Dec. 15, 1936. J. D. NIXON 2,064,267

BLOW-OUT PREVENTER

Original Filed March 14, 1932 3 Sheets-Sheet 1

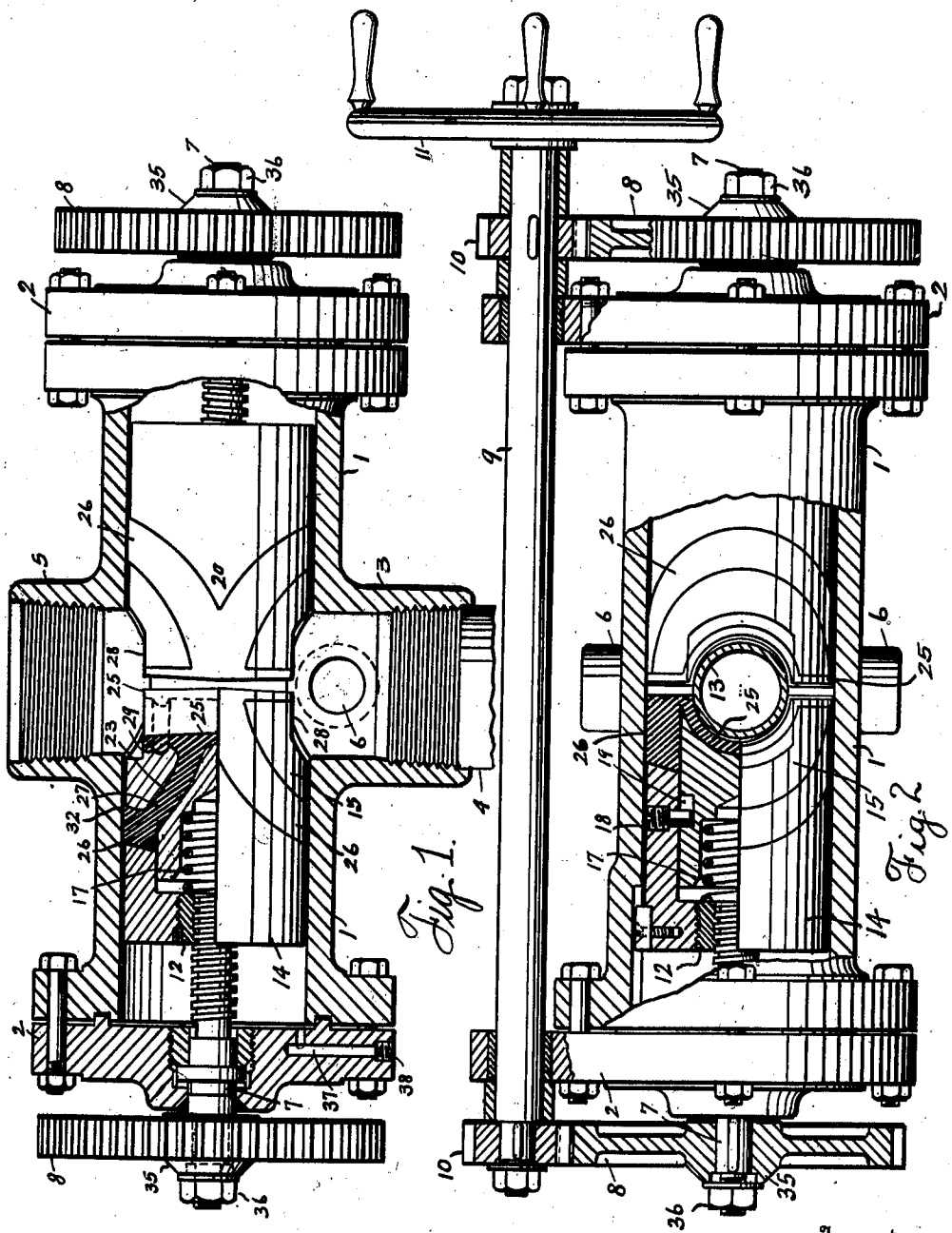


Fig. 1.

Fig. 2

Inventor

Jeddy D. Nixon

By Hardway & Cathey Attorneys

Dec. 15, 1936. J. D. NIXON 2,064,267

BLOW-OUT PREVENTER

Original Filed March 14, 1932 3 Sheets-Sheet 2

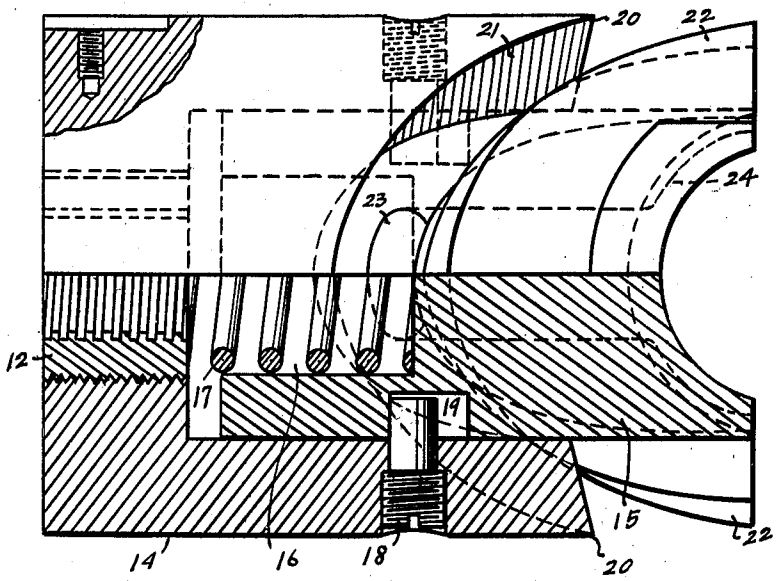


Fig. 3.

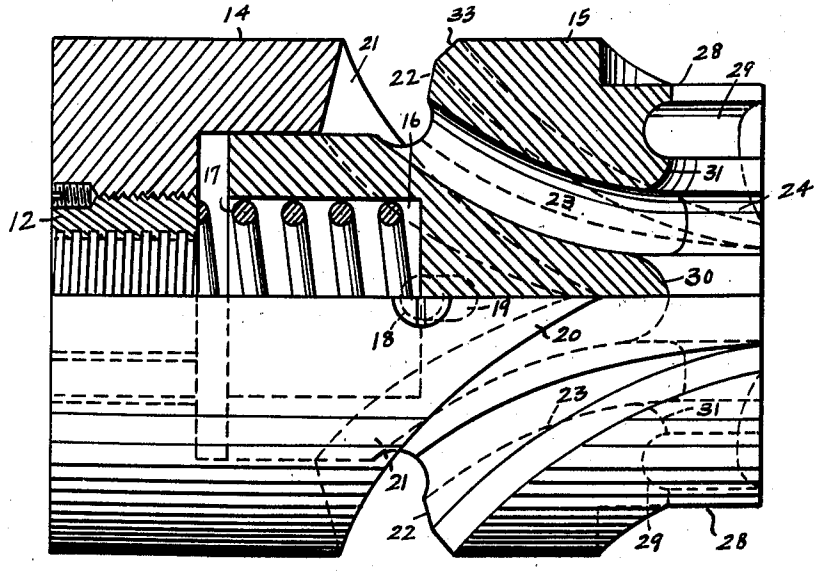


Fig. 4.

Inventor

Jeddy D. Nixon

By Hardway & Cathey

Attorneys

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BLOW-OUT PREVENTER

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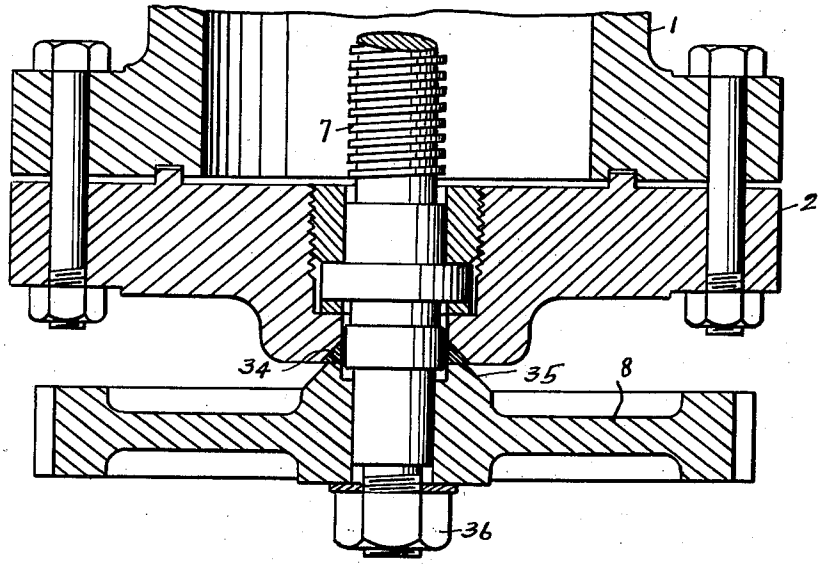


Fig. 5.

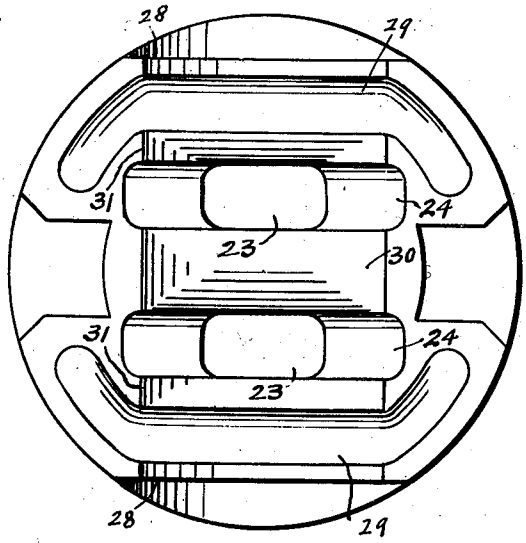


Fig. 6.

Inventor
Jeddy D Nixon

By Hardway & Cathey
Attorneys

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UNITED STATES PATENT OFFICE

2,064,267

BLOW-OUT PREVENTER

Jeddy D. Nixon, Houston, Tex.

Refiled for abandoned application Serial No. 598,848, March 14, 1932. This application March 14, 1935, Serial No. 11,178

9 Claims. (Cl. 251—62)

This invention relates to a blowout preventer.

An object of the invention is to provide an apparatus to be installed on an outer pipe, or casing, in a well for the purpose of controlling or preventing the escape of fluid, under pressure, from the well between the outer pipe and an inner pipe therein. The invention embodies novel means for forming a close seal about said inner pipe and for completely closing the space between said pipes whereby the escape of fluid, under pressure, from the well, through said space, may be entirely prevented.

Another object is to provide apparatus of the character described embodying oppositely arranged guide cylinders and rams or plungers therein, normally retracted when in inactive position so as not to interfere with operations in the well, said apparatus being equipped with means for quickly moving the plungers into active position, when a blow out is threatened, so as to completely close the space between said pipes; and the invention also comprehends plungers of such novel construction as to not only form said close seal about the inner pipe, when the plungers are in active position, but also to form leak proof joints with their respective cylinders when subjected to the internal pressure of the well.

Another object of the invention is to provide, in apparatus of the character specified, plungers of such construction that they may be moved into position to form a close seal about the inner pipe with a minimum of friction with the cylinder walls, and which, upon further movement of said plungers, will form also close seals between the respective plungers and the walls of the corresponding cylinders.

A further object is to provide a novel type of ram, or plunger having its forward end formed to fit closely about said inner pipe and composed of resilient material anchored in place by a rigid cage-like structure so shaped that said inner end of the plunger will be positively maintained in close fitting contact with the inner pipe under any well pressure to which it may be subjected.

With the above and other objects in view, as will be more specifically set forth hereinafter, this 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:—

Figure 1 shows a side view of the apparatus, partly in section.

Figure 2 shows a plan view thereof, partly in section.

Figure 3 shows a plan view of the ram, or plunger, partly in section.

Figure 4 shows a side elevation thereof, partly in section.

Figure 5 shows an enlarged, fragmentary longitudinal sectional view of the cylinder and the plunger actuating means associated therewith, and

Figure 6 shows an inner end view of the plunger cage.

Referring now more particularly to the drawings, wherein like numerals of reference designate similar parts in each of the views the numerals 1, 1 designate opposing cylinders which are preferably joined integrally together. Fastened on the outer ends of these cylinders are the respective heads 2, 2. Approximately midway between the heads, the cylinders have the depending tubular connection 3 for attaching the apparatus to the casing 4 in the well, and said cylinders also having the upstanding, tubular connection 5, opposite the connection 3 whereby a Christmas tree or other desired equipment may be installed in place. Above the casing 4 there are the outlet connections 6, 6 for the attachment of flow lines to the apparatus.

Suitable means for operating the device will be employed. As illustrated, said operating means includes the axial shafts 7, 7 having swivelling connections with, but confined against longitudinal movement relative to the heads 2 and fixed on the outer ends of these shafts are the gears 8, 8. There is a countershaft 9 rotatable in suitable bearings in the heads 2 and which has the pinions 10, 10 fixed thereon and in mesh with the respective gears 8 whereby the shafts 7 may be turned. The shaft 9 may be driven in any selected manner, as by a hand wheel 11, fixed thereon. The inner ends of the shafts 7 are provided with external coarse threads which are reversely pitched and in mesh with the internal coarse threads of the sleeves 12, 12 secured in the outer ends of the plungers, hereinafter described. By rotating the shaft 9 in one direction the plungers may be simultaneously moved inwardly and closed about an inner pipe 13 in the well and the space between the outer pipe, or casing 4, and the inner pipe 13 closed; and by rotating the shaft 9 in the other direction the plungers be moved outwardly into inactive position so as not to interfere with operations in the well.

The rams, or plungers, hereinabove referred to work in the respective cylinders 1, 1 and are of special construction and will now be described:—

Each plunger is formed with a body 14 shaped to fit in its corresponding cylinder 1 and a cage, or skeleton 15. As shown, the outer end of each cage is reduced and telescoped within the adjacent end of the corresponding body 14. The reduced end of each cage is provided with a socket 16 to receive a strong coil spring 17 interposed between said cage and the opposing end of the corresponding sleeve 12. The body 14 and cage 15 may be retained in assembled relation by the pin 18 which has a threaded connection with the body 14 and whose inner end projects into a longitudinal, external, slot 19 in the corresponding cage 15. The body and cage of each plunger thus have a limited lengthwise movement relative to each other.

The inner, or forward, end of each body 1 is approximately wedge-shaped, thus forming prongs 20, 20 which embrace the corresponding cage on opposite sides and these prongs have the arcuate, outwardly and forwardly pitched end faces 21, 21. These faces are opposed by the correspondingly shaped and pitched faces 22, 22 of the corresponding cage, said faces 22 being formed by the reduction of the outer end of said cage. The faces 22 are approximately parallel with and are spaced from the opposing faces 21, thus providing the upper and lower arcuate external grooves in each plunger which merge, on opposite sides, at the forward end of the cage. Leading from these respective upper and lower grooves through the cage are the channels 23, 23 whose forward ends are flared, as at 24, and terminate in the forward face of the cage.

In horizontal contour the inner end of each cage is approximately arcuate to conform to the contour of the inner pipe and is faced with rubber, or other selected resilient material 25. This material is moulded in place and similar material 26 is moulded into the upper and lower grooves of the plunger and tied to the facing 25 by the ties 27 of similar material in the channels 23. These resilient parts are all moulded in place about the cage at one moulding operation.

The adjacent ends of the cages 15, above and below are similarly flattened, as at 28, 28, and between the flattened faces, thus formed, and the channels 23, are the upper and lower, horizontal grooves 29, 29 whose ends taper out and are inwardly turned as more clearly shown in Fig. 6.

Between the flared ends of the channels 23 on the forward arcuate face of each cage there is a transverse arcuate, rib 30, convex in vertical sectional contour, and between the grooves 29 and the adjacent channels 23 the said forward face of each cage has the transverse arcuate ribs 31, 31, convex in vertical cross sectional contour, all as more clearly shown in Figures 4 and 6 to the end that the forward arcuate faces of the cages will be in effect, transversely corrugated, and the resilient material 25 will be moulded about said corrugations.

As shown in Figures 1 and 2 each resilient facing 25 recedes, or tapers, from the horizontal central line thereof to the end that when the plungers are moved inwardly into active, or closed, position about the inner pipe the elevated portion of the resilient material on the forward end of each plunger will first contact with said inner pipe and as the plungers are moved on to final closed position the resilient material of said forward ends will be crowded each way and into the corrugations of the cage and will thus be held firmly in position against the well pressure to which it may be subjected.

The springs 17 are of sufficient strength to withstand the stress required to force the plungers into closed position about the inner pipe without subjecting the resilient rings 26 in the plunger grooves to any considerable compression so that there will be no considerable friction between the plungers and the walls of the cylinder as said plungers are moved to closed position. Further inward movement of the plunger bodies 14 will result only in the compression of the springs 17 and of the resilient rings 26 and these rings will thereupon be expanded out into firm contact with the cylinder walls entirely around the lower and upper connections 3 and 5. On account of the pitch of the faces 21, 22, these rings assume an inwardly open, cup-shaped contour, having the overhanging lips, as 32 which overhang the outwardly beveled portions 33, at the outer margins of the faces 22, thus leaving annular spaces underneath said lips which the pressure fluid, escaping past the cages, may enter to hold said lips closely against the cylinder walls to prevent the escape of the fluid past the plungers.

In the outer ends of the bearings of the shafts 7 in the heads 2 are the annular, inwardly tapering seal rings, as 34, formed of lead or other suitable material and the outer ends of the hubs of the gears 8 have the annular ribs 35. When it is desired to close the blow out preventer and to maintain the well under pressure for a considerable period of time, the gears 8 may be reversed, as shown in Figure 5, and the retaining nuts 36 screwed up tight to force the ribs 35 against said seal rings 34 which in turn will be forced inwardly to closely surround the shafts 7. The equipment attached to the connection 6 may then be closed and the well may be maintained under pressure for an indefinite length of time even though the resilient material 25, 26 should deteriorate to permit the escape of pressure past the plungers.

Each head 2 has a relief channel 37 which communicates with the corresponding cylinder and which is normally open to permit the free inlet and outlet of air during the operation of the corresponding plunger, and to permit the drainage of any water that may collect in said cylinder. When the blow out preventer is to remain closed to maintain the well pressure for any considerable length of time these relief channels may be closed, as by means of plugs 38 screwed into the outer ends thereof.

The drawings and description disclose what is now considered to be a preferred form of the invention by way of illustration only, while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. Apparatus for controlling the flow of fluid, under pressure, from a well, comprising cylinders, means for connecting said cylinders to an outer pipe in the well, said apparatus having an opening for an inner pipe within and spaced from the outer pipe, plungers in the cylinders each having relatively movable parts and a yieldable member between said parts, means for moving the plungers into inactive position to clear

the space between the pipes and into active position about said inner pipe to close said space, said yieldable member maintaining the corresponding plunger parts against relative movement as the plunger is moved to said active position and thereafter yielding to permit relative movement of said parts, and resilient means arranged to be expanded upon said relative movement to form a close fit, with the corresponding cylinder wall, around said plunger.

2. Apparatus for closing the space between an outer pipe and an inner pipe in a well, comprising cylinders attached to the outer pipe, plungers in the cylinders movable into inactive position to clear said space and into active position to close said space, the forward ends of said plungers having resilient material thereon shaped to fit about the inner pipe when the plungers are in said active position, each plunger having an outer body and an inner cage and a yieldable member between said body and cage and also having expansible means disposed between opposing parts of the body and cage arranged to be expanded upon movement of said plunger to active position to form a close fit with the corresponding cylinder wall around said plunger.

3. Apparatus for closing the space between an outer pipe and an inner pipe in a well, comprising cylinders attached to the outer pipe, plungers in the cylinders movable into inactive position to clear said space and into active position to close said space, the forward ends of said plungers having resilient material thereon shaped to fit about the inner pipe when the plungers are in said active position, each plunger having an outer body and an inner cage and a yieldable member between said body and cage and also having expansible means disposed between opposing parts of the body and cage arranged to be expanded upon movement of said plunger to active position to form a close fit with the corresponding cylinder wall around said plunger, and tie members through each cage connecting the resilient forward end of the plunger to said expansible means on opposite sides of the plunger.

4. A blow out preventer having an opening therethrough and comprising cylinders, plungers therein whose inner, or forward, ends are shaped to fit around a pipe through said opening, means for moving the plungers forwardly, into position to surround the pipe, and outwardly into retracted position, each plunger having a resilient forward end face and resilient external annular packing members and relatively movable parts confining said members, means between said relatively movable parts normally preventing the relative movement thereof, said means being yieldable to permit such relative movement at the limit of the forward movement of the plunger whereby said members are caused to expand against the plunger wall entirely around the plunger.

5. In a blow out preventer a plunger including a body, a cage, a yieldable member between the body and cage, said body, and cage, having external, spaced, abutments therearound forming a seat between them and resilient material seated in said seat and expansible outwardly upon the relative movement of said abutments toward each other.

6. In a blow out preventer a plunger having a relatively movable body and cage and a yieldable member between them, an external resilient ring between the body and cage arranged to be compressed, and expanded outwardly, by them, the forward end of the cage being approximately arcuate in horizontal cross sectional contour, said end having a correspondingly shaped, resilient facing thereon.

7. In a blow out preventer a plunger having a relatively movable body and cage and a yieldable member between them, an external resilient ring between the body and cage arranged to be compressed, and expanded outwardly, by them, the forward end of the cage being approximately arcuate in horizontal cross sectional contour, said end having a correspondingly shaped, resilient facing thereon, united to said ring.

8. A blow out preventer having an opening therethrough and comprising cylinders, plungers therein whose forward ends are shaped to fit around a pipe through said opening, means for moving the plungers forwardly into position to surround the pipe and outwardly into retracted position, each plunger having external resilient means shaped to surround said plunger and also to complement each other to completely surround said opening when the plungers are in their forward position, each plunger having means movable in response to pressure exerted longitudinally thereon, for effecting the expansion of said resilient means outwardly into contact with the surrounding cylinder walls upon the movement of the plungers to their final forward position.

9. In a blow out preventer, a plunger formed of rigid material and whose forward end is shaped to conform to the contour of a pipe and corrugated and resilient material covering said corrugated end of the plunger.

JEDDY D. NIXON.