Aug. 29, 1939. F. J. SCHWEITZER ET AL 2,170,916

ROTARY COLLAR PASSING BLOW-OUT PREVENTER AND STRIPPER

Filed May 9, 1938 2 Sheets-Sheet 1

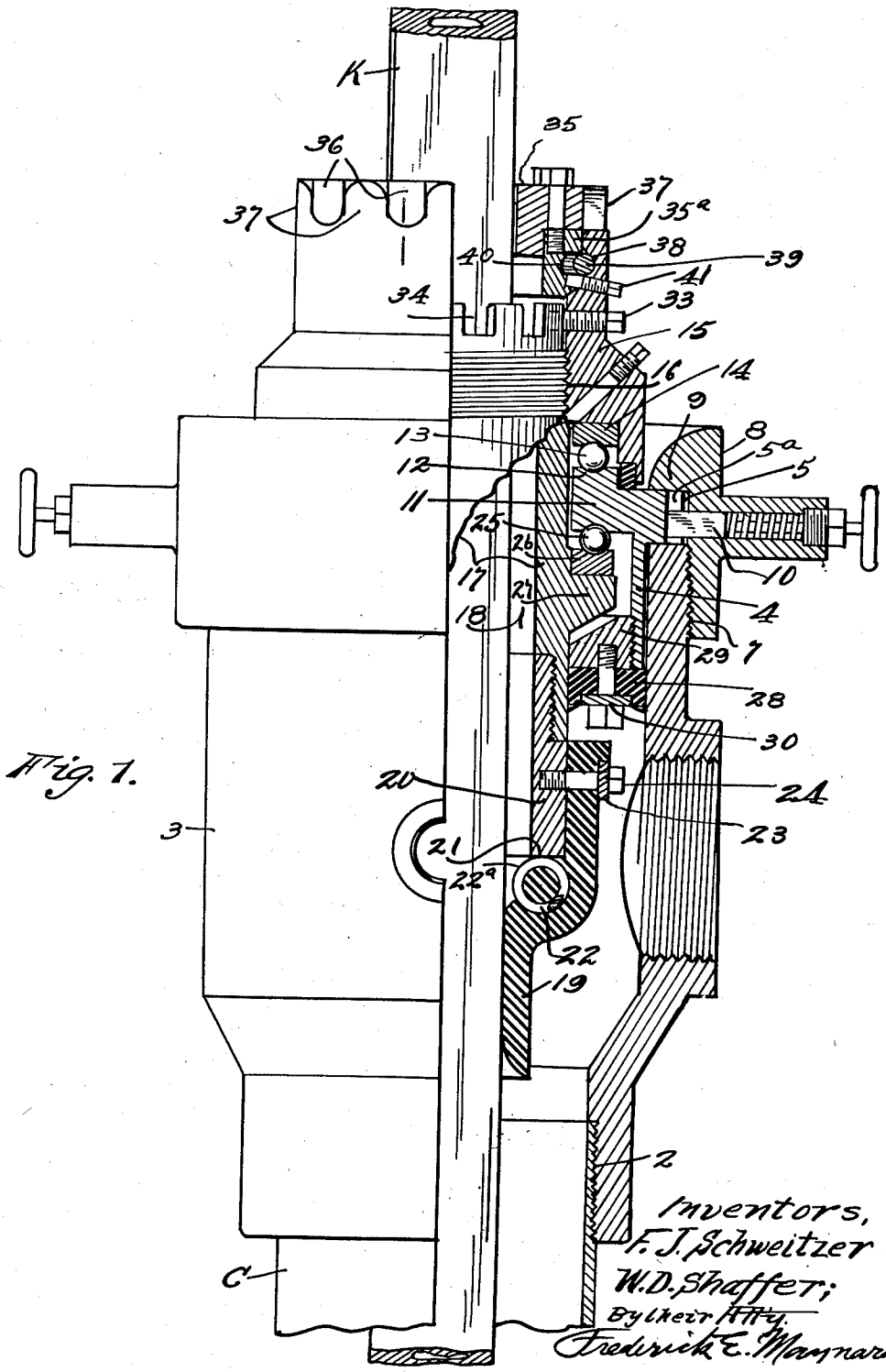


Fig. 1.

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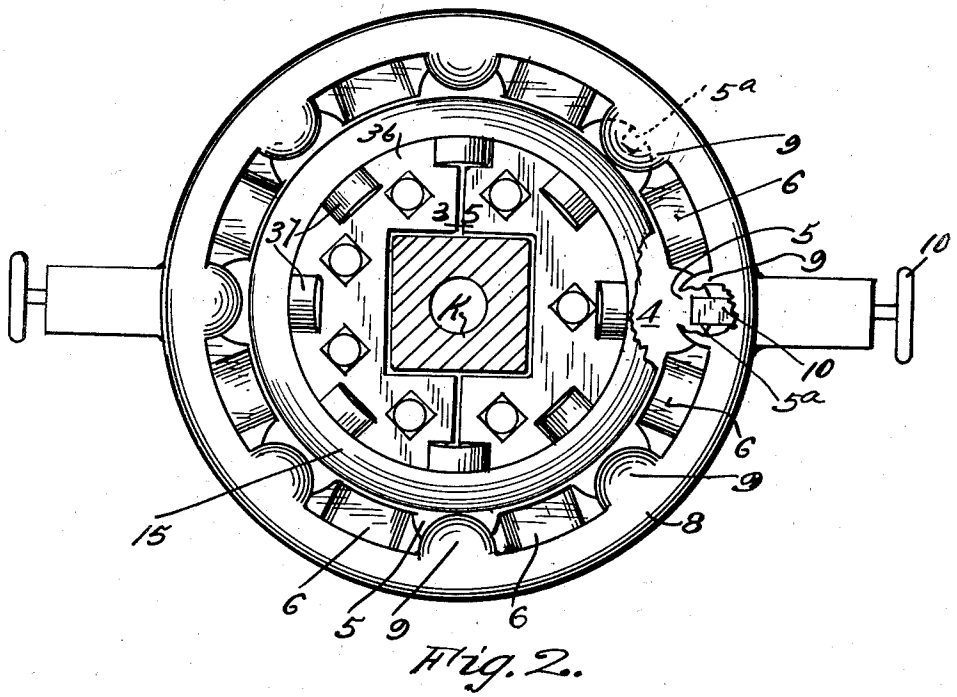


Fig. 2.

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ROTARY COLLAR PASSING BLOW-OUT PREVENTER AND STRIPPER

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Application May 9, 1938, Serial No. 206,792

14 Claims. (Cl. 255—1)

This invention is an improvement in apparatus for deep well operations such, for instance, drilling wells by rotary equipment.

The invention concerns a drill pipe, blow-out preventer of the type shown in pioneer patents of Childs, 1,503,476, Aug. 5, 1924, which shows: a shell on a well casing, packing on the drill pipe, a cooperating abutment (28—22) for "the" packing rotatable in the shell, and means for packing off between the abutment and the shell adapted for expansion to operative position by well pressure—that is by a common fluid-set packer such as seen in Joyce et al., 1,700,894, at part 22, or in another form seen at packing device E—F, of Williams, 517,509, of April 3, 1894, and in Bennett, 1,546,467, of July 20, 1925, or in Anderson, 1,472,952, of Nov. 6, 1922, at packing 44; any of which well known devices will perform their usual function as the packing 24 in Childs.

No claim is here made to such an aggregation of old elements as Childs and Joyce et al. disclose but an object is to provide a novel combination, in a blow-out preventer, including a rotary, re-inforced packing fitting a tool string section and providing for the passage in or out of shoulder parts along the string and at the same time provide for the elevation of a driving element from the relative driven element or sleeve of the swivel without in any manner effecting the position and function of the string sealing, blow-out preventing packing. In other words, an object is to provide for keeping the rotary stem or string sealed when the kelly bar is elevated and lifts the driving collar element from the driven, swivel sleeve.

A further purpose of the invention is to provide a rotary blow-out preventer and stripper including a stem-driven collar element which is so constructed, arranged and designed that it may be lowered into the bore of the driven sleeve element (see Childs' swivel 22) by a relative longitudinal movement of said elements and interlocked thereto by a spline-like means for drive relation (such as the mountings for the pivoted bolts 26 fitting in the spline slots 27, Childs et al. patent, supra), and to provide means to automatically, yieldably and releasably lock the drive collar in the driven swivel element in splined relation to enable instant release of the drive collar by an elevation of the tool string kelly bar without the need of any direct manual operation of or attention to special connecting or disconnecting devices associated with the swivel assembly to permit lift thereof from the casing head, such as the nuts of the bolts 26 of Childs, and the "drawing means" or bolts 24 of Collins, 1,560,763, of Nov. 10, 1925, and others. The elimination of such manual or manually controlled releasing means is for the purpose of greatly facilitating the operation of making up or breaking down of well strings by lifting only the kelly collar without disturbing swivel barrel and still leaving the string section packed in the swivel to prevent opportunity for a blow-out, at the head.

Another object of the invention is to provide means for the ready change of drive collar devices and swivels for adaptation of the assembly for passage of tubing, pipe and string sections of different size with their different size collars or shoulder parts used in string make-up according to the job.

An additional object is to provide an assembly of the type concerned in which a driven sleeve has an unobstructed bore to pass a pipe shoulder, etc., and carries an expansible armor to pass a shoulder and supporting a pressure-fluid set packing contractive on the string section and expandible to pass shoulders, and further to provide a standing packer between the spinning sleeve of the swivel.

The invention consists in certain advancements in this art as set forth in the ensuing disclosure and having, with the above, additional objects and advantages as hereinafter developed, and whose construction, combinations and details of means, and the manner of operation will be made manifest in the description of the herewith illustrative embodiment; it being understood that modifications, variations and adaptations may be resorted to within the scope, spirit and principle of the invention as it is more directly claimed hereinbelow.

Figure 1 is an elevation of an embodiment of the invention, partially in axial section; a kelly bar being in place in the assembly. Figure 2 is a plan of the race collet, its locking bonnet, and shell rim assembly and lock.

A casing C has attached by threads 2, or otherwise as desired, a combined casing head and swivel shell 3 whose upper end freely telescopically receives a collet 4 having a set of radial lugs 5 to fit between complementary rim spurts 6 of the shell 3.

The rim of the shell 3 is externally threaded at 7 to receive an annular bonnet 8 having inner spaced bills 9 to turn into overhanging and retaining position with the lugs 5 of the collet in the shell bore. Only about a one-eighth turn of the bonnet will set the bills 9 either over or clear of the relative collet lugs 5.

The bonnet 8 is releasably locked on the shell rim against accidental turn, due to incident vibrations of the assembly, by any suitable device such as a spring bolt 10 mounted therein to snap into anti-rotational interlock in relative recesses or notches 5a in the outer faces of the contiguous lugs 5 when lowered into position between rim spurs 6. It will be seen that the bill-ring or bonnet 8 is a direct reversal of the annular flange 29 of Childs et al., which prevents upward removal of the swivel.

The collet 4 has an inwardly directed, annular flange 11 presenting a top ball race 12 for a set of anti-friction bearing balls 13 on which is imposed a race ring 14 set in a driving band 15 which has internal threads 16 (preferably right-hand) receiving the upper end of a spinning or swivel sleeve 17.

This sleeve has a cylindrical bore 18 to axially pass a drill kelly bar K and attached tool or other parts commonly connected by shoulder forming elements or collars, not shown. The bore 18 of the sleeve is entirely unobstructed by packing, or rings or elements of any description and this is a new feature in rotary, blowout preventers.

To prevent any fluid from flowing out of the bore of the sleeve 17 under well pressure, or circulation pressure, a packing nipple 19 is fitted to and is self-contractive on the string kelly or other section in the bore 18 and is externally carried by a bushing 20 screwed into the lower end of the sleeve 17; the nipple closing the open lower end of the bore 18 through the sleeve. Such a nipple would be blown out through the bore 18 unless suitably re-enforced. Therefore, a contractive and expensive end thrust barrier device is movably imposed against the lower end face 21 of the bushing 20. This barrier is here in the form of a ring 22 of helical spring radially sliding directly on the thrust face 21 and being largely embedded in a thick body part of the nipple 19 through which the inner part of the coils at 22a are exposed for metallic engagement with such shoulders as may be presented along the well string passing through the bore of the sleeve 17. The upper end of the nipple 19 is positively sealed and fixed on the bushing 20 by a girdle 23 and screw means 24 on the outer face of the bushing to be removed as a unit therewith from the sleeve if desired.

Thus any enlargement along a well string in the swivel bore 18 may pass freely up or down by engaging and expanding the sealing nipple 19 and the expansible barrier 22, whose minor diameter is normally less than the outside diameter of a collar or shoulder of the well string; the normal characteristic of the nipple and the barrier plus the circulation or well fluid pressure operating to maintain an effective packing seal and the barrier 22 operative to prevent the packing nipple being blown out through the bore of the swivel.

Upthrust of the sleeve 17 is taken by anti-friction balls 25 on a race 26 on a flange 27 of the sleeve 17; the balls bearing up against bottom face of race flange 11 of the collet 4.

A stationary or other packing device is provided to directly engage on the running sleeve 17 and the bore of the shell 3, and is shown as comprising a packing ring 28 which also seals on the removable collet 4 which is loosely fitted in the bore of the shell. It will be noticed that there is no fitted bore face seats between the shell 3 and the collet 4 and no fitted faces between the running sleeve and the bore of the collet, and the one packing ring 28 completely seals the two open joints between the sleeve 17 and the collet 4, and between the collet 4 and the shell 3. The packing ring 28 is fixed to a breech-ring 29 by a screw-set washer 30, and the ring of packing 28 may have fluid-pressure set lips 31-32 or not as desired.

The drive band 15 is prevented from unscrewing if the tool is rotated left hand by means of a dog-screw 33 taking into a contiguous notch 34 of the castellated upper end of the swivel sleeve 17.

In making up or pulling a string of sections of a well tool it is highly objectionable to unclamp or unlock an entire assembly of parts making up a swivelling assembly setting in the usual bowl of the casing head merely for the purpose of enabling the joining or un-joining of string sections, and this invention provides a means to eliminate pulling the running swivel or sleeve and its packings from the casing head when string joints are to be made or broken.

This means includes a split kelly collar 35 (as of Childs et al.) with radial slots 36 to slide like a spline by longitudinal movement down on complementary crown keys or lugs 37 (like the lugs for the pivots of the screws 26 of Childs et al.). This split kelly collar 35 is the direct driver for the complementary driving band 15, and to eliminate manually set or manually controlled fastening means which usually have the additional function of holding down the swivel sleeve of such class of preventers, means are here provided for releasably but automatically connecting the kelly collar 35 to the swivel sleeve 17 by the mere raising or lowering of the kelly with the relative, installed collar 35.

In the upper end of the bore of the band 15 is an annuar groove 38 in which there automatically expands a resilient, split lock ring 39. The collar 35 is removably bolted to a bezel 35a, through which a string collar or shoulder can pass, with an outer peripheral groove 40 opposed to the expanded lock ring 39 and the bottom wall of the groove 40 so underlies the lock ring 39 that when a string shoulder moves up and engages and lifts the collar device 35—35a with enough pressure the ring 39 will yieldably contract into collar groove 40 and will disconnect from the band 15, and only the collar device 35—35a and lock ring 39 will go up with elevated string and kelly bar K; thus leaving intact all of the other parts of the preventer assembly in the casing head bowl.

On a downward movement of the kelly the spring ring 39 will be forcibly contracted again into the collar groove 40 as the spring enters the drive band 15; the bore of which latter has the dual function to contract the lock ring 39 on either elevation or descent of the kelly collar.

The joints of the kelly bar and of the lower string collars can pass up or down in the bore 18 of the sleeve and still the string will be engaged and packed by the nipple 19 which remains unshiftably united with the collar-passing sleeve 17 to hold back fluid pressure in a manner not heretofore known in swivelled packers.

By a gradual elevation of the kelly with the drive collar device 35—35a engaging the spring 39 without shock the swivel assembly can be hoisted from the bowl of the head as soon as the bill-ring is turned clear of the lugs 5 of the collet 4. To prevent possible drop of the hoisted swivel sleeve 17 by centripetal recession of the lock ring 39 a safety screw 41 is provided to be

manually run in to jam the self-releasing ring 39 at any time the whole assembly is to be hoisted from the bowl.

It will be seen that the preventer assembly can be built up or assembled on the well derrick floor or at shop and then bodily set into the casing head bowl, and that the kelly collar 35 alone has to have its two like sections (that is halves) united about the kelly and bolted to the full ring bezel 35a having a bore of such size to freely pass such size collars or shoulders as incidental to a given string, like a drill stem, to be passed into the bore of the swivel. When the kelly collar is lowered to the installed swivel assembly the lock ring 39 will automatically interlock to the drive band, and when the collar is elevated by the uprising kelly, in operations of a tool, the lock ring will automatically release itself, and at will the whole assembly can be safely lifted from the casing head bowl.

Reference is made to U. S. Patent No. 2,170,915 (Ser. No. 157,141), to claims to the specific packer shown and not claimed, per se, in the instant case.

What is claimed is:

1. A well string, rotary blow-out preventer and stripper including a rotal sleeve having an unobstructed bore to pass shoulder parts of the string, collar means co-axially, co-rotatively and removably connected to the sleeve to axially pass a part of the string between shoulders thereof and engageable by an upwardly moving shoulder of the string, means rotatively supporting the sleeve and means attached to the sleeve below the collar and operative resiliently to contractively seal on said string part in the sleeve and which is adapted to be expanded by the passing shoulders and to seal thereon, and barrier means interposed between the sleeve and said resilient means for preventing blow-out of the sealing means.

2. A well casing head assembly including a tubular element axially receiving a well string, a string rotative collar device fitting a complementary part of said element, means rotatively supporting the assembly and preventing its lift; and means to automatically, yieldably interlock the device with the said element when the device is lowered to the sleeve and being readily releasable when the collar is elevated as to the sleeve.

3. The assembly of claim 2, and including exterior projections on the rim on the sleeve and means on the collar to co-rotatively connect the collar device and the sleeve by a small angular relative movement of the collar.

4. A well casing head assembly including a sleeve to axially receive a well string, a collar element to co-rotatively, slidably fit a string member removably fitting a complementary part of the sleeve, and means to releasably, automatically interlock the element as it is lowered to engage with the sleeve.

5. A well assembly as in claim 4, and which means is automatically operative by the up-pulled element to disconnect it from the sleeve.

6. A rotary blow-out preventer and stripper assembly including a swivel element having a contractile, stripping packing expansible to pass, axially, string shoulder parts, and a kelly collar device complementary to and interlockable with the said element and co-rotative with and vertically operative by a kelly bar and movable into drive interlocking position with and from the said element by the kelly, when in place thereon while the packing remains in effective sealing and co-rotative position on said string.

7. An assembly as in claim 6, and automatic means to releasably interlock the device in driving interlock with the element.

8. A rotary blow-out preventer and stripper assembly including a sleeve and means for rotatively, releasably attaching it to a casing head, and a kelly driven collar device complementary to and movable at will to and from interlock with the sleeve, and means rotative with and carried by the sleeve for contractively sealing on the kelly while the drive device is either elevated from or is engaged with the sleeve to prevent a blow-out through the sleeve and past the kelly.

9. A rotary blow-out preventer and stripper assembly including a string-passing, swivelled sleeve and means for operatively attaching it to a given support, a normally contractive packing on the sleeve to slidably pass and seal by well fluid pressure the string in the sleeve, and a collar device to drivably fit and slide on a string part and which is seated on and interlockable with the sleeve to drive it and which is detachable therefrom by a pulling action of a part of the string; said packing device operative on the string to seal it in either interlocked or lifted position of the said device.

10. An assembly as in claim 9, and having means for automatically interlocking the device with the sleeve and for readily releasing it under removing effort of the device by the string.

11. An assembly as in claim 9, and having an automatic and a safety means to hitch the device with the sleeve so that the assembly may be lifted intact by string action on the said device.

12. A rotary blow-out preventer and stripper including a collet adapted to be secured in the bore of a given support, a string-passing sleeve swivelled in the collet, a driving collar device applicable to a kelly bar of a string to be raised or lowered by the kelly as to the sleeve, a fluid pressure set packing on the sleeve to contract and seal on the kelly part in the sleeve and expansive by and to pass shoulders of the string whether the drive device is elevated or is seated on the sleeve, and packing between the sleeve and the bore of the support; said device seating on and driving the sleeve.

13. An assembly as in claim 12, and which bore packing is attached to the collet to be moved therewith as a part of the assembly from said support.

14. A rotary stripper packer assembly including a rotative member having a bore to pass a given string shoulder, a packing body mounted on, and having a nipple extending axially from the bore of, said member and having a bore surface directly contractive on a string section passing through the bore of said member and being freely expansible by a passing string shoulder, and an expansive and contractive guard device bearing on a near face of said member for ready expansive radial movement and projecting across the near, open end of the bore of said member to prevent flow of the nipple into the bore of said member under fluid or other pressure, and being free to expand as a string shoulder passes.

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