

Aug. 9, 1955

G. A. BOUVIER

2,714,931

REMOVABLE BRIDGING PLUG

Filed Aug. 8, 1951

2 Sheets-Sheet 1

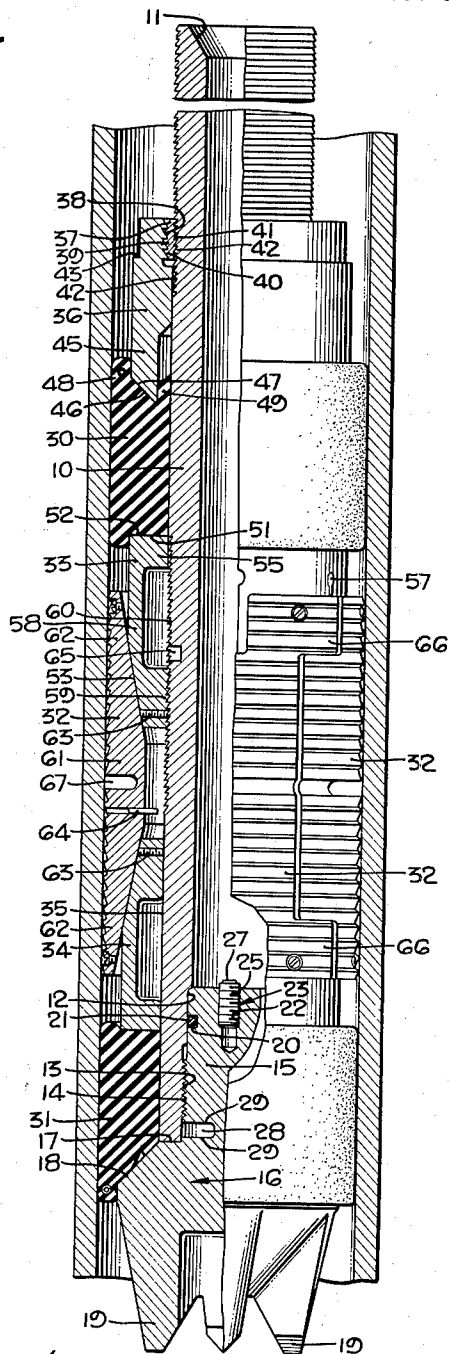
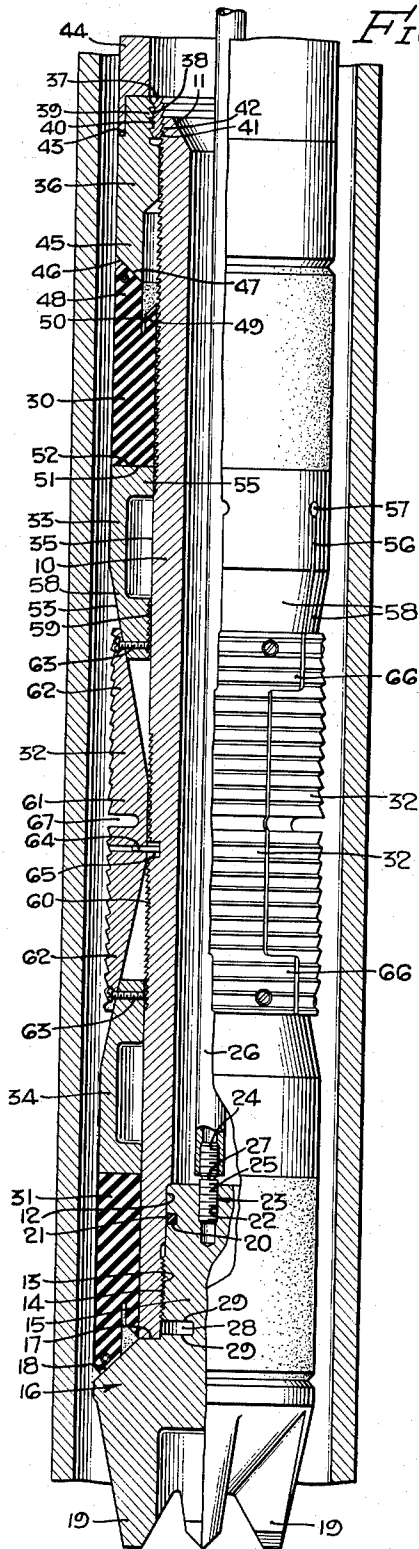


FIG. 2.

INVENTOR.
GEORGE A. BOUVIER

BY

Lyle Lillon

ATTORNEY

Aug. 9, 1955

G. A. BOUVIER
REMOVABLE BRIDGING PLUG

2,714,931

Filed Aug. 8, 1951

2 Sheets-Sheet 2

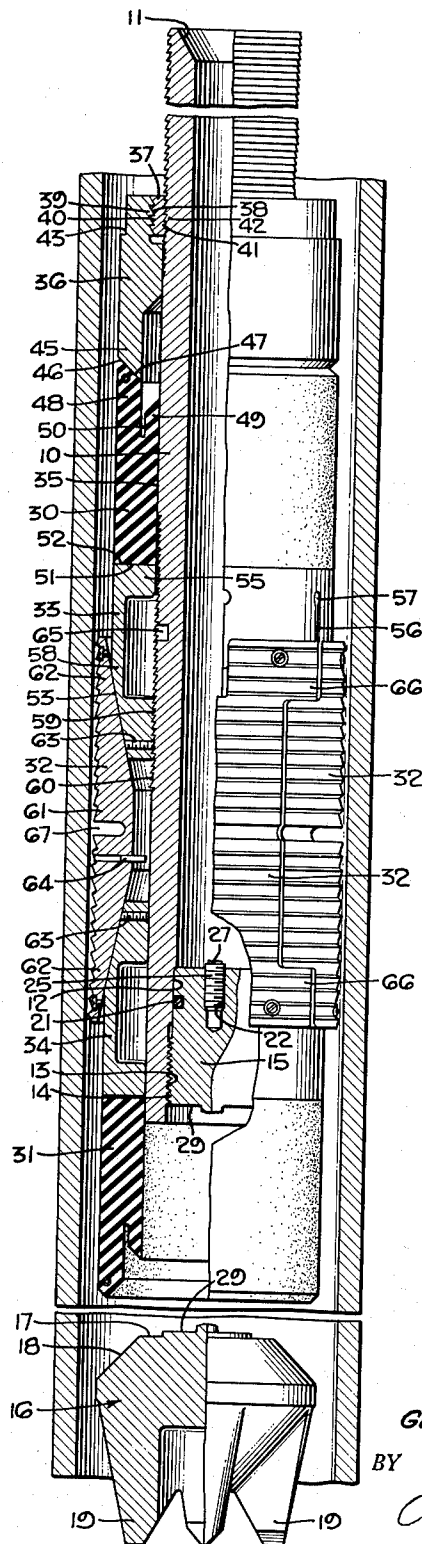


FIG. 3.

INVENTOR.
GEORGE A. BOUVIER

BY

^Y
Lyle Willow

ATTORNEY

2,714,931

REMOVABLE BRIDGING PLUG

George A. Bouvier, Sierra Madre, Calif., assignor to Lane-Wells Company, Los Angeles, Calif., a corporation of Delaware

Application August 8, 1951, Serial No. 240,847

14 Claims. (Cl. 166—119)

This invention relates to bridging plugs for packing well boreholes and casings, and is more particularly concerned with removable bridging plugs which may be disengaged from the well bore or casing and withdrawn when it is desired to terminate the bridging function.

Bridging plugs, as commonly employed, comprise packing devices which are lowered to the desired location in the well and there set or expanded to seal such location against the passage of well fluid. Since such plugs are frequently used only as a temporary expedient for test purposes and for plugging the well bore or casing during squeeze-cementing and the like operations, their construction and the materials used in their manufacture are frequently such that subsequent drilling operations may readily destroy the plug and restore the free flow of well fluid. Obviously, the destruction of the plug by such drilling operations is costly and time-consuming. Furthermore, sacrifice in strength and durability is called for in order to facilitate the subsequent destructive drilling. Another undesirable factor in the use of such "drillable" bridging plugs is the fact that, in such subsequent drilling, plug fragments may remain at the original location of the plug or fall therebelow to complicate subsequent operations, while other fragments and drill chips may be entrained in the well fluid to damage valves, pumps, and like equipment.

It is accordingly an object of the present invention to provide a bridging plug in which many of the undesirable and limiting features, heretofore prevalent in bridging plugs and like packer apparatus, have been eliminated. More specifically, it is an object of the present invention to provide a bridging plug the packing function of which may be terminated without necessitating a drilling operation and without the subsequent cost and time consumption thereof.

A further object is to provide a removable bridging plug, the parts of which may be readily withdrawn from the well bore or casing when the packing function is terminated, without leaving residual fragments or contaminating the well fluid by drill chips.

Another object is to provide a removable bridging plug having a readily fracturable element constituting one of the uniting parts of the assembly, fracture of which may be induced by application of predetermined stress by a manipulating mechanism, whereby the parts may disassemble and relax their engagement to be conveniently removed from the well bore or casing.

Other objects of the invention are to provide a novel, simple, efficient, and effective bridging plug well designed to meet the demands of economic manufacture, and one in which the materials used and the construction adopted may be such as to withstand shocks, forces, and abrasive action comparable to those of a drilling operation, as distinct from drillable plugs which must be destructible by such action.

These and other objects, advantages, and features of novelty will be evident hereinafter.

In the drawings, which show by way of illustration a

preferred embodiment of the invention, and in which like reference characters designate the same parts throughout the several views:

Figure 1 is a vertical elevation, partly in longitudinal section, of the plug of the present invention assembled in position to be lowered into the well bore or casing for subsequent setting;

Figure 2 is a view similar to Figure 1, showing the plug as it appears in set position within a well casing; and

Figure 3 illustrates the plug after being released from set position, ready to be removed from the well.

In considering the present invention as exemplified by the present specification and accompanying drawings, it will be understood that the inventive concept hereof, as outlined by the appended claims, is in no way limited to the structural details herein set forth. Thus, the invention may be practiced in a wide variety of combinations with component parts wholly dissimilar from those here presented. Changes, modifications, and the full use of equivalents are therefore contemplated in the practice of the invention.

The invention here claimed relates particularly to the retrievability of the bridging plug and to the achievement of such retrievability by the use of a fracturable part to which a fracturing force may be applied by a retracting tool so as to avoid the necessity of destruction of the bridging plug by drilling and the consequent disadvantages adherent thereto. Certain other novel and improved features are herein disclosed in combination with the claimed structure, and with respect thereto reference may be had to the copending application of Archie E. Thompson, filed on even date herewith, Serial No. 240,856, including a similar disclosure but having claims directed to structural features not necessarily combined with the claimed features hereof.

Referring now to the drawings, the present structure comprises a central cylindrical mandrel 10 preferably of uniform, smooth internal diameter. The upper open end of the mandrel 10 is shown as formed with an internal bevel 11. The opposite lower end of the mandrel is provided with a counterbore 12, the intermediate surface of which is threaded as at 13 to engage the intermediate external threads 14 of the upwardly extending shank 15 of a bull nosepiece 16 which closes the lower end of the mandrel 10. Below the shank 15 the nosepiece 16 is formed with an expanded head portion having a mandrel-receiving shoulder 17 at the junction of the shank and a downwardly diverging, frusto-conical packer-engaging surface 18 extending therefrom, together with conventional prongs 19.

Above the threads 14 of the shank 15, there is provided in the external cylindrical wall of the shank a circumferential groove 20, in which is seated an O ring 21 adapted to form a fluid-tight seal between the mandrel and the nosepiece. Centrally of the upper end surface of the shank 15 of the nosepiece 16 a coaxial threaded hole 22 is formed, into which is threadedly secured an actuating stud 23. The stud 23 has upper and lower spaced threaded surfaces 24 and 25, respectively. The lower threads 25 engage the threads of the hole 22 to secure the stud 23 to the upper end of the shank 15, while the upper threads 24 are adapted to be engaged by a central actuating rod 26 of a setting tool (not otherwise shown). Intermediate the threads 24 and 25 of the stud 23, the body thereof is formed with a circumferential groove 27, preferably semicircular in cross section and of such depth with respect to the thickness of the stud as to provide a transverse fracture plane such that, upon the application of sufficient upward pull on the actuating rod 26, the stud 23 will fracture or fail at the groove 27 at a predetermined maximum tension, thereby freeing the actuating rod 26 from the

shank 15 and permitting withdrawal of the setting tool and the upper portion of the stud after the plug is properly set.

Another important feature of the nosepiece 16 is the provision of a peripheral fracture groove 28 adjacent the shoulder 17 and between it and the upper threaded portion 14 of the shank 15. As here shown, the groove 28 is of substantial depth in relation to the diameter of the nosepiece, and to attain such depth is formed with parallel, radially extending side walls 29. While the relation of the depth of the groove 28 to the diameter of the shank of the nosepiece may well vary with the design of the bridging plug and the material used, the present design, with the groove depth approximately two-thirds the radius of the shank, has been found desirable. A lesser groove depth may be employed if weaker materials are used, or in conjunction with hollow nosepieces; conversely, a groove of greater depth would be formed in nosepieces formed of material having a greater tensile strength.

It is important to note that the groove 28 is located at a point between the threaded attachment at 13, 14 of the nosepiece shank 15 with the mandrel 10, and the head of the nosepiece 16 which receives the packing setting thrust at the surface 18. It will thus be seen that the groove 28 provides a transverse fracture or failure section across the nosepiece so as to permit dismemberment and separation of the enlarged lower head member 16 from the shank 15 and from the mandrel 10 upon the application of a predetermined maximum, upwardly directed force through the mandrel, which force is transferred from the head at surface 18 to the packing and plug setting mechanism hereinafter described.

The well bore or casing engagement elements of the bridging plug comprise upper and lower sleeve-shaped resilient packings 30 and 31, respectively, slips 32, and intermediate upper and lower slip-actuating cones 33 and 34, respectively. The packings, slips, and cones are all slidably mounted in interrelated, coaxial alignment on the cylindrical outer surface 35 of the mandrel 10. Such parts are retained in assembled relation upon the mandrel by disposition between the frusto-conical surface 18 of the head of the nosepiece 16 and a packing compression sleeve 36 on the upper end of the mandrel.

The compression sleeve 36 is mounted upon the mandrel to permit relative longitudinal slidable movement thereof along the mandrel toward the nose thereof and to preclude return from such relative movement by means of an internally and externally wickered lock ring 37. The lock ring 37 is seated within an internally wickered counterbore 38 at the upper end of the compression sleeve 36 and is retained within the counterbore 38 by interengagement of internal wickers 39 of the counterbore with the external wickers 40 of the ring 37. As indicated, the lands of the internal wickers 39 of the counterbore 38 are buttress-shaped and face downwardly, while the matching lands of the external wickers 40 of the ring 37 face upwardly so as to provide restraining interengagement therebetween upon relative downward movement of the compression sleeve 36 with respect to the ring 37. The ring 37 is, of course, a split, resilient ring, permitting contraction thereof, whereby it may be received within the counterbore 38. A similar one-way slidable locking engagement between the ring 37 and the mandrel 10 is provided by the buttress-shaped internal wickers 41 formed on the inside surface of the ring and matching external wickers 42 formed on the outer surface of the mandrel 10 at the upper end thereof. The relation of the mandrel wickers 42 to the wickers 40 on the inner surface of the ring 37 is similar to the relation of the sleeve wickers to those on the outer surface of the ring in that the mandrel wickers 42 have buttress-shaped lands facing downwardly to abut upwardly facing, buttress-shaped lands of the internal ring wickers. Thus, there may be relative downward move-

ment of the compression sleeve 36 and ring 37 with respect to the mandrel 10 and relative upward movement of the mandrel 10 through the sleeve 36 and ring 37, but the interengagement of the wickers is such as to preclude opposite relative movement, i. e., upward movement of the sleeve 36 and ring 37 over the mandrel 10 or downward movement of the mandrel 10 through the sleeve and ring. The lock ring 37 is, of course, permanently secured within the sleeve against relative downward movement by abutment of its inner face against the upper face of the shoulder formed by the end of the counterbore. As here indicated, it is preferable that the depth of the wickers between the mandrel and ring be substantially less than that of the wickers between the ring and sleeve counterbore, since no longitudinal sliding movement between ring and sleeve takes place after assembly, while such sliding movement between mandrel and ring is required during setting of the bridging plug. In the form of the invention shown, the mandrel wickers and their companion lock ring wickers are of approximately one-half the depth of the ring and sleeve wickers, and sufficient radial clearance must be provided between the wickers on the outside surface of the lock ring and the wickers on the inside of the counterbore of the sleeve to permit the wickers between the lock ring and the mandrel to ratchet with one another.

The upper end of the compression sleeve 36 is formed with a necked portion 43 of reduced diameter concentric with the internal counterbore 38 and adapted to receive, upon the annular shoulder formed thereby, downward thrust from the tubular body 44 of a setting tool (not otherwise shown). The compression sleeve 36 is further provided with a downwardly extending, cylindrical flange 45 encircling, but spaced from, the outer surface of the mandrel 10. The lower edge of the flange 45 is formed with a downwardly diverging, frusto-conical thrust surface 46 adapted to engage a conforming edge surface 47 formed upon the upwardly extending outer lip 48 of the upper packing sleeve 30. The upper end of the packing sleeve 30 is also provided with an inner lip 49 parallel to the outer lip 48 and spaced therefrom by a short, longitudinally extending, coaxial slot 50. The inner lip 49 is shorter than the outer lip and terminates in an oppositely slanting frusto-conical surface such that any pressure leakage there-to will seal the lip against the outer surface of the mandrel. Below the lips 48 and 49, the upper packing sleeve 30 is formed as a relatively thick-walled tubular body of resilient or yieldable material terminating at its lower end with a flat, transverse, pressure-transmitting surface 51.

While the inner surface of the body of the packing sleeve 30 snugly fits the smooth outer surface of the mandrel 10 below the upper external wickers 42 thereof, it will be understood that the packing sleeve is free to slide longitudinally upon the sleeve prior to expansion thereof under axial pressure from the compression sleeve 36. Upon such sliding movement, pressure is transmitted through the packing sleeve from the compression sleeve 36 to the upper slip cone 33, the upper flat surface 52 of which abuts the lower flat surface 51 of the packing sleeve 30.

The upper slip cone 33 has a substantially cylindrical portion and a downwardly converging, frusto-conical portion 53. An upper bearing for the cone upon the outer surface of the mandrel, with respect to which it may slide, is provided by an inwardly extending annular flange 55. The cone 33 is further formed with longitudinally extending, circumferentially spaced slots 56 terminating at their upper ends in radially directed, circular apertures 57. The slots extend inwardly from the apex ends through the frusto-conical portion 53 of the slip cone 33 to a point adjacent the flange 55, thus dividing the frusto-conical portion into individual fingers 58, each of which is individually flexible. The inner faces of the fingers 58 are provided with upwardly facing, buttress-shaped wickers 59 similar in shape and size to the internal wickers 41 of the lock ring 37. The internal finger wickers 59 are

adapted to engage external wickers 60 formed on the surface of the mandrel 10 intermediate the ends thereof. The wickers 60 are buttress-shaped similar to wickers 42 at the upper end of the mandrel and thus, while relative upward movement of the mandrel 10 with respect to the cone 33 is permitted as the spring-like fingers 58 flex and ratchet over the mandrel wickers 60, opposite relative movement is thereby prevented.

The slips 32 are mounted between the cones 33 and 34 with the outer tapered ends seated upon the cones. Each slip comprises an elongated, externally wickered member formed with a central body section 61 and tapered end 62. The general contour of the outer faces of the slips and the internal face of the central body section thereof are parallel and disposed in planes parallel to the axis of the bridging plug. The inner faces of the tapered ends 62 incline outwardly from the central section with an angle of inclination approximately equal to the angle of inclination of the taper of the cones. In original assembly, as shown in Figure 1, the ends of the slips are temporarily secured to the cones by shear screws 63. As the cones are forced inwardly toward each other in setting the plug, the shear screws are sheared and the slips ride out on the inclined surfaces of the cones to engage the well bore or casing. One or more of the slips 32 are provided with guide pins 64, which are slidably received within apertures 65, extending radially of the mandrel.

Each slip is preferably, although not necessarily, formed with circumferentially offset end portions 66, which overlap and interengage with adjacent slips. The width of each slip and of each offset end 66 is preferably equal to the width of each finger 58 of the upper cone; thus each slip may partake of the individual movement of each such finger. Each slip is further provided with a central exterior groove 67, which grooves 67 together constitute a central circumferential groove to receive a securing band or spring to secure the parts in assembled relation before setting, or to assist in collapsing the slips after setting pressure is relieved. The grooves 67 also constitute weakened area across each slip so as to permit flexure or fracture thereof without loss of grip should the plug be set against a wall surface of such irregularity that the ends of the slips may not otherwise contact and grip the same.

The lower cone 34 is similar to the upper cone 33 except that the slots forming the individual fingers are omitted and the inner face of the tapered end is not wickered for engagement with the mandrel wickers. Thus the mandrel 10 may move freely within the lower cone. By upward movement of the mandrel in the lower cone 34, the lower packing may be compressed to effect the setting thereof.

The lower packing 31 is preferably identical with the upper packing 30 and is mounted in reverse position on the mandrel, its outer lip lying against the outer frusto-conical surface 18 of the nosepiece 16 in similar but reverse relation to that of the contact of surface 46 of packing 30 against the frusto-conical surface 46 of the actuator sleeve 36.

Prior to lowering the bridging plug into the well, the slips, cones, and packings are arranged upon the mandrel 10 in relaxed interrelation, as shown in Figure 1, the actuator sleeve 36 together with the nosepiece 16 retaining the parts in such assembly without longitudinal pressure. A setting tool is applied to the bridging plug by means of the actuating rod 26, as before described, and the whole assembly lowered on the setting tool to the position within the borehole where it is desired it be set. Such setting tools may be of widely varying types and designs with respect to which the present invention is not concerned. A preferred type of setting tool, admirably adapted for lowering and setting the present bridging plug, is that disclosed in the patent to Hart, No. 2,308,004, issued January 12, 1943. Such devices have an external cylindrical body, as indicated at 44, which may be applied in telescoping abutment with the necked portion 43 at the top end of the compression

sleeve 36, together with a central actuating tension rod, such as shown at 26. In operation, the setting of the plug is accomplished by imparting relative downward movement of the outer cylinder 44 to the compression sleeve 36 and opposite relative upward movement of the central rod 26 to the shank 15 and nosepiece 16.

In the setting operation of the present tool, equal and opposite movement of the rod 26 and cylinder 44 causes the nosepiece 16 and the sleeve 36 to move toward one another, thus applying longitudinal pressure to the upper packing by the sleeve 36. Since the packing is free to slide upon the mandrel 10, such pressure is transmitted therethrough to the cone 33, which is thus urged downwardly along the mandrel toward the lower cone 34. As the cones thus move toward each other, the apex ends thereof slide under the slips, forcing them radially outwardly after first shearing the shear screws 63. Such outward radial movement of the slips is terminated by the firm anchoring engagement thereof with the inside surface of the well bore or casing, and thereafter further longitudinal pressure exerted between the nosepiece 16 and actuating sleeve 36 by the setting tool compresses the packings. The packings are thus expanded radially against the inside surface of the well bore or casing to securely pack the same on either side of the anchoring slips 61.

When the bridging plug is fully set, further setting movement is precluded by well bore or casing resistance to outward expansion of the slips and packings, whereupon further setting pressure results in a fracture or failure of the stud 23 at the groove 27. After such fracture, the setting tool may be removed, it being noted that the outer cylinder 44 is detachably coupled to the sleeve 36 and is not secured to the setting tool, and that the actuating rod 26 constitutes the only fixed attachment between the setting tool and bridging plug.

In thus setting the plug, it will be noted that the mandrel 10 has been moved upwardly with respect to the cones 33 and 34, packings 30 and 31, and slips 61, and with respect to the actuating sleeve 36, which is moved equally and oppositely downwardly relative to the upward movement of the nosepiece 16. In such movement, the external wickers 42 of the mandrel have ratcheted through the internal wickers of the lock ring 37 and slip cone fingers 58. In such movement, the ring 37 is retained against upward movement with the mandrel by interengagement of its external wickers 40 with the internal wickers 39 of the counterbore 38, while the upper cone 33 is retained by the upper packing 30 and the engagement of wickers 59 of the slip cone fingers 58 with wickers 60 of the mandrel. Upon release of the actuating rod 26, by fracture of the stud 23 at groove 27, return of the original relation between mandrel and sleeve, or mandrel and upper cone, under influence of the resiliency of the packings, is precluded by interengagement of the mandrel and lock ring wickers and mandrel and slip cone finger wickers. Thus, the plug is firmly and positively retained in set position with the parts in the positions shown in Figure 2.

When it is desired to remove the plug, a retrieving tool is run into the mandrel and there expanded to grip the internal walls of the mandrel, an expanding spear being commonly employed for this purpose. With the mandrel securely gripped by such a tool, upward force is exerted, which force is transmitted to the nosepiece 16 through the shank 15 and through the reduced section thereof formed at the groove 28. Such force is, however, resisted by the firm engagement of the anchoring means and packings with the well bore or casing, and the strains of such force are therefore distributed through the nosepiece. When such forces have acquired a predetermined degree, the nosepiece shank will fracture at its weakest point, namely, at the section bounded by the inner surface of the groove 28, and after such fracture the mandrel with the nosepiece shank 15 thereto

attached may be withdrawn upwardly by the retrieving tool, leaving the head of the nosepiece 16 free to drop down in the casing or well bore. Since the mandrel may always move freely upwardly through the ring 38 and upper cone 33, it will slip out of all of the companion parts of the plug, leaving such parts unsupported by the mandrel and free to drop downwardly to be subsequently withdrawn by suitable means such as a junk basket or other fishing tools. The entire plug is thus simply and easily removed from the well.

Instead of employing a fracture groove 28 as and for the purpose hereinbefore described, other frangible or detachable means may be employed between the nosepiece 16 and the mandrel 10 or between the nosepiece shank 15 and the mandrel, adapted to fail, shear, or otherwise release the nosepiece from attachment to the mandrel upon application of a predetermined upward tension through the mandrel in the manner before described. For example, the threads 13, 14 may be so proportioned as to fail under the predetermined tensile force. If desired, a transverse shear pin may be employed extending diametrically through the shank 15 and the surrounding walls of the mandrel 10.

From the foregoing, it will be seen that the present invention provides a novel, simple, effective, and efficient bridging plug which may be readily set to pack-off a desired well zone, and which may be easily and quickly removed to permit free passage of well fluid, drilling tools, or the like without requiring a drilling operation for the destruction of the parts. It will further be noted that the invention provides for a self-locking of the parts in set position, permitting the simple withdrawal of the setting tool at any time after setting.

As hereinbefore indicated, the invention is not limited to the exact structural features herein disclosed, and the invention may be successfully practiced with numerous changes, modifications, and the full use of equivalents without departing from the spirit or scope of the appended claims.

What is claimed is:

1. A bridging plug comprising: a mandrel; a compression sleeve encircling said mandrel and longitudinally slidable thereon; packing means on said mandrel with one end thereof adjacent said compression sleeve; a nosepiece having a shank portion and a head portion, said shank portion being attached to said mandrel adjacent the end thereof opposite to said compression sleeve, and said head portion being adapted to engage the other end of said packing means and cooperable with said compression sleeve when said compression sleeve and said head member are moved longitudinally toward one another to apply longitudinal compressive force through said packing means on said mandrel; and a fracture groove encircling said nosepiece between said shank portion and said head portion.

2. A bridging plug comprising: a mandrel; a compression sleeve encircling said mandrel and longitudinally slidable thereon; packing means on said mandrel with one end thereof adjacent said compression sleeve; a nosepiece having a shank portion and a head portion, said shank portion being attached to said mandrel adjacent the end thereof opposite to said compression sleeve, and said head portion abutting the lower end of said mandrel and having a portion of increased diameter adapted to engage the other end of said packing means and cooperable with said compression sleeve when said compression sleeve and said head member are moved longitudinally toward one another to apply longitudinal compressive force through said packing means on said mandrel; and a fracture groove encircling said shank portion intermediate the point of attachment thereof to said mandrel and the point of abutment of said head with said end of said mandrel.

3. A bridging plug comprising: a mandrel; a compression sleeve encircling said mandrel and longitudinally

slidable thereon; packing means on said mandrel with one end thereof adjacent said compression sleeve; a nosepiece carried adjacent the end of said mandrel opposite to said compression sleeve; a fractureable attachment means between said nosepiece and said mandrel having a weakened portion adapted to rupture to permit said nosepiece to detach from said mandrel upon application of a predetermined maximum tensile force through said weakened portion between said nosepiece and said mandrel; and a flared head portion on said nosepiece adjacent the other end of the said packing means and cooperable with the said compression sleeve when said compression sleeve and said head are moved longitudinally toward one another, to apply longitudinal compressive force from said mandrel through said attachment means and through said packing means on said mandrel.

4. A bridging plug comprising: a mandrel; a compression sleeve encircling said mandrel and longitudinally slidable thereon; packing means on said mandrel with one end thereof adjacent said compression sleeve; a nosepiece carried adjacent the end of said mandrel opposite to said compression sleeve; a fractureable attachment between said nosepiece and said mandrel having a weakened portion adapted to rupture to permit said nosepiece to detach from said mandrel upon application of a predetermined maximum tensile force through said weakened portion between said nosepiece and said mandrel; and a flared head portion on said nosepiece positioned in abutment with the end of said mandrel and adjacent the other end of the said packing means and cooperable with the said compression sleeve when said companion sleeve and said head are moved longitudinally toward one another, to apply longitudinal compressive force from said mandrel through said attachment and through said packing means on said mandrel.

5. A bridging plug according to claim 4, in which said mandrel is tubular, and having a fractureable stud extending from said nosepiece into said mandrel to make attachment with the tension member of a setting tool, said stud being adapted to fracture at a tensile force less than that at which said fractureable attachment is rupturable.

6. A bridging plug comprising: a hollow cylindrical mandrel; a relatively movable actuator encircling said mandrel; means between said mandrel and said actuator for restraining longitudinal movement of said actuator with respect to said mandrel in one direction; upper and lower packing means mounted on said mandrel, with the upper packing means in contact with said actuator; anchoring slips and slip cones mounted on said mandrel between said packing means; a nosepiece having a shank attached to said mandrel adjacent the end thereof opposite to said actuator; a fractureable stud extending from said shank upwardly in said mandrel to be engaged by an actuating rod, said stud being formed to rupture upon application therethrough of a predetermined tensile force and said nosepiece having a head extending radially from said shank beyond the end of said mandrel to engage the lower end of said lower packing means and cooperable with the said actuator to apply longitudinal setting pressure through said packing means on said mandrel; and a fracture groove of reduced tensile strength encircling said nosepiece between said shank and said head.

7. A nosepiece for a well packer having a tubular mandrel and casing-engaging elements shiftably mounted thereon, comprising: a plug member having a portion adapted to be secured to said mandrel and a radial flange portion adapted to engage at least one of said elements, said portions being joined by an integral neck fractureable upon the application therethrough of a tensile force of predetermined amount.

8. A nosepiece for a well packer having a tubular mandrel and casing-engaging elements shiftably mounted thereon, comprising: a plug member having a portion

adapted to be secured to said mandrel and a flange portion adapted to engage at least one of said elements, said portions being joined by an integral neck fracturable upon the application of a tensile force of predetermined amount therethrough between said portions, and said flange portion extending across and radially outwardly from the lower end of said mandrel.

9. A nosepiece for a well packer having a tubular mandrel and casing-engaging elements shiftably mounted thereon, comprising: a plug member having a shank portion adapted to be secured within and to said mandrel and a flange portion adapted to engage at least one of said elements, said portions being joined by an integral neck fracturable upon the application therethrough of a tensile force of predetermined amount, and said flange portion being adapted to receive and transmit said force to said neck.

10. A nosepiece for a well packer having a tubular mandrel and casing-engaging elements shiftably mounted thereon, comprising: a plug member having a portion adapted to be secured to said mandrel and a radial flange portion adapted to engage at least one of said elements, said portions being joined by an integral neck fracturable upon the application therethrough of a tensile force of predetermined amount, said flange portion extending across and protruding radially outwardly from the lower end of said mandrel and having a frusto-conical surface adapted to abut one end of a packing body.

11. A nosepiece for a well packer having a tubular mandrel and casing-engaging elements shiftably mounted thereon, comprising: a plug member having a shank portion adapted to be secured within and to said mandrel and a portion adapted to engage at least one of said elements, said portions being joined by an integral neck fracturable upon the application therethrough of a tensile force of predetermined amount, said flange portion adapted to receive and transmit said force to said neck, and said shank portion having means to secure thereto a setting tool tension stud.

12. A nosepiece for a well packer having a tubular mandrel and casing-engaging elements shiftably mounted thereon, comprising: a plug member having a shank por-

tion adapted to be secured within and to said mandrel and a portion adapted to engage at least one of said elements, said portions being joined by an integral neck fracturable upon the application therethrough of a tensile force of predetermined amount, said flange portion being adapted to receive and transmit said force to said neck, and said shank portion having threaded bore means to secure thereto a setting tool tension stud.

13. A bridging plug comprising: a mandrel; packing means on said mandrel; a nosepiece carried adjacent one end of said mandrel engageable with one end of said packing means for applying longitudinal compressive force therethrough from said mandrel; and an attachment means between said nosepiece and said mandrel having a weakened portion adapted to fail upon application of a predetermined maximum tensile force therethrough between said nosepiece and said mandrel to permit said nosepiece to detach from said mandrel upon application of said predetermined tensile force.

14. A bridging plug comprising: a mandrel; packing means on said mandrel; a nosepiece carried adjacent one end of said mandrel engageable with one end of said packing means for applying longitudinal compressive force therethrough from said mandrel; and an attachment means between said nosepiece and said mandrel, said attachment means having less strength in tension than said mandrel and being adapted to fail upon application of a predetermined maximum tensile force therethrough between said nosepiece and said mandrel to permit said nosepiece to detach from said mandrel upon application of said predetermined tensile force.

References Cited in the file of this patent

UNITED STATES PATENTS

244,042	Farrar	July 12, 1881
1,814,800	Heeter	July 14, 1931
2,182,196	Brown	Dec. 5, 1939
2,345,872	Hart	Apr. 4, 1944
2,345,873	Hart	Apr. 4, 1944
2,352,744	Stoddard	July 4, 1944
2,637,402	Baker et al.	May 5 1953