

Feb. 26, 1957

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2,783,028

DRILL STEM SUPPORTER AND STABILIZER

Filed May 10, 1955

4 Sheets-Sheet 1

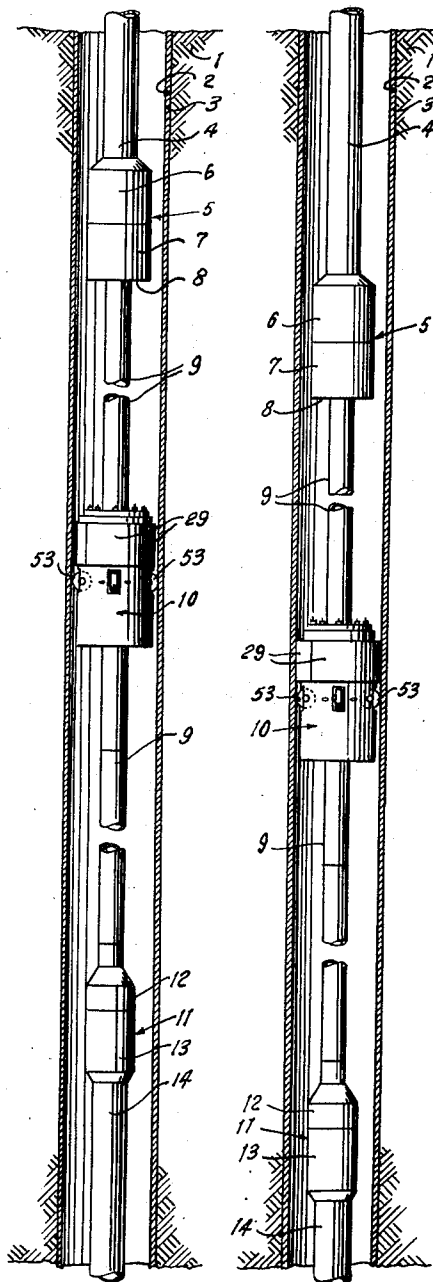


Fig. I

Fig. II

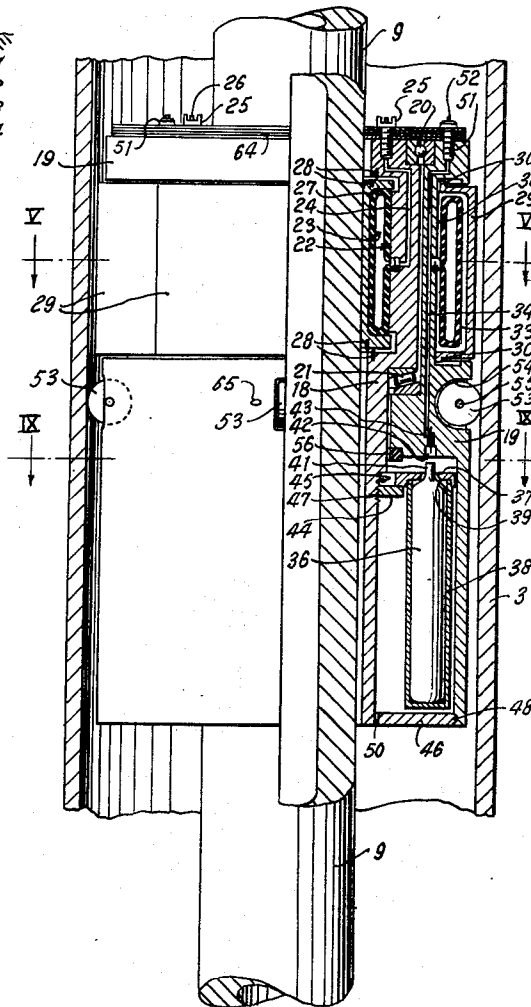


Fig. III

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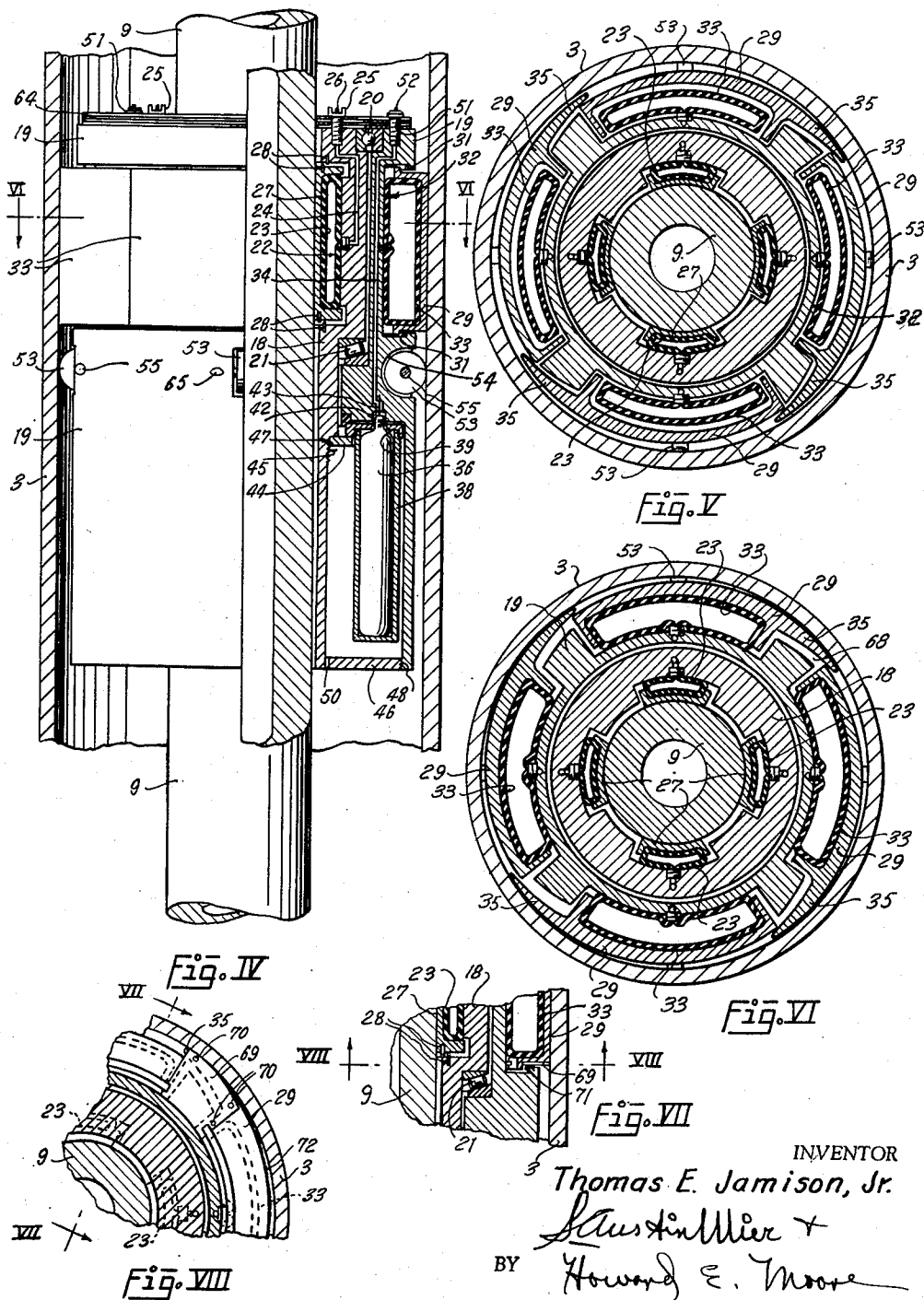
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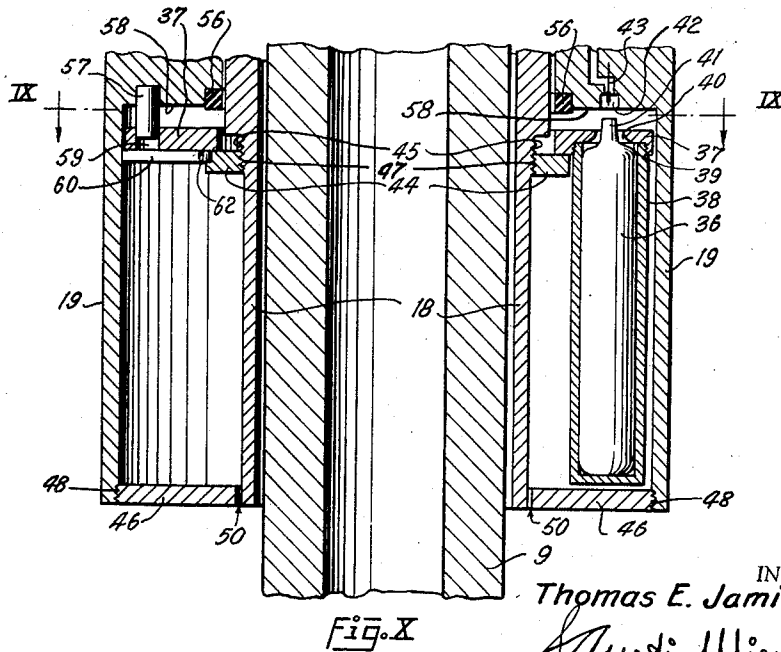
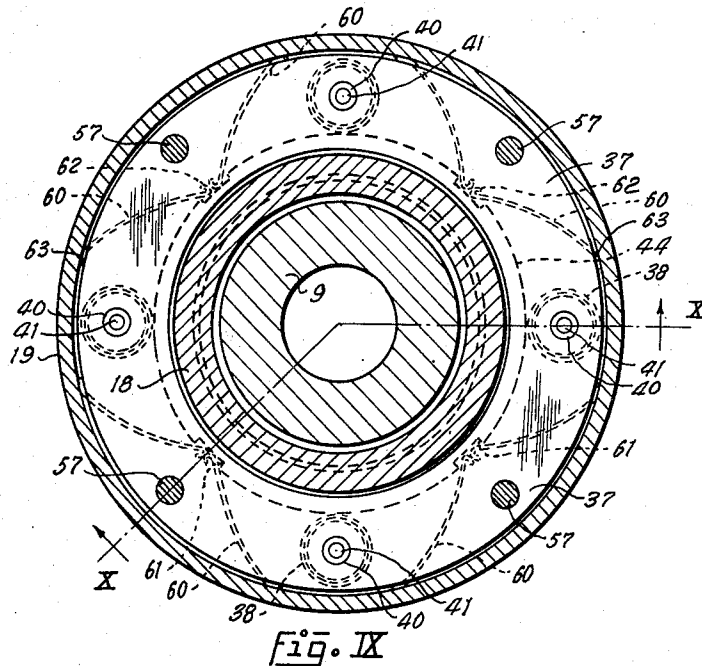


Fig. X

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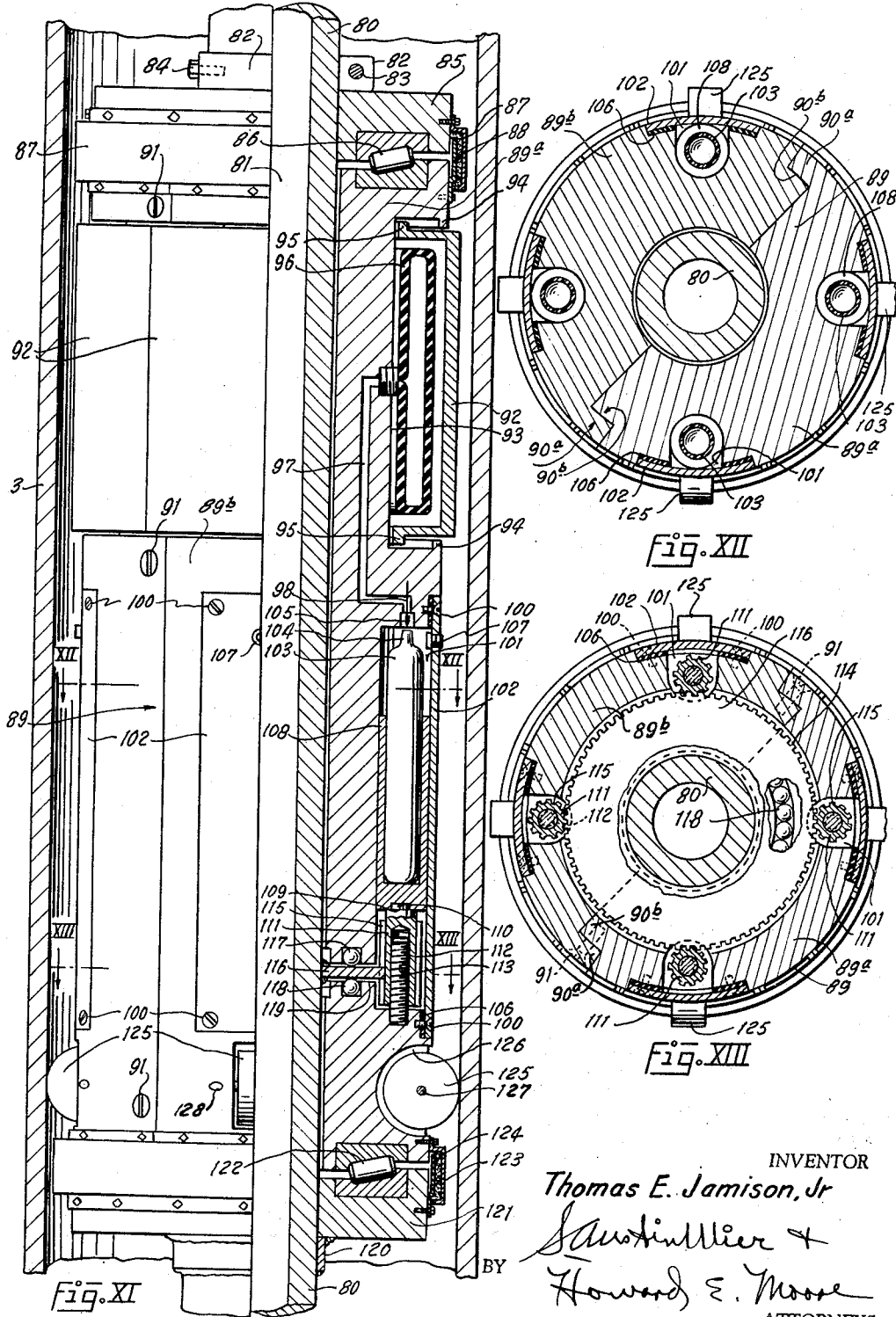
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DRILL STEM SUPPORTER AND STABILIZER

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4 Sheets-Sheet 4



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DRILL STEM SUPPORTER AND STABILIZER

Thomas E. Jamison, Jr., Coleman, Tex., assignor of three and one-half percent to William T. Jones, three and one-half percent to Roy L. Harding, seven percent to Thomas E. Jamison, Sr., seven percent to Mack Sampson, seven percent to Gene Love, and three percent to Charles F. Koehne, Jr.

Application May 10, 1955, Serial No. 507,426

12 Claims. (Cl. 255—28)

This invention is concerned with a device for supporting and stabilizing a drilling string or other pipe in an oil well, and is particularly concerned with a supporter and stabilizer device which may be engaged between the drill stem or other pipe in a well and the well bore or casing by inflating expansible tubes incorporated in the device.

A drilling string used in drilling an oil well into the earth's strata consists of a series of joints of pipe, joined together by suitable couplings. A drill bit is attached to the lower end of the drilling string and the drilling string is rotated by power equipment at the surface as the drill bit bites into the earth's strata.

At the lower end of the drilling string there is usually provided a plurality of so-called "drill collars" which are in reality joints of very heavy, thick-walled, pipe.

As the drill collars and joints of drilling string are added as the hole is deepened, the drilling string becomes increasingly heavier, placing additional weight on the derrick and other surface equipment. Therefore, there is a definite limitation on the depth at which a well bore can be drilled, due to the limitation on the weight which the derrick can support.

Furthermore such weight eventually becomes so great that the drill stem is pulled in two.

Another factor which places a limitation on the depth at which a hole may be drilled is the deviation of the hole from the vertical. As the drilling string is lengthened, it becomes increasingly more flexible and the drill string is caused to wobble, thus causing the bit to cut unevenly, and the hole is drilled crooked and deviates from the vertical. This becomes increasingly more prevalent as the hole is deepened, and many times causes the drill stem to be twisted in two.

Therefore, there is a definite need for a device which will support a part of the weight of the drill stem and at the same time will center the drill stem in the hole, prevent wobbling of the drill stem and cause the hole to be drilled straight and vertical.

It is therefore a primary object of this invention to provide a device attachable to the drilling string and engageable with the well bore or casing which will support part of the weight of the drilling string, while at the same time centering and stabilizing the drill string as it rotates, and is lowered, as drilling progresses.

Another important object of this invention is to provide a drilling string supporter and stabilizer which is attachable to the drilling string at the surface, and after being lowered to a desired depth in the hole, can be engaged with the well bore or the casing by actuation of expansible means incorporated in the device.

Another object of this invention is to provide a drilling string supporter and stabilizer which may be engaged to the drilling string and to the well bore or casing by means of inflatable tubes incorporated as a part of the device, one set of which may be inflated after lowering same into the hole.

A further object of this invention is to provide such a

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supporter and stabilizer device which permits normal circulation of well fluid during the drilling operation.

A still further object of this invention is to provide such a supporter and stabilizer device which may be easily adapted for use as a packer to seal between the drill stem or other pipe and the casing.

A further object of this invention is to provide such a supporter and stabilizer which may be used as an anchor for a pipe in a well against which weight or pressure may be applied for carrying out such operations as cementing, formation testing, core drilling, and logging.

Another object of this invention is to provide a drill stem supporter and stabilizer which may be quickly and easily attached to the drill string and which may be set in position of support in the well after lowering it into the well by simply rotating the drill stem in a clockwise direction, and which may be released by simply rotating the drill stem in a counterclockwise direction.

Another object of this invention is to provide a drill string stabilizer and supporter which permits the drilling of straighter holes, and deeper holes, and which places less strain on the derrick and other surface equipment and on drill stem.

Other and further objects of this invention will become apparent upon reading the detailed specification hereinafter following, and by referring to the drawings annexed hereto.

In the drawings:

Fig. I is a fragmentary side elevational view, partially in cross section, showing the supporter and stabilizer device secured to the drill stem while it is being lowered into a cased well bore.

Fig. II is a view similar to Fig. I, showing the supporter and stabilizer device after it has been anchored to the well casing by inflating the outer inflatable tubes, and pushing the outer shoes into engagement with the well casing.

Fig. III is a fragmentary, partially sectionalized, elevational view of the supporter and stabilizer device attached to a section of the drilling string as it would appear while being lowered into a cased well bore, and prior to inflating the outer inflatable tubes to push the outer shoes into engagement with the well casing.

Fig. IV is a view similar to Fig. III, showing the supporter and stabilizer device after it has been lowered to the desired depth in the cased well bore, and after the outer inflatable tubes have been inflated to push the outer shoes into engagement with the casing.

Fig. V is a cross-sectional plan view taken along the line V—V of Fig. III.

Fig. VI is a cross-sectional plan view taken on the line VI—VI of Fig. IV.

Fig. VII is a fragmentary cross-sectional side elevational view showing a modified form of the supporter and stabilizer device adapted for use as a packer, said view being taken on the line VII—VII of Fig. VIII.

Fig. VIII is a fragmentary cross-sectional plan view taken on the line VIII—VIII of Fig. VII.

Fig. IX is a cross-sectional plan view taken on the line IX—IX of Fig. III.

Fig. X is a cross-sectional elevational view taken on the line X—X of Fig. IX.

Fig. XI is a quarter-sectional elevational view of a modified form of the device attachable to a string of pipe, which form is particularly adapted for use as an anchor for pipe in a well.

Fig. XII is a cross-sectional plan view taken on the line XII—XII of Fig. XI.

Fig. XIII is a cross-sectional plan view taken on the line XIII—XIII of Fig. XI.

Numerical references are employed to designate the various parts shown in the drawings, and like numerals

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designate like parts throughout the various figures of the drawings.

Referring, first, to Figs. I and II, the numeral 1 indicates the earth's strata into which a well bore 2 is being drilled.

A conventional well casing 3 extends into the well bore, such casing being customarily set as the well is drilled.

A section of drill pipe 4 extends into the cased well bore from the earth's surface (not shown) and is usually made up of a plurality of sections of pipe joined together by suitable couplings. The drill pipe 4 is attached to a smaller diameter drill collar 9 by means of a conventional tool joint 5, which is used to connect a small diameter and a large diameter pipe.

The tool joint 5 is made up of a pin end 6 having a male threaded portion (not shown) extending therefrom which is threadedly engaged to female threads (not shown) in box end 7 of the tool joint. The pin end 6 is secured to the section of drill pipe 4 and the box end 7 is secured to the drill collar 9 as by welding.

A flat lower shoulder 8 is provided on the pin end 7 of tool joint 5 for the purpose which will be hereinafter indicated.

The drill collar section 9 may actually be comprised of several joints of thick-walled pipe. A small diameter drill collar is preferably used with the stabilizer and supporter device, hereinafter described, because it provides a larger annular space between the drill collar and the casing or well bore to permit sufficient expansion of the inflatable tubes within the device to form a firm grip between the shoes operated thereby and the drill pipe and the wall of the well bore or casing. Better circulation about the device is also provided.

The drill stem supporter and stabilizer device is indicated generally at 10, and is shown in Fig. I as it would appear after it has been engaged with the drill collar section 9, and while the device is being lowered into the well, before the outer shoes have been expanded into contact with the casing or well bore.

It will be noted that while the supporter and stabilizer device 10 is being lowered into the well, the resilient rollers 53 roll along the inner side of the well casing, which serves to center the device and also permits sufficient frictional engagement with the well casing to hold the outer housing against rotation when the drill stem is rotated to set the device, in the manner which will be hereinafter described.

The drill collar section 9 is secured to the section of drill pipe 14 extending therebelow by means of a conventional tool joint 11, which is made up of a pin end 12, attached to the drill collar section 9, and the box end 13, which is attached to the section of drill pipe 14. The pin end 12 and box end 13 are threadedly engaged in the same manner which has already been described with reference to the tool joint 5.

The drill pipe 14 may be made up of one or more joints of drill pipe, or drill collars, joined together by suitable couplings, and may have attached to its lower end a drill bit (not shown).

In Fig. II the stabilizer and supporter device 10 is shown after it has been lowered to the desired level in the hole and the outer shoes have been expanded into engagement with the well casing 3 in the manner which will be hereinafter described. The device is then in position to support a part of the weight of the drill stem as it is rotated in carrying out the drilling operation. It also centers the drill stem in the casing and prevents it from wobbling and deviating from the vertical, and thereby provides for the drilling of a straighter hole.

It will be understood that the supporter and stabilizer device 10 can be used in an uncased hole, the outer shoes being engageable with the wall of the open hole. The use in connection with casing 3 is merely illustrative.

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Referring now to Fig. III, the stabilizing and supporting device is shown after it has been engaged with the drill collar section 9, and is being lowered into the casing. The resilient rollers 53 are rolling along the inner side of the casing and the outer shoes 29 have not been expanded into engagement with the casing 3.

The stabilizing and supporting device 10 generally comprises an inner housing 18 and an outer housing 19, the said housings 18 and 19 being rotatable with respect to each other on the upper bearing 20 and lower bearing 21, interposed therebetween. The inner housing 18 has a plurality of tube-retaining recesses 22 formed about the inner side thereof. In each of the recesses 22 is disposed a balloon-like inflatable tube 23 which is preferably made of rubber or other like elastic material. The interior of each tube 23 communicates with a filling passage 24 provided in the body of the inner housing 18. Each filling passage 24 communicates with a conventional filler valve 25 which is preferably of the back-flow check type. The valve stem 26 is preferably spring-loaded and controls the opening of the valve 25 and when said valve stem 26 is pressed downward, the valve is opened and compressed air, carbon dioxide or other suitable pressure fluid may be admitted through the valve 26 and through the passage 24 to the interior of the tube 23. The tubes 23 may be thus inflated with pressure fluid and expanded. The tubes 23 are inflated at the earth's surface by connecting a source of supply of compressed air or other gas to the filler valve 25. The compressed air or gas may be supplied from a conventional storage cylinder or air compressor. The tubes 23 may also be deflated by pressing down upon the valve stem 26, to open the valve 25 to allow the escape of pressure fluid from the interior of the tubes 23. The back flow check valves 25 retain pressure fluid in the tubes 23 until the valve stems 26 are pressed downward against the springs therein to open valves 25.

A substantially C-shaped inner shoe 27 is disposed in each of the recesses 22. The shoes 27 may be secured in retracted position in the recesses 22 by means of shear pins 28. When the tubes 23 are inflated, in the manner hereinbefore described, the shoes 27 are pushed outwardly of the housing 18 against the drill collar section 9, or other pipe with which the device is engaged, breaking the shear pins 28, and the shoes 27 tightly engage the drill collar 9 in the position shown in Fig. III.

A plurality of substantially rectangular cavities 32 are formed about the outer side of the outer housing 19. An outer shoe 29 is slidably disposed in each of the cavities 32. Each of the shoes 29 has outwardly extending lips 30 at the upper and lower sides thereof which are engageable with an inwardly extending ledge 31 at the outer edge of the cavity 32 to limit the outward movement of the shoes 29 to prevent them from becoming displaced from the cavities before the device is placed in a well pipe such as the casing 3. Each of the shoes 29 has an extending skirt 35 thereon, at one edge thereof, which overlaps the adjacent shoe, thus causing the shoes to entirely encircle the outer housing 19.

There is disposed in each of the cavities 32, behind each of the shoes 29, an inflatable balloon-like tube 33, preferably made of rubber or other elastic material. The interior of each of the inflatable tubes 33 communicates with a flow passage 34 extending through the housing 19, there being one of said passages 34 communicating with each of the inflatable tubes 33. Each passage 34 is closed at its upper end by a conventional spring loaded back flow check valve 51, which is threadedly engaged in the upper face of the outer housing 19. The opening of back flow check valve 51 is controlled by a spring-urged stem 52 extending thereabove. Such valves 51 prevent escape of pressure fluid from tubes 33 until valve stems 52 are pressed downward.

A plurality of cylinders 36, which are charged with compressed air, carbon dioxide or other suitable fluid under pressure are detachably mounted inside the housing

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19. Each cylinder 36 is carried in a cylindrical case 38 which is threadedly engaged in a circular recess 39 formed on the lower side of the slidable plate 37.

A plurality of tapered passages 40 extend through the plate 37, and a neck 41 of each of the cylinders 36 extends through one of the tapered passages 40.

An enlarged pocket 42 is arranged in the housing 19 immediately above each of the necks 41. A plurality of piercing pins 43 are secured to the housing and a piercing point of one of the piercing pins extends into each of the pockets 42 in position to contact the upper end of the neck 41 when the cylinder 36 is moved upwardly in the manner which will be hereinafter described.

Each pocket 42 communicates with a passage 34 and with the interior of an inflatable tube 33.

It will be noted, as clearly shown in Fig. IX, that the plate 37 extends entirely around the housing 19, and is freely movable upwardly and downwardly with relation thereto.

A raising nut 44, having threads 47 on the inner side thereof, extends around the outer side of the inner housing 18 and is threadedly engaged to the exterior threads 45 on the outer side of the housing 18.

The annular raising nut 44 extends underneath the inner edge of the plate 37 so that when the raising nut 44 moves upwardly, it will carry with it the plate 37.

An annular, removable ring 46 is threadedly engaged, by companion threads 48, to the outer housing 19. An annular space 50, constituting an escape port, is provided between the inner edge of the ring 46 and the outer side of the inner housing 18. The escape port 50 permits the pressure fluid, when released from the inflatable tubes 33, to escape when the tubes are deflated, in the manner which will be hereinafter described.

A plurality of pairs of nut-holding leaf springs 60 are attached at their outer ends to the inner side of the outer housing 19; and the inner ends 62 of each pair of said springs 60 extend into a slot 61, provided on the outer side of the raising nut 44.

A plurality of alignment pins 57 are spaced about the downwardly facing shoulder 58 on the outer housing 19, said alignment pins being secured at one end to the shoulder and slidably extend into apertures 59 provided in the plate 37. The alignment pins 57, when disposed in the apertures 59, align the necks 41 on the cylinders 36 with the pointed ends of the piercing pins 43, so that the necks 41 will be pressed against the piercing pins 43 to puncture the cylinders 36 when the cylinders are raised into engagement with the piercing pins in the manner hereinafter explained.

A plurality of resilient rollers 53 are spaced about the outer housing 19, said resilient rollers being rotatably disposed in recesses 54 provided about the housing 19. The rollers 53 are preferably made of relatively soft rubber-like material and each has an axle 55 thereon which is rotatably supported in the holes 65 provided in the housing 19 on opposite sides of the recesses 54. The rollers are arranged to press against the casing 3 as the supporting and stabilizing device 10 is lowered into the casing and rolled therealong as they frictionally engage the casing.

After the inner shoes 27 have been frictionally secured to the drill collar section 9 by inflating the inner tubes 23, in the manner hereinbefore described, and the device is lowered into the hole on the drill stem to the desired depth where the supporter and stabilizer device is to be set, the drill stem may be rotated in a clockwise direction a few revolutions to move the cylinders 36 upwardly in the following manner:

The resilient rollers 53 will frictionally engage the inner wall of the casing 3 sufficiently to hold the housing 19 against rotation. Therefore, since the inner housing 18, is frictionally engaged with the drill collar section 9 by the shoes 27, pressing thereagainst, the inner housing 75

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will rotate with the drill stem on the bearings 20 and 21. The raising nut 44 is held against rotation by the springs 60. Therefore, the rotation of the inner housing 18 with relation to the raising nut 44 will cause the raising nut 44 to move upwardly on the threads 45 with relation to the inner housing 18. The raising nut 44 carries with it the plate 37 which in turn carries with it the cylinders 36. The necks 41 of cylinders 36 contact the sharp ends of the piercing pins 43, and the piercing pins penetrate the necks 41, and rupture the cylinders 36, allowing the pressure fluid in the cylinders 36 to escape through the passages 34 into the inflatable tubes 33, thereby inflating the tubes 33 and pushing the shoes 29 outwardly against the casing 3, and frictionally engaging them therewith.

The necks 41 are preferably made of soft material, such as lead, so that they are easy to puncture and also when the material is pressed into the cavities 42, it will spread and seal in the said cavities, thus preventing the escape of pressure fluid from the tubes 33. Other means for sealing the cavities 42 could be provided which will be obvious to those skilled in the art. The back flow check valves 51 prevent the escape of pressure fluid through the other ends of passages 34 until the pins 52 are pressed downwardly to open the valves.

The outer housing 19 is thus secured to the casing 3 by tight frictional engagement of the shoes 29 with the inner wall of the casing, and the housing 19 is thereby held against rotation. As the drill stem is rotated, the inner housing 18 will rotate therewith on the bearings 20 and 21, and the outer shoes 29, being in tight frictional engagement with the casing, will support a part of the weight of the drill stem. The drill stem is also perfectly centered in the hole as it rotates.

It will be understood that a plurality of such supporting and stabilizing devices 10 can be placed along the drill stem in order to distribute the weight thereof, and they may be added as the hole is deepened as the needs may require.

This device stabilizes the drill stem and centers it in the hole, as it rotates, thereby permitting the drilling of a straight hole. It actually constitutes one or more stabilizing bearings distributed along the length the drill stem, and they may be set in place at desired levels after being lowered in the hole on the drill stem.

As drilling progresses, the drill stem moves downwardly, while the stabilizing and supporting device 10 remains at a predetermined place. The drill collar section 9 frictionally slides through the shoes 27, as the drill stem moves downwardly.

It may be necessary to deflate the outer tubes 33 and disengage the device from the casing 3 in order that the drill stem may be pulled from the well to replace a worn drill bit or for other purposes. The tubes 33 may be deflated by rotating the drill stem counterclockwise sufficiently to cause the raising nut 44 to move downwardly on the threads 45 to permit the necks 41 to move away from the pockets 42 sufficiently to allow the pressure fluid to escape from the tubes 33, through the passages 34, and thence through the escape port 50. The shoes 29 will then retract sufficiently to allow the drill stem and the supporter and stabilizer device 10 to be withdrawn from the well on the drill stem.

The tubes 33 may also be deflated by permitting the shoulder 8 on the tool joint 5 to come into contact with the pins 52 of the check valves 51, thereby pressing the pins 52 downwardly, opening the check valves 51 and permitting the pressure fluid to escape from the tubes 33 through the upper ends of the passages 34.

Suitable conventional mud seals 64 are provided on the upper face of the supporter and stabilizer device 10 to protect the bearing and race 20 from mud and trash in the well.

A circular resilient seal 56 is provided between the

inner and outer housings 18 and 19, respectively to protect the bearing and race 21 against mud and trash which might otherwise enter same.

It will be noted in Fig. VI that when the outer shoes 29 are moved into engagement with the casing 3, flow passages 68 are provided between the outer housing 19 and the skirts 35 on said shoes 29. These flow passages permit circulation of drilling fluid through the annulus between the casing and the drill stem during drilling.

This device may be easily adapted for use as a packer to seal the space between two concentric pipes in a well, as illustrated in Figs. VII and VIII. This may be done by attaching a plate 69, preferably made of rubber or other resilient material, to the lower side of each of the skirts 35 on the shoes 29 by means of screws 70, so as to span and close the passages 68 when the shoes 29 are expanded. The plates 69 are arranged to engage the lips 30 on the shoes 29 on their inner edges and are supported on the ledges 31 at the lower edge of the cavities 32. It is preferable when using this device as a packer, in the modified form shown in Figs. VII and VIII, that the outer sides of the shoes 29 be covered with a layer of rubber or other resilient material 72 of sufficient thickness and shape to press between, and seal, the annular area between the shoes 29 and the casing 3. This rubber coating 72 may be detachably secured to the shoes by means of screws (not shown), or it may be molded thereto, as shown.

The ring 46 may be removed for the purpose of replacing used cylinders 36. The removal of the ring 46 permits access to the cylinder support cartridges 38. The cartridges 38 may be unscrewed from the plate 37, and the cylinders removed therefrom. New, charged cylinders can then be inserted in the support cartridges 38, which may be then, again, threadedly engaged with the plate 37, in the position shown in Fig. III. The support and stabilizer device 19 is then ready for attachment to a drill stem and re-used to support and stabilize the drill stem in the manner hereinbefore described.

A modified form of the device is shown in Figs. XI-XIII. In such modified form only outside expansible tubes are employed, being carried by a housing, which housing is rotatable with respect to the drill stem or other pipe on which it is carried.

This modified form is particularly useful to serve as a support and base for a drill stem or other pipe extending into a well during such operations as cementing, hydraulic fracturing, formation testing, core drilling, logging, and other like operations, where it is not necessary that the drill stem or other pipe on which it is mounted move downwardly with respect to the anchoring device. This modified device could replace such well-known devices as slips and locking units which usually must be set by vertical movement of the pipe on which they are mounted. This device may be set by simply rotating the drill stem or other pipe a few turns in a clockwise direction and may be disengaged by rotating the pipe a few turns in a counterclockwise direction. The simplicity and ease of setting is a matter of importance in this device.

The numeral 80 indicates a tubular mandrel which may be incorporated in a drilling string or other pipe extending into the well by means of suitable couplings (not shown). The ring-like bearing retainer block 85 is passed over the mandrel 80 and is held in place by means of a divided attachment C clamp 82, which may be passed over the mandrel 80, to embrace same. The free ends of the attachment clamp 82 are secured together by means of a bolt 83, and drawn securely together. The attachment ring 82 is secured to the mandrel 80, against rotation, by means of a threaded machine bolt 84 which extends through the ring 82 and into the mandrel 80. The clamp 82 is pressed firmly against bearing block 85, thus pressing the bearing block securely against the bearing and race 86. Such removable

attaching arrangement is provided so that the ring 82 and bearing retainer block 85 may be removed to permit the bearing 86 to be serviced or replaced.

The bifurcated central housing 89 is made in two separable halves 89a and 89b. The halves 89a and 89b of the housing 89 have overlapping side portions 90a and 90b, and the screws 91 pass through the overlapping portions of the housing and thus secure the halves of the housing together. The housing 89 is rotatably supported on the bearings 86 and 122. The separable halves 89a and 89b of housing 89 permits the housing to be assembled on, and removed from, mandrel 80, with the gear 116 rotatably extending in the annular groove 119 arranged about the inner side of the housing.

The bearing 86 is protected by a mud seal comprised of a removable outer seal member 87 and a removable inner seal member 88, which protect the bearing against entry of well mud and trash.

A plurality of recesses 93 are formed about the outer side of the housing 89.

Mounted in each of the recesses 93 is an inflatable tube 96 preferably made of elastic material such as rubber. In each of said recesses is a slidably disposed shoe 92 which is the same in construction as the shoes 29, hereinafter described. Each shoe 92 is arranged to be pushed outwardly by the tube 96 when the tube 96 is inflated. Each shoe 92 has an annular flange 95 thereon which is engageable with an overhanging lip 94 arranged about the outer edge of each recess 93 to limit outward movement of the shoe with respect to the housing 89.

A plurality of passages 97 are arranged in the housing 89, each passage 97 being in communication with the interior of an inflatable tube 96.

A piercing pin 98 is attached in the lower end of each passage 97 and the sharp penetrating end thereof extends into an enlarged socket 105 at the outer end of each passage 105.

A plurality of cylinder chambers 101 are formed about the housing 89, each cylinder chamber being closed by a cover plate 102, said cover plates being attached to the housing 89 by means of screws 100. A seal of resilient material is arranged between the outer edge of each cover plate 102 and the housing to prevent the entry of mud and other foreign material into the cylinder chambers.

A cylinder 103, charged with compressed air, carbon dioxide, or other fluid under pressure, is disposed in each cylinder chamber 101. Each cylinder 103 is removably carried in a cylindrical support cartridge 108, which cartridges being removable from the chambers 101.

Each cylinder 103 has a neck 104 thereon, which is preferably made of lead or other soft material, so that when the necks are forced into the sockets 105, they spread and seal in the sockets and thereby seal the passages 97 against the escape of pressure fluid, which such pressure fluid is released from the cylinders 103 to inflate the tubes 96 by rupturing the cylinders.

A hole 109 is formed concentrically of the bottom of each cylinder support 108, and an alignment pin 110 slidably fits in each such hole 109. Each alignment pin 110 is preferably an integral part of a cylinder raising sleeve 111. There is a cylinder raising sleeve 111 in each chamber 101, and each sleeve 111 is threaded on the inner side, as indicated at 113. The exteriorly threaded shafts 112 are secured at their lower ends to the housing 89 and one extends upwardly into each chamber 101. Each shaft 112 is threadedly engaged with the threads 113 on the inner side of a sleeve 111. A plurality of gear teeth 115 are spaced about the outer side of each sleeve 111, which gear teeth 115 intermesh with the teeth 114 on the raising and lowering gear 116.

The gear 116 is secured to the mandrel 80, as by welding, and rotates upon the upper bearings 117 and the lower bearings 118, which are interposed between the gear 116 and the housing 89. The gear 116 is ro-

tatably disposed in an annular groove 119 which extends about the inner side of the housing 89 and intersects the cylinder chambers 101 so that the teeth on the gear 116 extend into each cylinder chamber 111 in position to intermesh with the teeth 115 on the sleeve 111.

A bearing block support sleeve 120 is secured, as by welding, to the mandrel 80, and the bearing block 121 is secured to said ring and to the said sleeve 120 and to the mandrel 80. The lower bearing 122 is supported between the bearing block 121 and the housing 89. Therefore, the mandrel 80 is rotatable on the bearings 86 and 122 with respect to the housing 89.

The bearing 122 is protected against mud and other debris in the well by means of complementary removable mud seals 123 and 124 attached to the housing.

A plurality of resilient rollers 125, preferably made of relatively soft rubber material, are spaced about the housing 89. Each roller 125 is rotatably supported in a recess 126 in the housing 89, on a shaft 127 which rotatably extends into diametrically spaced holes in the housing 89 at each side of each recess 126.

The operation of the modified form described above is as follows:

The support device is secured to the mandrel 80 in the manner described, and the mandrel is incorporated in a string of pipe and run into the well to the desired depth where it is to be set to support or stabilize the pipe. Of course, a plurality of such devices may be incorporated in a single string of pipe, as conditions may require.

After the device has reached the level at which it is to be set, the string of pipe on which it is mounted is rotated clockwise. The rollers 125 are in frictional engagement with the casing 3 and hold the housing 89 against rotation sufficiently to allow the gear 116 to rotate the sleeves 111, thereby causing the sleeves 111 to rise on the threaded shafts 112. This pushes the cylinder support cartridges 108 upwardly in the chamber 101, thus pushing the necks 104 of the cylinders 103 against the pointed ends of piercing pins 98, thereby puncturing the cylinders 103 and allowing the pressure fluid therein to escape through the passages 97 and inflate the tubes 96. The inflation of the tubes 96 pushes the shoes 92 outwardly into tight frictional engagement with the wall of the casing or well bore in which the device is disposed, thereby forming a support for the pipe string into which the device is mounted.

It may be desirable to place teeth (not shown) on the outer sides of the shoes 92 to form a more secure grip with the casing or well bore. This may also be true of the shoes 29, shown in the preferred form.

The shoes 92 are the same in construction as the shoes 29 in the preferred form and have overlapping portions similar to those shown at 35 thereon which, when expanded, permit the circulation of fluid therebetween.

Of course, this modified device could be adapted for use as a packer by merely providing plates, such as shown at 69, attached to the lower edges of the shoes 92 in the same manner illustrated in Figs. VII and VIII.

When it is desired to disengage the device, shown in the modified form, from the casing or well bore, the string of pipe to which it is attached may be rotated counterclockwise, thereby causing the gear 116 to turn the sleeves 111 in reverse direction, causing the sleeves 111 to move downwardly on the shafts 112, thereby permitting the cylinders 103 to move downwardly and to break the seals formed by the necks 104 in the sockets 105. This permits the escape of pressure fluid from the tubes 96 through passages 97 into chambers 101. The pressure fluid may escape from the chamber 101 through an outwardly opening check valve 107 of conventional construction. The shoes 92 are thus permitted to slide inwardly and become disengaged from the casing 3 (or

well bore) and the string of pipe to which the device is attached may be withdrawn from the well.

Newly charged cylinders 103 may be placed in the device simply by removing the screws 100 and the cover plates 102, permitting the removal of the cylinder support cartridges 108. Newly charged cylinders 103 may then be inserted in the cartridges 108 and the cartridges 108 and cylinders 103 may then be placed back into the chambers 101 and the cover plates 102 attached. The support and stabilizer device is then ready for re-use.

It will be apparent that other and further forms and modifications of my device may be made, without departing from the spirit and scope of the appended claims.

I claim:

1. In a supporter and stabilizer device for a well pipe extending into a well, a housing arranged to be rotatably carried by a well pipe; bearing means mountable between the housing and the well pipe on which the well pipe may rotate relative to the housing; a plurality of shoes carried by said housing and arranged to move outwardly thereof; inflatable means carried by said housing behind each of said shoes arranged to push the shoes outwardly into engagement with a surrounding surface when expanded.

2. In a supporter and stabilizer device for a well pipe extending into a well, a housing arranged to be rotatably carried by a well pipe; bearing means mountable between the housing and the well pipe on which the well pipe may rotate relative to the housing; a plurality of shoes carried by said housing and arranged to move outwardly therefrom; inflatable means carried by said housing behind each of said shoes and arranged to push the shoes outwardly into engagement with a surrounding surface when expanded; and means carried within the housing to expand the inflatable means.

3. In a supporter and stabilizer device for a well pipe extending into a well, a housing having a central passage therethrough and arranged to be rotatably carried about a well pipe; bearing means mountable between the housing and the well pipe on which the well pipe may rotate relative to the housing; a plurality of shoes carried by said housing and arranged to move outwardly thereof; inflatable means carried by said housing behind each of said shoes and arranged to push the shoes outwardly into engagement with a surrounding surface when expanded; means carried within the housing to expand the inflatable means, said means including cylinders charged with fluid under pressure, the said cylinders being arranged about the central passage and being arranged to communicate with the inflatable means; and means carried by the housing to rupture the said cylinders to thereby release the fluid under pressure into the inflatable means to expand same.

4. In a device of the class described, an inner housing and an outer housing rotatable with respect to each other; bearing means rotatably attaching the inner housing and outer housing; means for securing the inner housing to a well pipe; a plurality of shoes carried by the outer housing and arranged to move outwardly thereof into engagement with a surrounding surface; inflatable means carried by the outer housing and disposed behind each of the shoes, arranged to push the shoes outwardly when expanded; and means to expand the inflatable means.

5. In a device of the class described, an inner housing and an outer housing rotatable with respect to each other; bearing means rotatably attaching the inner housing and outer housing; means for securing the inner housing to a well pipe; a plurality of shoes carried by the outer housing and arranged to move outwardly into engagement with a surrounding surface; inflatable means carried by the outer housing and disposed behind each of the shoes, arranged to push the shoes outwardly when expanded; means carried by the outer housing to expand the inflatable means, said means including cylinders charged with fluid under pressure, said cylinders being arranged

to communicate with the expansible means; and means carried by the outer housing to rupture the cylinders to allow the escape of the fluid under pressure into the inflatable means to expand same.

6. In a device of the class described, an inner housing and an outer housing rotatable with respect to each other; bearing means rotatably attaching the inner housing and outer housing; a plurality of shoes spaced about the inner side of the inner housing, arranged to move inwardly thereof; expansible means carried by the inner housing and arranged behind each of the said shoes to push the said shoes inwardly of the housing when expanded; a plurality of shoes carried about the outer side of the outer housing, arranged to move outwardly thereof; expansible means carried by the outer housing and arranged behind each of said outer shoes to push the shoes outwardly when expanded; and means to expand each of said expansible means.

7. In a device of the class described, an inner housing and an outer housing rotatable with respect to each other; bearing means rotatably attaching the inner housing and outer housing; a plurality of shoes spaced about the inner side of the inner housing, arranged to move inwardly thereof; expansible means carried by the inner housing and arranged behind each of the said shoes to push the said shoes inwardly when expanded; means to inflate the expansible means in the inner housing; a plurality of shoes carried about the outer side of the outer housing, arranged to move outwardly thereof; expansible means carried by the outer housing behind each of said outer shoes and arranged to push the shoes outwardly when expanded; means to inflate said expansible means in the outer housing, said means including a plurality of cylinders charged with fluid under pressure carried by the outer housing and arranged to communicate with the expansible means therein; and means carried by the outer housing to puncture said cylinders and allow the escape of fluid under pressure therefrom into the expansible means in the outer housing.

8. In a device of the class described, an inner housing and an outer housing rotatable with respect to each other; bearing means rotatably attaching the inner housing and the outer housing; a plurality of shoes spaced about the inner side of the inner housing arranged to move inwardly thereof; expansible means carried by the inner housing and arranged behind each of the said shoes to push the said shoes inwardly when expanded; means to expand the expansible means in the inner housing; a plurality of shoes carried about the outer side of the outer housing, arranged to move outwardly thereof; expansible means carried by the housing behind each of said outer shoes and arranged to push the shoes outwardly when expanded; means to inflate the expansible means in the outer housing, said means including a plurality of cylinders charged with fluid under pressure arranged to communicate with the expansible means in the outer housing; means carried by the outer housing to puncture said cylinders and allow the escape of pressure fluid therefrom into the expansible means in the outer housing; and means to deflate the expansible means in the outer housing to allow the outer shoes to retract.

9. Claim 1 wherein the shoes having overlapping edges and are spaced from each other when extended to form flow channels therebetween.

10. In a stabilizing and supporting device for a well pipe, said device being arranged to be rotatably connected to the well pipe; a housing having a longitudinal passage therethrough arranged to receive a well pipe; bearing means mountable between the housing and the well pipe to rotatably support the housing on the well pipe; a plurality of shoes spaced about the housing and arranged to move outwardly thereof; an expansible tube carried by the housing and arranged behind each of the shoes in position to push the shoes outwardly when expanded; a plurality of cylinders charged with fluid under pressure carried in the housing externally of the longitudinal passage and arranged to communicate with the tubes; a plurality of piercing pins carried by the housing, one being in position to rupture each of the cylinders when moved thereagainst; and means to move the cylinders into engagement with the piercing pins.

11. In a stabilizing and supporting device for a well pipe, an inner housing and an outer housing rotatable with respect to each other; bearing means rotatably attaching the inner housing to the outer housing; extensible shoes carried by the inner and outer housings, respectively; inflatable expansible tubes incorporated in each said housing arranged to extend the shoes from the respective housings when inflated; means to inflate the tubes in the inner housing from the exterior thereof and means carried within the outer housing to inflate the tubes therein.

12. In a supporter and stabilizer device for a well pipe extending into a well, a housing arranged to be rotatably carried by a well pipe; bearing means mountable between the housing and the well pipe for rotatively attaching the housing to the well pipe; a plurality of shoes carried by said housing and arranged to move outwardly thereof, the said shoes having overlapping edges and being spaced from each other when extended to form spaces therebetween; inflatable means carried by said housing behind each of said shoes arranged to push the shoes outwardly into engagement with a surrounding surface when expanded; plates attached to the lower side of each of the shoes in position to close the spaces therebetween when extended; and the outer sides of the shoes being covered with resilient material to thereby form a seal to close the annular space between two concentric pipes in a well.

References Cited in the file of this patent

UNITED STATES PATENTS

50	1,721,004	Debose	July 16, 1929
	1,864,274	Santiago	June 21, 1932
	1,921,522	Hamer	Aug. 8, 1933
	1,957,795	Mulert	May 8, 1934
	2,194,331	Strom	Mar. 19, 1940
55	2,326,404	Spangler	Aug. 10, 1943
	2,368,399	Baker	Jan. 30, 1945
	2,370,832	Baker	Mar. 6, 1945

FOREIGN PATENTS

60	2,636	Austria	July 15, 1900
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