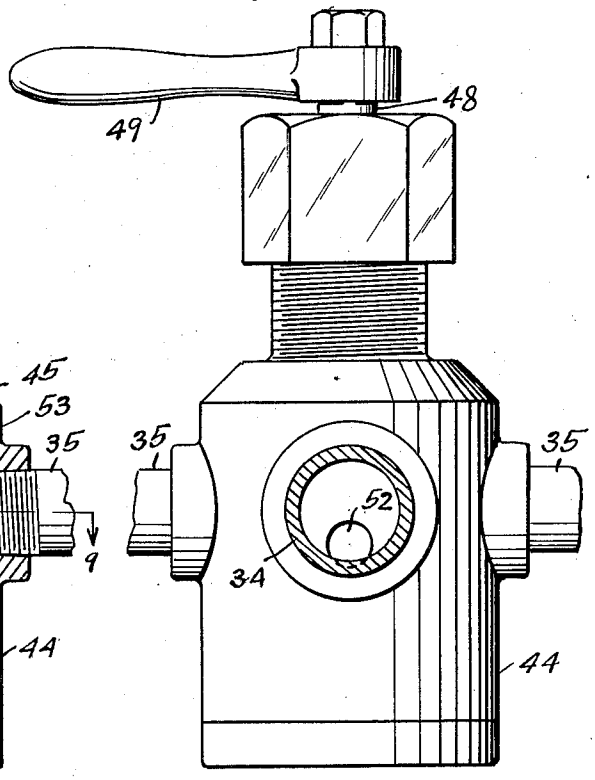


Fig. 8.

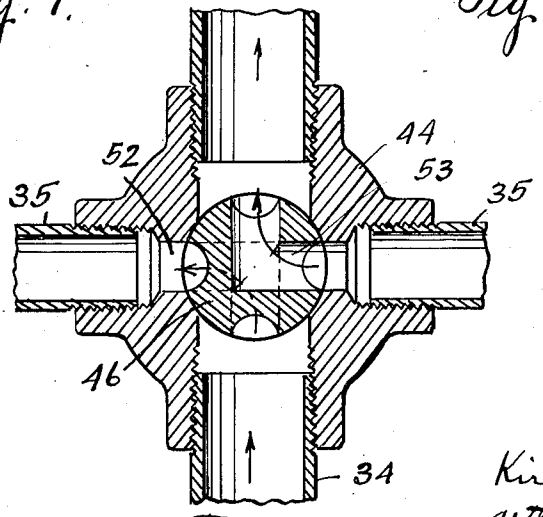


Fig. 9.

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Patented July 14, 1936

2,047,520

UNITED STATES PATENT OFFICE

2,047,520

FLUID OPERATED BLOW-OUT PREVENTER

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Houston, Tex.

Application October 11, 1935, Serial No. 44,504

12 Claims. (Cl. 166—14)

This invention relates to a fluid operated blow-out preventer.

An object of the invention is to provide apparatus of the character described adapted to be mounted on a casing head, or on the upper end of a casing, or pipe, in a well bore, and including a pressure head shaped to surround an inner pipe in a well and, when in active position, to close the space between the inner pipe and the outer pipe to prevent the escape of gas or other liquid under pressure from the well.

Another object of the invention is to provide apparatus of the character described wherein the pressure head is formed of sections, said apparatus having means arranged to be operated by fluid under pressure to actuate the pressure head sections into active position around the inner pipe, or into inactive, or outer, position.

A further object of the invention is to provide means whereby the sections of the pressure head, when in outer, or inactive position, may be yieldingly supported above the upper end of the casing head or the casing.

The invention also comprehends means whereby the pressure head may be elevated from its active position on its seat, or lowered into position on said seat by the application of an operating fluid under pressure.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrangement of parts, an example of which is given in this specification and illustrated in the accompanying drawings wherein:

Fig. 1 shows a plan view of the apparatus showing the pressure head sections in inactive position, or outer position.

Fig. 2 shows a fragmentary plan view, partly in section, showing the pressure head in active position, and seated in the casing head around the inner pipe.

Fig. 3 shows an end view of the type of apparatus shown in Fig. 1, showing the pressure head elevated and in inactive position.

Fig. 4 shows a fragmentary side elevation, showing the pressure head section in inactive position.

Fig. 5 shows a side view, partly in section, of another form of the apparatus equipped with means for elevating and lowering the pressure head by the application of an operating fluid, showing the pressure head in inactive position.

Fig. 6 shows a fragmentary side elevation, partly in section, of a slightly modified form of the type of apparatus shown in Fig. 5.

Fig. 7 shows a vertical sectional view of a two-way valve employed.

Fig. 8 shows a side view thereof, and

Fig. 9 shows a cross-sectional view taken on the line 9—9 of Fig. 7.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the figures, the numeral 1 designates a casing, or other pipe, set in a well bore, and the numeral 2 designates the casing head attached to the upper end of said casing, and whose upper end is formed with an inside seat 3 which is preferably downwardly tapered. Beneath the seat the casing has the outlet flow lines 4, 4, preferably oppositely arranged. On the upper end of the casing head are the arcuate clamps 5, 5, which at one side, are hinged together, and also hinged to the casing head by the hinge designated generally by the numeral 6. At their opposite ends these clamps are normally held together by means of the pull-spring 7, and they may be secured against opening by the pin 8 which is fitted vertically through the intermeshing lugs 9, 9, and 10, of the respective clamps. The construction of these clamps and the method of mounting them, as well as of securing them in closed position, is shown more clearly in our Patent No. 1,997,152 issued by the United States Patent Office on the 9th day of April, A. D. 1935.

There is a pressure head formed of the complementary sections 11, 11, which are arcuate in cross-sectional contour and which are shaped to be closed about the inner pipe 12 and to seat in the seat 3. The upper ends of these pressure head sections are formed of metal and their lower ends are preferably formed of rubber, or suitable packing material, and when fitted together about the inner pipe, they are capable of being lowered through between the clamps 5, 5, onto the seat 3, and to be engaged and held in such lowered or active position, by said clamps, as fully disclosed in our patent above referred to so as to close the space between the inner pipe and the casing head. The sections 11, 11, of the pressure head, however, are not hinged together, as disclosed in said patent, and need not be latched about the inner pipe, as therein disclosed, but are preferably separate and independent units, as illustrated herein.

On opposite sides of the casing head are the outwardly extended yokes 13, 13, whose inner ends are formed with the opposing flanges 14, 14. The inner ends of said yokes are shaped to conform to the contour of and to fit against the adjacent

sides of the casing head and the flanges 14 are secured in position by means of the cross-bolts 15 arranged above and below the corresponding outflow lines 4.

As illustrated in Figs. 1 to 4, inclusive, there are the standards 16 whose lower ends are slidable vertically through the bearings 17 at the outer ends of the respective yokes, and which are retained against detachment therefrom by the enlarged heads 18 on the lower ends.

Mounted on the upper ends of the standards 16 are the horizontally arranged cylinders 19, 19, and interposed between said cylinders and the upper ends of the bearings 17 and surrounding said standards are the coil springs 20 whereby the cylinders 19 are supported. The standards 16 are slidable through the bearings 17, thus allowing the required vertical movement of the assembly, including the cylinders 19, mounted on the standards. In the form shown in Fig. 5, the standards 16*a* are extended beneath the bearings 17 and have the pistons 21 attached to the lower ends thereof and which work in the cylinders 22, 22, whose upper ends are bolted or otherwise secured to the bearings 17, the standards 16*a* in this instance forming, in effect, plunger rods which work through stuffing boxes, as 23, at the upper ends of the cylinders 22. In the form shown in Fig. 6, the cylinders 19 are mounted on the upper ends of vertical cylinders 24, and in the cylinders 24 are the pistons 25, attached to the upper ends of the rods 16*b*. These rods extend through the lower ends of the cylinders 24 and are surrounded by the stuffing boxes 26, carried by said lower ends.

The rods 16*b* are supported on the outer ends of the laterally extending yokes 13*a* whose inner ends are suitably clamped about the casing 1 beneath the casing head 2 by the clamp rods 15*a* which extend through the confronting flanges 14*a* carried by the inner ends of the yokes 13*a*.

The operating fluid under pressure may be introduced into the cylinders 22, 24, above and beneath the respective pistons therein through the pipe 27, 28, connected into said cylinders. It is to be noted, however, that the pipes 27, 28, shown in Fig. 5, enter the cylinders 22 above and beneath, respectively, the pistons 21, and as shown in Fig. 6, the pipes 27 and 28 enter the cylinders 24 beneath and above, respectively, the pistons 25. Accordingly, when the operating fluid is admitted through the pipes 27, the cylinders 19 will be lowered, and when admitted through the pipes 28, the cylinders 19 will be elevated. It is, of course, to be understood that when the operating fluid is admitted through the pipes 27, it will be relieved through the pipes 28, said pipes 27, 28, being connected to a common source of pressure and being controlled by a suitable valve, preferably a conventional type of two-way valve adapted for the purpose, or of the type shown in Figs. 7 to 9, inclusively. Each cylinder 19 has the laterally extended arms 29, 29, whose outer ends are formed with bearings 30, 30. The manifold pipes 31, 31, have their ends anchored in the bearings 30, and clamped in position by the clamp nuts 32, 33. There is a supply line 34 for the admission of an operating fluid such as steam under pressure, which separates into branch lines 35, 35, which enter the manifold pipes 31, 31, at one end, as shown, in Figs. 1 and 2, the other ends of said manifold pipes being closed. Each cylinder 19 has conduits 36, 37, the conduits 36 leading from one of the manifold pipes 31 into the outer ends of cylinders 19 and the conduits 37 leading from the other manifold pipes into the inner end of said cylinders. The pistons 38 work in the cylinders 19 and are attached to the inwardly extended piston rods 39 which work through the stuffing boxes 40 at the inner ends of said cylinders and whose inner ends are attached to the upstanding lugs 41 carried by the pressure head sections 11. These pressure head sections also have the bearings 42, 42, which slide on the manifold pipes 31, as tracks. The manifold pipes 31 also have the oppositely arranged stops 43 thereon and located mid-way between the cylinders 19. These stops are provided so that the inward movement of the respective pressure head sections 11 will be limited and so that said sections will come together in exact concentric relation with the inner pipe 12, as well as with the seat 3 beneath. The pipe 34 for controlling the application of operating fluid is controlled by a suitable valve mechanism shown in Figs. 7, 8, and 9, and comprising the valve casing 44 having a tapering valve seat 45, in which is located the turnable valve 46. This valve has a stem 47 working through a stuffing box 48 and the stem may be turned by a suitable handle or lever 49. The valve 46 is held yieldingly but snugly against its seat by means of a strong coil spring 50 which is seated against the end of the valve casing and which supports a convex friction plate 51 which bears against the larger end of the valve.

An operating fluid under pressure is admitted through the pipe 34, and with the valve in positions shown in Figs. 7 and 9, will pass through the channel 52 into one of the pipes 35 and will pass thence through the channels 37 in front of the pistons 38, moving said pistons and the pressure head sections 11, outwardly into position shown in Fig. 1, the spent operating fluid behind said pistons exhausting through the channels 36 and through the other pipe 35 and passing out through the channel 53 of the valve mechanism to the free atmosphere.

If the valve 46 is manipulated a quarter turn in the appropriate direction, the operating fluid will pass from the pipe 34 through the channel 53 and into the last-mentioned pipe 35 and thence through the channels 36 behind the pistons 38 and the pressure heads 11 will be moved inwardly into position around the inner pipe 12, as shown in Fig. 2, the spent pressure fluid in front of the pistons 38 exhausting through the channels 37 into the corresponding pipe 35, and thence through the channels 52 to the free atmosphere.

When the pressure head sections are forced inwardly into active position, that is, into position around the inner pipe 12, when said pipe is lowered, the pressure head sections, as well as the complete assembly mounted on the standard 16 or 16*a* will also be lowered. The pin 8 should meanwhile be removed, and as the pressure head passes through between the clamps 5, said clamps will spread to permit the pressure head to seat on the seat 3, and the clamps will then engage with the pressure head sections, and lock the pressure head in place, the pin 8 meanwhile having been re-inserted. When the pressure head sections are lowered, as explained, the springs 20 will be placed under compression. In case the form shown in Fig. 5 is employed, the operating fluid may be introduced into the cylinders 22 through the pipes 27 to force the pistons 21 downwardly to assist in seating the pressure head into the said seat, and in case the form

shown in Fig. 6 is used, operating fluid may be introduced into the cylinders **24** through the pipe **27** for a like purpose.

When it is desired to elevate the pressure head out of the seat, the pin **8** may be removed and the clamps **5** swung open and the springs **20** will ordinarily be sufficient to elevate the assembly mounted on the standards **16**, or **16***a*, thus unseating and elevating the pressure head sections, and the elevation of the said assembly may be assisted by elevating the pipe **12**, or operating fluid may be introduced into the cylinders **22** beneath the pistons **21**, or into the cylinders **24** above the pistons **25** for a like purpose.

When the pressure head is elevated, the operating fluid may be applied through the channels **37**, from the corresponding pipe **35**, to force the pistons **38** and the corresponding pressure head sections, outwardly into position, as shown in Fig. 1, where they may remain until they are again to be moved into active position.

The cylinders **19** are provided with the eyes **54** providing means for the engagement of hooks, or the like, of a hoisting mechanism for handling the apparatus in installing or dismembering it.

The invention herein disclosed is an improvement over the structure shown in our co-pending applications for patent, Ser. Nos. 8,039 filed February 25, 1935, and 8,040 filed February 25, 1935, respectively.

The drawings and description disclose what we now consider to be preferred forms of the invention by way of illustration only, while the broad principle of the invention will be defined by the appended claims.

What we claim is:

1. The combination with a casing, in a well, having a seat at its upper end; of an assembly including a transverse track, a pressure head formed of complemental sections movable along the track and means for actuating the sections into active position about an inner pipe in the casing and into inactive, or retracted, position; means supporting the assembly above the casing, said supporting means being yieldable to allow the assembly to move downwardly to land the pressure head on the seat.

2. The combination with a casing, in a well, having a seat at its upper end; of an assembly including a transverse track, a pressure head formed of complemental sections shaped to surround an inner pipe in the casing and to fit on said seat, said sections being movable along the track, means adapted to be actuated by an operating fluid, under pressure, to move the sections into active position about the inner pipe, and into inactive, or retracted position; means supporting the assembly in position above the seat, the supporting means being yieldable to allow the pressure head to move downwardly with the inner pipe and land on the seat.

3. The combination with a casing, in a well, having a seat at its upper end; of an assembly including a transverse track forming guide means, a pressure head formed of sections mounted to move on said track, said sections being shaped to fit around an inner pipe in the casing and to fit said seat, fluid pressure operable means connected to the sections and operative to move them into active position about the inner pipe or into inactive or retracted position; and means normally supporting said assembly above the seat.

4. The combination with a casing, in a well, having a seat at its upper end; of an assembly including a transverse track forming guide means, a pressure head formed of sections mounted to move on said track, said sections being shaped to fit around an inner pipe in the casing and to fit said seat, fluid pressure operable means connected to the sections and operative to move them into active position about the inner pipe or into inactive or retracted position; and means normally supporting said assembly above the seat, said supporting means being yieldable to allow the pressure head to move downwardly onto the seat.

5. The combination with a casing, in a well, having a seat at its upper end; of an assembly including a transverse track forming guide means, a pressure head formed of sections mounted to move on said track, said sections being shaped to fit around an inner pipe in the casing and to fit said seat, fluid pressure operable means connected to the sections and operative to move them into active position about the inner pipe or into inactive or retracted position and means normally supporting said assembly above the seat, said supporting means being operable by fluid under pressure to elevate and lower the assembly.

6. A blowout preventer comprising a casing head having a seat, an assembly having guide means, a pressure head mounted on the guide means and formed of complemental sections shaped to fit around an inside pipe in the casing head, said assembly also having fluid pressure operable means connected to the sections and effective to actuate them into active position about the inner pipe, or into inactive, or retracted, position, means for yieldingly supporting the assembly above said seat.

7. In a blowout preventer for forming a seal between an outer pipe and an inner pipe in a well, a vertically movable assembly comprising transverse guide means, a pressure head formed of sections slidable on the guide means and shaped to fit between the outer and inner pipes to close the space between them, means normally supporting the assembly in elevated position, means connected to the respective sections and adapted to be actuated by an operating fluid under pressure to move the sections into active position around the inner pipe and into retracted, or inactive position.

8. In a blowout preventer for forming a seal between an outer pipe and an inner pipe in a well, a vertically movable assembly comprising transverse guide means, a pressure head formed of sections slidable on the guide means and shaped to fit between the outer and inner pipes to close the space between them, means normally supporting the assembly in elevated position, means connected to the respective sections and adapted to be actuated by an operating fluid under pressure to move the section into active position around the inner pipe and into retracted, or inactive position, said supporting means being yieldable to permit the downward movement of the assembly to seat the pressure head in the space between the pipes.

9. In a blowout preventer for forming a seal between an outer pipe and an inner pipe in a well, a vertically movable assembly comprising transverse guide means, a pressure head formed of sections slidable on the guide means and shaped to fit between the outer and inner pipes to close the space between them, means normally

supporting the assembly in elevated position, means connected to the respective sections and adapted to be actuated by an operating fluid under pressure to move the sections into active position around the inner pipe and into retracted, or inactive position, said supporting means being arranged to be actuated by an operating fluid under pressure for elevating and lowering the assembly.

10. In a blowout preventer for forming a seal between an outer pipe and an inner pipe in a well, a vertically movable assembly comprising spaced tracks, a pressure head formed of sections movably mounted on said tracks, means operable by fluid under pressure for moving said sections into active position around the inner pipe or into inactive, or retracted position.

11. In a blowout preventer for forming a seal between an outer pipe and an inner pipe in a well, a vertically movable assembly comprising spaced tracks, a pressure head formed of sections movably mounted on said tracks, means operable by fluid under pressure for moving said sections into active position around the inner pipe or into inactive, or retracted position, supporting means normally holding said assembly in elevated position, but being yieldable to permit the downward movement of the assembly as the inner pipe is moved downwardly to seat the pressure head between the outer and inner pipes.

12. In a blowout preventer for forming a seal between an outer pipe and an inner pipe in a well, a vertically movable assembly comprising spaced tracks, a pressure head formed of sections movably mounted on said tracks, means operable by fluid under pressure for moving said sections into active position around the inner pipe, or into inactive, or retracted position, said supporting means being formed to be actuated by an operating fluid under pressure to elevate or lower the assembly.

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