April 10, 1962 A. E. WILDE 3,029,083

SEAL FOR DRILLING HEADS AND THE LIKE

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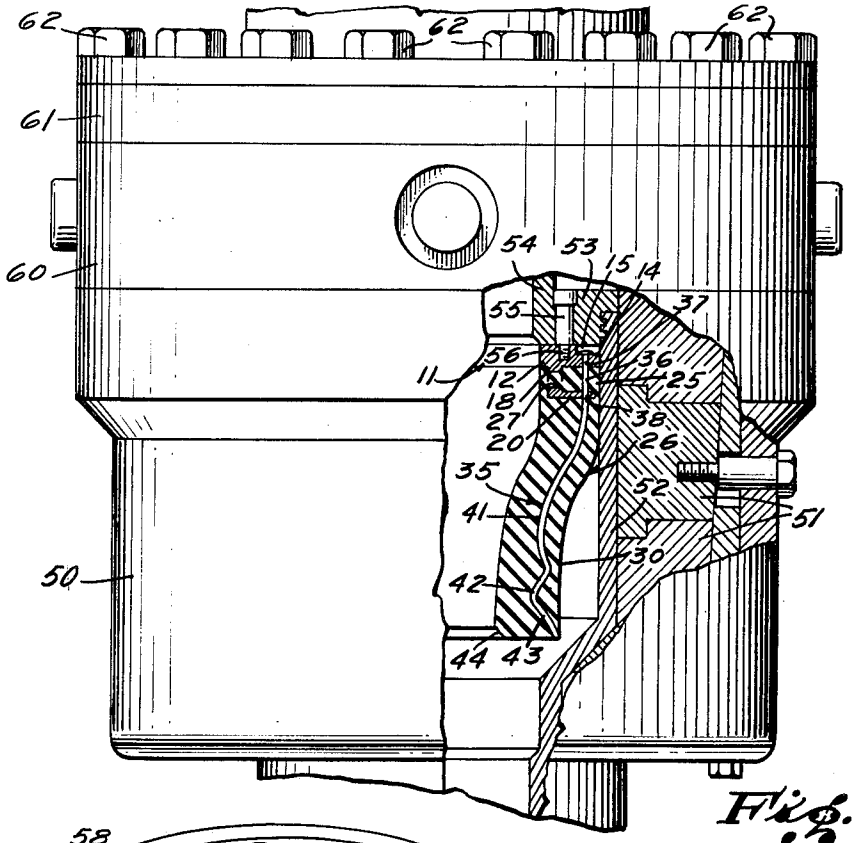


Fig. 1.

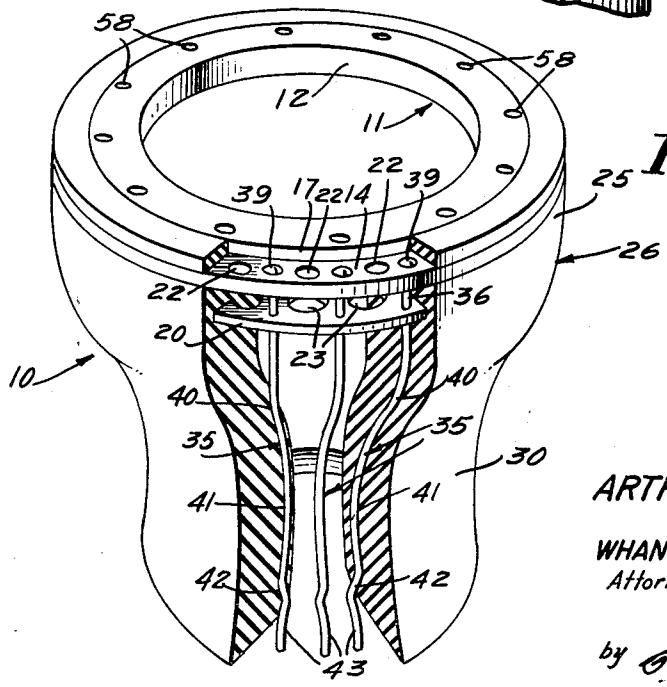


Fig. 2

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SEAL FOR DRILLING HEADS AND THE LIKE

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This invention relates generally to well drilling equipment or apparatus and relates more particularly to seals for drilling heads and the like.

While the invention has particular utility in connection with oil well drilling equipment, and is shown and described in such connection, it is to be understood that its utility is not confined thereto.

In certain types of drilling operations, blowout preventers and strippers are used which include a stripper rubber which is adapted to maintain a continuous seal around the various elements in the drill string, except for such abnormally large diameter tools as bits or reamers which may be disposed in said preventers and strippers. However, with such stripper rubbers, certain problems are encountered. For example, often drill strings having collars at the joints are used and when such a drill string is being raised through the stripper rubber which sealingly engages said string, the rubber tends to bunch at the top and form a shoulder and if these collars are not suitably tapered they are apt to catch this shoulder and rip or tear the rubber and render same unfit for further use. This problem is particularly aggravated in stripper rubbers having a series of pivoted mounting plates arranged at the upper end and embedded in the body of rubber of the device. The lower ends of these plates tend to swing inwardly as the drill string is being raised and sometimes these plates move inwardly to a point whereat they tend to overlie the upper end of an approaching collar and when said collar contacts the shoulder in which said plates are disposed further upward movement of the string or pipe is prevented or the stripper rubber seriously damaged as the collar is forcibly pulled therethrough.

It is, therefore, an object of the present invention to provide a stripper rubber which overcomes the above problems and difficulties.

Another object of the invention is to provide a device of this character which permits a smooth and easier passage of tool joints and the like therethrough.

Still another object of the invention is to provide a device of this character which minimizes or entirely eliminates catching and tearing of the rubber by elements of the drill string or the like passing therethrough.

A further object of the invention is to provide a device of this character that will accommodate pipes and tools of various configurations.

A still further object of the invention is to provide a device of this character that will keep the same pack off and same differential pressure for drill string elements therein of various diameters.

Another object of the invention is to provide a device of this character wherein the formation of a shoulder therein which is subject to engagement and damage by parts of a drill string passing therethrough is eliminated.

Still another object of the invention is to provide a device of this character that may be used in various types of apparatus, including rotating and stationary preventers and strippers, and which may be used in connection with various types of high pressure drilling equipment and procedures.

A further object of the invention is to provide a device of this character having an initial sealing force about the various elements of the pipe string disposed therein.

Another object of the invention is to provide a device

of this character that is simple in construction, durable, and reliable in operation.

Still another object of the invention is to provide a device of this character that is relatively inexpensive to manufacture.

The characteristics and advantages of the invention are further sufficiently referred to in connection with the following detailed description of the accompanying drawings which represent one embodiment. After considering this example, skilled persons will understand that variations may be made without departing from the principles disclosed, and I contemplate the employment of any structures, arrangements or modes of operation that are properly within the scope of the appended claims.

Referring to the drawings:

FIG. 1 is a side elevation of a drilling head with a portion broken away and showing a longitudinal section of the stripper rubber operably disposed in said head; and

FIG. 2 is an enlarged perspective view of the stripper rubber device per se showing portions thereof in section.

The stripper rubber device is indicated generally at **10** and comprises a metal anchoring ring, indicated generally at **11**, having a body portion **12** provided with an outwardly extending flange **14** at the lower outer edge portion. The flange **14** defines the bottom of a recess **15** at the upper outer side of said body **12**, the outer peripheral edge portion **17** of the body **12** defining the inner side of said recess **15**. Spaced outwardly of the inner edge of the body **12** is a depending flange **18** from the lower end of which a flange **20** extends radially outwardly in substantially parallel relationship to the body **12** and flange **14** thereof.

Flange **14** is provided with a plurality of annularly spaced openings **22** therethrough and the flange **20** is provided with similar openings **23**, the latter being somewhat larger than said openings **22**. The flanges **14, 18** and **20** are embedded or molded in the upper end portion **25** of a sealing element indicated generally at **26**.

The sealing element is of any suitable material which is resistant or substantially impervious to the action of fluid, such as oil or drilling fluids, which may come into contact therewith. For example, there are synthetic rubber materials or the like known in the oil industry which may be used and when the term rubber is used with reference to the material composing the sealing element, any suitable resilient material is meant.

The rubber of the seal is received in the openings **22** and **23** of the flanges **14** and **20** and also in openings **27** in the flange **18** so that the various parts of the seal about the flanges **14, 18** and **20** are thus interconnected, it being noted that there is rubber in the recess **15** above the flange **14**, between said flanges **14** and **20** and at the inner side of the flange **18**. Rubber sealing element **26** curves inwardly to a reduced diameter portion **30**, the thickness of the seal being substantially the same throughout the length thereof.

Molded within the sealing element **26** are a plurality of annularly spaced rods or wires indicated generally at **35**, of suitable resilient material such as, for example, steel. An upper end portion **36** of each rod is securely held by the flanges **14** and **20**, there being aligned openings **37** and **38** therefor in the respective flanges **14** and **20** disposed between the openings **22** and **23** of said flanges. The upper end of each rod is provided with a flattened head **39** and said rods are secured in the openings in said flanges **14** and **20** by press fitting, welding or other suitable means. Below the flange **20**, each rod curves inwardly at **40** and then curves generally downwardly at **41**. The curved portions **40** and **41** of the rods conform generally to the curvature of the rubber sealing element **26** and are substantially parallel to the inner and

outer surfaces thereof. At the lower end of the curved portion **41**, there is a generally S-shaped portion **42** having a terminal portion **43** which ends at or adjacent the outer lower edge of said element **26**, as best shown in FIG. 1. The shape of the rods, of course, may be varied from that shown.

The rods **35** form a caging, said rods being pre-loaded inwardly to urge the lower end portion **30** of the sealing element **26** inwardly for sealing engagement with such equipment as is disposed within same. This pre-loading is effected by suitable means such as a mandrel which holds the lower ends of said rods outwardly while said rods are being molded within the rubber element **26**.

Thus, an initial seal is provided with such equipment as is disposed within the device and there is also provided the same pack off and the same differential pressure across the sealing element for different diameters of equipment therein. Also, the rods **35** provide longitudinal strength for the sealing element **26** so that when a pipe string or the like is being raised through said sealing element and an enlarged diameter portion is moved thereinto, the element starts to spread at the lower free end and thus permits easier and smoother movement of the parts of the string therethrough.

Further, it is believed that it will be apparent therefore that the rods **35** minimize or eliminate longitudinal compression of the rubber sealing element when a pipe string or the like is being raised therethrough as said sealing element is prevented from being pulled upwardly by the frictional engagement with a pipe string being raised therethrough. Hence, no shoulder is formed at the upper end of the sealing element which would be engaged by the pipe collars at the joints and torn or otherwise damaged so as to prevent said element from providing an effective seal with said string or other piece of equipment disposed therein.

It is to be understood, of course, that this device may be used in various pieces of equipment. For example, it may be used in different types of drilling heads, such as stationary or rotary types. Also, it may be incorporated in equipment where there is drilling with air or gas as a circulating medium as well as with equipment using other types of circulating medium.

In FIG. 1, one type of rotary drilling head or blowout preventer and stripper with the present device installed therein is shown by way of example. This blowout preventer and stripper is known in the art and hence but a brief description thereof will be given here. There is a hollow body **50** having bearings **51** disposed therein, in which is rotatably mounted a sleeve **52**. At the upper end of sleeve **52** is threadably secured an outwardly extending flange **53** of a rotatable sleeve **54**. The flange **53** is provided with a plurality of annularly spaced openings therethrough for reception of screws **55** which have externally threaded lower end portions **56** which are received in tapped openings **58** in the body **12** of the stripper rubber device. There is a cage **60** disposed on the upper end of the body **50**, said cage having locking pins which releasably secure the sleeves **52** and **54** with the sealing element operatively in said body **50**. On top of the cage **60** is a cover **61** for said cage and said cage and cover are secured to the body **50** by bolts **62**.

With the stripper rubber device installed in a blowout preventer and stripper, a drill string or the like is adapted to be received through the equipment, said drill string extending through the sleeve **54** and the stripper rubber device **10**, said stripper rubber engaging the drill string or other equipment disposed therein and providing a seal therewith. The sleeves **52** and **54** and the stripper rubber device **10** rotate with the drill string or other equipment disposed within the apparatus and, as pointed out above, said stripper rubber permits the drill string to be moved longitudinally downwardly or upwardly therethrough while maintaining a seal therewith.

It is believed that the invention and many of the attendant advantages will be understood from the foregoing description and it is believed that it will be apparent that various changes may be made in the form, construction and arrangement of the parts of the invention without departing from the spirit and scope thereof or sacrificing all of its material advantages, the form hereinbefore described being merely by way of example.

I claim:

1. A seal device for drilling heads and the like, comprising: a metal anchoring ring comprising an annular body with a radially outwardly extending flange at the lower outer edge thereof, the upper side of said flange defining the bottom of an annular recess, the outer periphery of the body above the flange defining the inner side of said recess, said body having a plurality of annularly spaced tapped openings in the upper side thereof and said flange having a plurality of annularly spaced openings therethrough; a second flange depending from said body and spaced inwardly of the inner wall thereof, said second flange having a plurality of annularly spaced openings therethrough; a third flange extending radially outwardly of the lower end of said second flange, said third flange being of smaller external diameter than the first flange and being provided with a plurality of annularly spaced openings therethrough, said first and third flanges being spaced apart in substantially parallel relationship to each other and having aligned openings therein, said openings in the respective flanges being spaced annularly apart and located between the first mentioned openings in said flanges; a tubular rubber sealing element, one end of said sealing element being of substantially the same annular size as said body and first flange and said body and flanges being molded into said end of the sealing element with parts of the rubber disposed in the first mentioned openings in said flanges so as to interconnect various parts of said end of the rubber disposed about said flanges and body, said sealing element curving inwardly and longitudinally to a reduced diameter free end part from the first mentioned end; and a plurality of annularly spaced rods having end portions received in said aligned openings in said first and third flanges, said rods being welded in said openings and having inwardly and downwardly curved portions extending longitudinally within the wall of said sealing element and having free end portions of generally S-shape with a terminal free end part extending outwardly and downwardly to the outer peripheral edge of the reduced diameter part of said sealing element, said rods being of resilient material and being preloaded inwardly, the free ends of said rods being movable radially inwardly and outwardly.

2. A seal device for drilling heads and the like, comprising: a rigid anchoring ring having an annular body with a radially outwardly extending flange at the lower outer edge thereof, the upper side of said flange defining the bottom of an annular recess and the outer periphery of the body above the flange defining the inner side of said recess, said body having a plurality of annularly spaced tapped openings in the upper side thereof and said flange having a plurality of annularly spaced openings therethrough; a second flange depending from said body, said second flange having a plurality of annularly spaced openings therethrough; a third flange extending radially outwardly of the lower end of said second flange and provided with a plurality of annularly spaced openings therethrough, said first and third flanges being spaced apart substantially parallel to each other and having aligned openings therein, said openings in the respective flanges being spaced annularly apart and located between the first mentioned openings in said flanges; a tubular rubber sealing element, one end of said sealing element being of substantially the same annular size as said body and first flange and said body and flanges being molded into said end of the sealing element with parts of the rubber disposed in the first mentioned openings in said flanges so as to interconnect various parts thereof about

said flanges and body, said sealing element curving inwardly and longitudinally to a reduced diameter part from the first mentioned end; and a plurality of annularly spaced resilient rods embedded within the sealing element and having end portions secured in said aligned openings in said first and third flanges and having inwardly and downwardly curved portions extending longitudinally within said sealing element and each rod having a free end portion extending to the outer peripheral edge portion of the reduced diameter part of said sealing element.

3. A seal device for drilling heads and the like, comprising: an anchoring ring having a plurality of annularly spaced tapped openings in the upper side thereof; a tubular sealing element of rubber material, one end of said sealing element being of substantially the same annular size as said ring, said ring being molded into said end of the sealing element, said sealing element curving inwardly and longitudinally to a reduced diameter portion from the first mentioned end; and a plurality of resilient, annularly spaced rods firmly secured at their upper ends to said ring and free at their lower ends, said rods being curved inwardly and downwardly within the wall of said sealing element and having free end portions terminating adjacent the outer peripheral edge portion of the reduced diameter part of said sealing element, said rods resisting longitudinal compression of said sealing element, the free ends of said resilient rods yieldingly urging said tubular sealing element radially inwardly, and said rods being individually free, annularly separated by said material of said sealing element, and embedded within said material so as to provide material coextensive with said rods and positioned between said rods and the inner tubular surface of said element.

4. In a sealing device for well drilling apparatus: an anchor ring adapted to be operably secured within said apparatus; a tubular, sealing element of resilient material having a relatively thick annular wall, one end of said sealing element being secured to said anchor ring, said sealing element curving inwardly and longitudinally from the first mentioned end to an annular reduced diameter part; and a plurality of annularly spaced, resilient rods secured at one end to said anchor ring, free at the opposite end and extending longitudinally within the wall of said sealing element throughout substantially the length of said sealing element and having their free ends terminating adjacent the free end of said sealing element, the free ends of said resilient rods yieldingly urging said tubular sealing element radially inwardly, and said rods being individually free, annularly separated by said material of said element, and embedded within said material so as to provide material coextensive with said rods and positioned between said rods and the inner tubular surface of said element.

5. In a sealing device: an annular anchor member; a tubular sealing element of resilient material having one end secured to said member, said sealing element tapering inwardly and longitudinally from the first mentioned end to a reduced diameter part; and a plurality of annularly spaced resilient rods extending longitudinally within the material of said sealing element throughout substantially the length thereof and having the ends at the large diameter end of said sealing element secured to said anchor member and the opposite ends free, the opposite ends yielding outwardly upon expansion of said reduced diameter part of the sealing element, the free ends of said resilient rods yieldingly urging said tubular sealing element radially inwardly, and said rods being individually free, annularly separated by said material of said sealing element, and embedded within said material so as to provide material coextensive with said rods and positioned between said rods and the inner tubular surface of said element.

6. In a tubular sealing device: an annular anchor member; a tubular sealing element of resilient material having one end secured to said member, said sealing element tapering inwardly and longitudinally from the first mentioned end to a reduced diameter part; and a plurality of annularly spaced, resilient rods embedded within said sealing element and extending substantially the length of said element, said rods having their ends at the large diameter end of said sealing element secured to said anchor member and the opposite ends free, the free portions of said rods being resiliently movable radially with expansion and contraction of said sealing element, the free ends of said resilient rods yieldingly urging said tubular sealing element radially inwardly, and said rods being individually free, annularly separated by said material of said sealing element, and embedded within said material so as to provide material coextensive with said rods and positioned between said rods and the inner tubular surface of said element.

7. In a sealing device: a rigid, annular anchor member; a tubular sealing element of resilent material having one end secured to said anchor member; and a plurality of annularly spaced, resilient rods extending longitudinally within the material of said sealing element throughout substantially the length thereof with the ends adjacent the annular anchor member secured to said anchor member and the opposite ends free so that said rods have a cantilever mounting, the free ends of said resilient rods yieldingly urging said tubular sealing element radially inwardly, and said rods being individually free, annularly separated by said material of said sealing element, and embedded within said material so as to provide material coextensive with said rods and positioned between said rods and the inner tubular surface of said element.

8. In a tubular sealing device: an annular anchor member; a tubular sealing element of resilient material having one end secured to said anchor member; and a plurality of annularly spaced, resilient rods embedded within said sealing element and extending substantially the length of said element, the ends of said rods adjacent the anchor member being secured to said member and the opposite ends free, the free portions of said rods being resiliently movable radially with expansion and contraction of said sealing element and resisting longitudinal compression of said resilient sealing element, the free ends of said resilient rods yieldingly urging said tubular sealing element radially inwardly, and said rods being individually free, annularly separated by said material of said sealing element, and embedded within said material so as to provide material coextensive with said rods and positioned between said rods and the inner tubular surface of said element.

9. In a sealing device for well drilling apparatus: an tnnular anchor member; an annular wall of resilient material defining a tubular sealing element, said sealing element tapering inwardly and longitudinally from one end to a reduced diameter part, the opposite larger end having said anchor member molded therein; and a plurality of annularly spaced resilient rods extending longitudinally within said wall of the sealing element throughout substantially the length thereof, having the ends as the large diameter end of the sealing element secured to said anchor member and the opposite ends free, the free portions of said rods being resiliently movable substantially radially with expansion and contraction of said sealing element, said rods resisting longitudinal compression of said resilient sealing element, the free ends of said resilient rods yieldingly urging said tubular sealing element radially inwardly, and said rods being individually free, annularly separated by said material of said sealing element, and embedded within said material so as to provide material coextensive with said rods and positioned between said rods and the inner tubular surface of said element.

10. In a sealing device for well drilling apparatus: an annular anchor member; an annular wall of resilient material defining a tubular sealing element, said sealing element being of smaller diameter at one end than at the

other end, said anchor member being molded in the larger end of said sealing element; and a plurality of annularly spaced resilient rods extending longitudinally within said wall of the sealing element throughout substantially the length thereof, having the ends at the large diameter end of the sealing element secured to said anchor member and the opposite ends free, the free ends of said resilient rods yieldingly urging said tubular sealing element radially inwardly, and said rods being individually free, annularly separated by said material of said sealing element, and

embedded within said material so as to provide material coextensive with said rods and positioned between said rods and the inner tubular surface of said element.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,029,083 April 10, 1962

Arthur E. Wilde

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 57, for "as" read -- at --.

Signed and sealed this 28th day of August 1962.

(SEAL)
Attest:

ESTON G. JOHNSON
Attesting Officer

DAVID L. LADD
Commissioner of Patents