

April 22, 1952

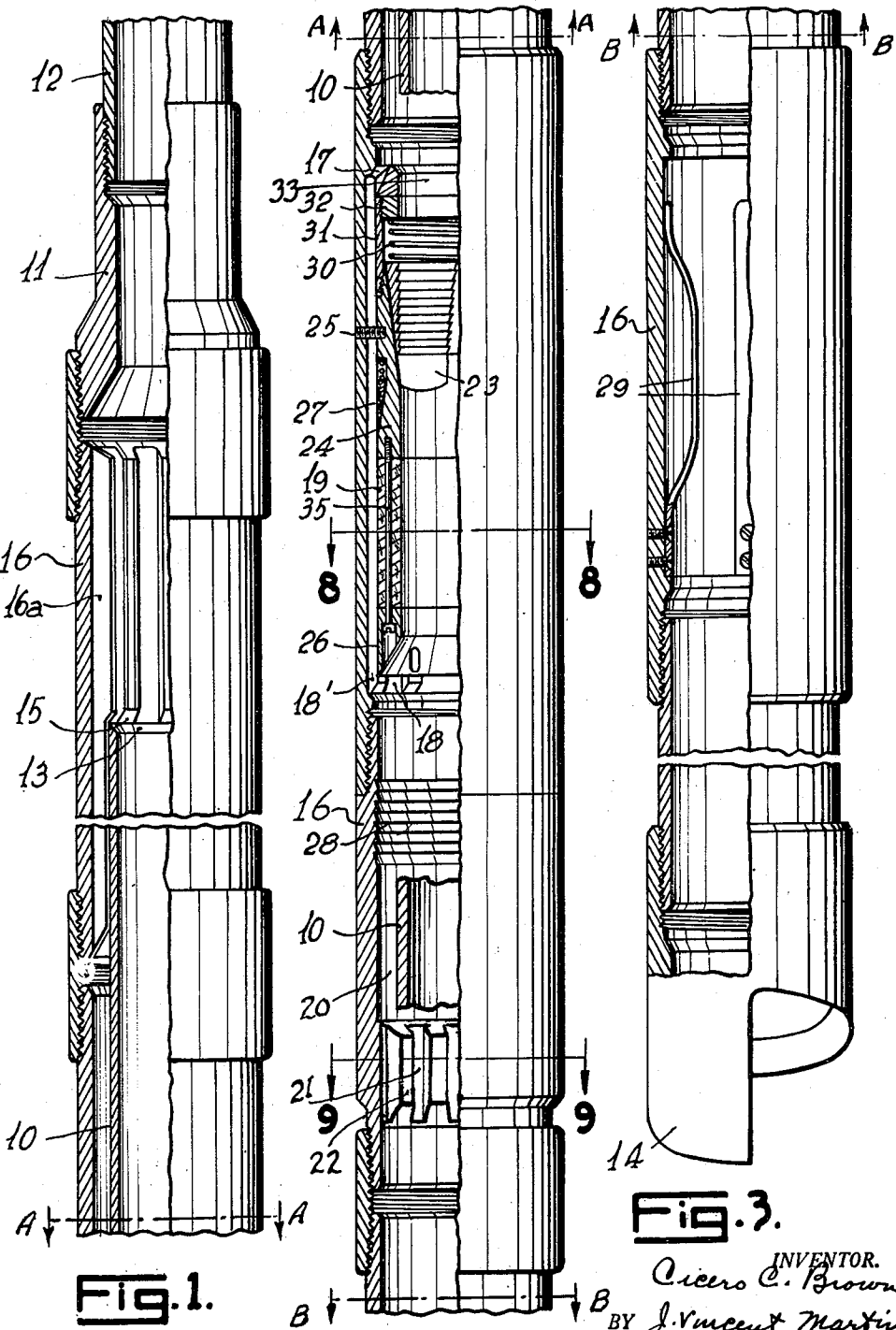
C. C. BROWN

2,593,725

CASING REPAIRING DEVICE

Filed April 22, 1946

4 Sheets-Sheet 1



INVENTOR.
Cicero C. Brown
BY J. Vincent Martin
Ralph R. Browning
James B. Simmes
ATTORNEYS

April 22, 1952

C. C. BROWN
CASING REPAIRING DEVICE

2,593,725

Filed April 22, 1946

4 Sheets-Sheet 2

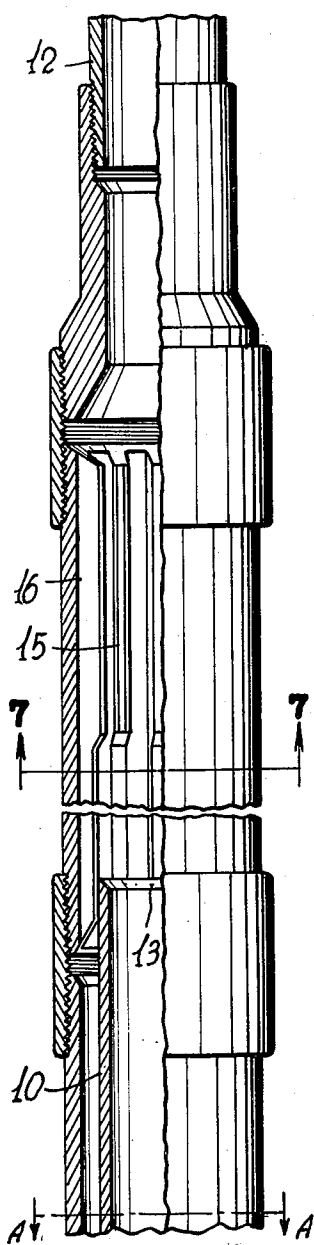


FIG. 4.

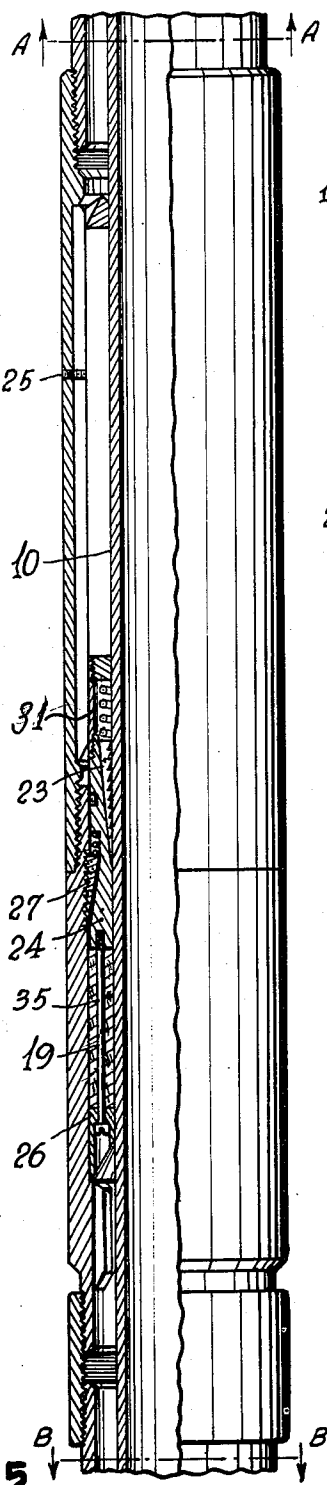


FIG. 5.

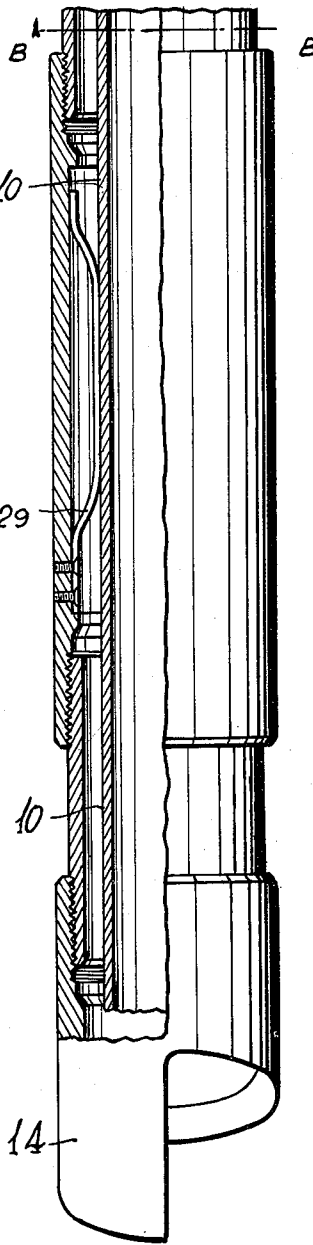


FIG. 6.
Cicero C. Brown
INVENTOR.
J. Vincent Martin
BY Ralph R. Browning
James B. Simms
ATTORNEYS

April 22, 1952

C. C. BROWN

2,593,725

CASING REPAIRING DEVICE

Filed April 22, 1946

4 Sheets-Sheet 3

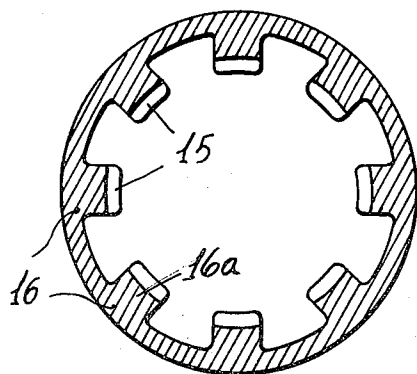


FIG. 7.

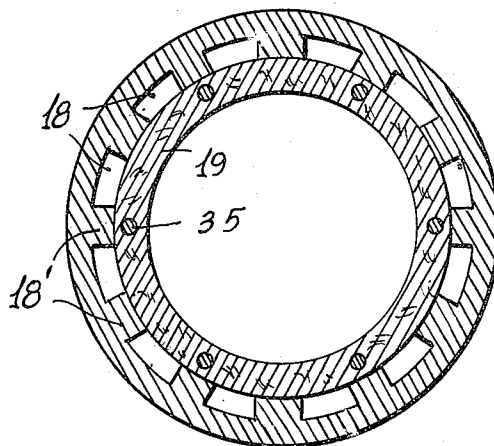


FIG. 8.

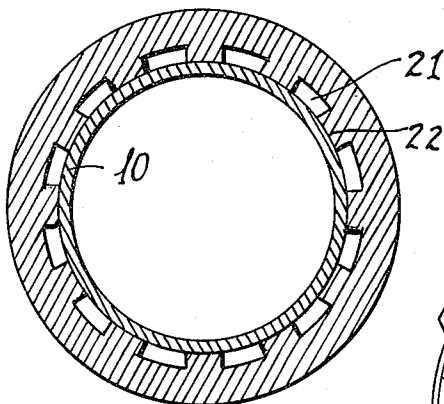


FIG. 9.

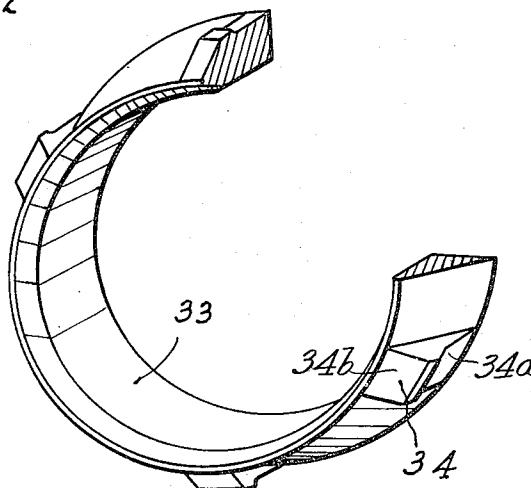


FIG. 10.

INVENTOR.
Cicero C. Brown
BY J. Vincent Martin,
Ralph R. Browning,
James B. Simms,
ATTORNEYS

April 22, 1952

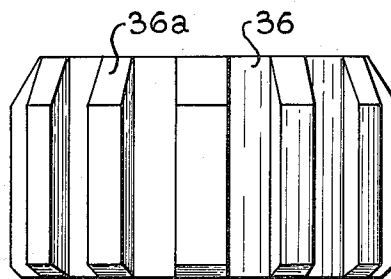
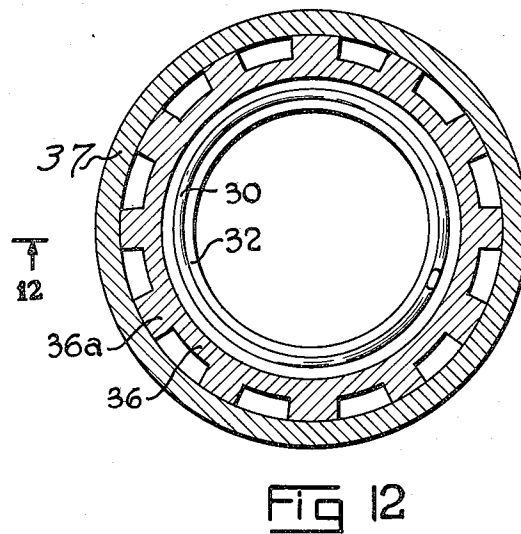
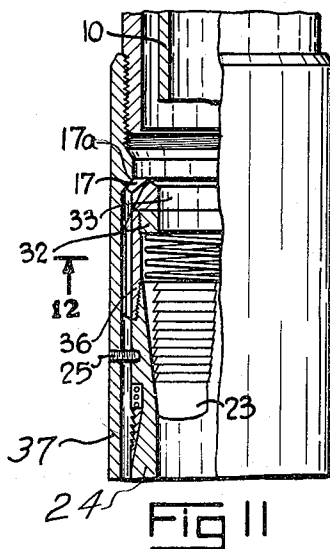
C. C. BROWN

2,593,725

CASING REPAIRING DEVICE

Filed April 22, 1946

4 Sheets-Sheet 4



Cecero C. Brown
INVENTOR
BY J. Vincent Martin
Ralph R. Browning
James B. Stimm
ATTORNEYS

UNITED STATES PATENT OFFICE

2,593,725

CASING REPAIRING DEVICE

Cicero C. Brown, Houston, Tex.

Application April 22, 1946, Serial No. 664,031

13 Claims. (Cl. 166-4)

1

This invention relates to improvements in an oil well tool and refers more particularly to a tool and method for repairing faulty well casing.

The device has to do primarily with the repair of faulty casings in completed wells. Usually the casing fails because of corrosion, cracking, cave-ins or the like. When failure occurs, the casing is cut adjacent but beneath the failure and the portion above the cut is removed from the well bore leaving the lower portion of the casing intact. A repair tool is then lowered on the end of a new string of casing to encase the cut end of the old casing. The tool housing is of greater diameter than the well casing and the annulus between the tool housing and old casing is customarily sealed with cement.

Heretofore tools of this type have not been entirely successful. The slips associated with the tool for anchoring it on the casing restrict the flow passage between the casing and tool housing, throttling the flow of cementing material in setting the tool. Also, when the cementing job is completed there often is a tendency for back pressure created in pouring the cement to result in a back flow of the cement in the annulus between the casing and tool housing. In addition, the cementing material used in effecting the seal between the cut end of the old casing and the repair tool and new casing is subject to corrosion and decay. When this sets in it rapidly spreads in the material and results in a new failure. Another difficulty heretofore experienced resides in the determination of the completion of the seal. In other words, there has been no way to test the effectiveness of the cementing material as a seal between the old casing, the repair tool and the new casing.

An object of this invention is to provide a casing repair tool having flow passages by-passing the assembly for anchoring or securing the tool to the well casing, providing non-restricted flow passages for the cement.

Another object is to provide a tool and method for repairing casing in which the cement flow passage may be blocked to prevent back flow of cement when the tool is set.

A further object is to provide a method and tool for repairing well casing wherein a packing assembly is utilized to seal off the cement flow passage when the tool is set.

Still another object is to provide a method and tool for repairing well casing wherein a packing assembly is utilized to seal off the cement flow passage when the tool is set to provide a testing means as to efficacy of the seal.

2

A still further object is to provide a method and tool for repairing well casing wherein a packing material is expanded in the annulus between the tool housing and casing flow passage providing a partition within the cementing or sealing material which is relatively impervious to decay or corrosion as compared to cement.

Other and further objects of this invention will appear in the following description.

In the accompanying drawings, which form a part of the instant specification and are to be read in conjunction therewith, and wherein like reference numerals are used to indicate like parts in the various views,

Figs. 1, 2 and 3 are to be pieced together seriatim on the sections A—A and B—B, to illustrate the tool as it appears when placed over the old casing;

Figs. 4, 5 and 6 are to be pieced together seriatim on the sections A—A and B—B, illustrating the tool as it appears when it is set on the old casing;

Figs. 7, 8 and 9 are sectional views taken on lines 7—7, 8—8 and 9—9 of Figs. 2 and 4 in the direction of the arrows;

Fig. 10 is a partial perspective and sectional view of one of the elements employed in the tool;

Fig. 11 is a fragmentary view illustrating a modification of the tool shown in Figs. 1 to 10;

Fig. 12 is an enlarged view taken along the line 12—12 in Fig. 11 in the direction of the arrows; and

Fig. 13 is an elevational view of the ribbed element shown in Fig. 12.

Briefly, the tool of this invention comprises a tubular member which may be attached to the lower end of a new section of well casing and lowered thereby to encircle the upper portion of the old well casing remaining in the bore after the removal of the faulty portion. Centering means are positioned within the tubular member so that the casing and member are substantially concentric forming an annulus through which cementing material is poured to set the tool relative to the old casing. An anchoring assembly including slips is associated with the tubular member to secure the tool to the casing. Flow passages are provided in the tubular member so as to by-pass the anchoring means, thus providing non-restricted flow passages for the cement. Means are provided to block off or seal off the annulus between the casing and tubular member when the cement is poured, thus preventing back flow of this material.

Referring now to the drawings, it will be as-

3

sumed that a well casing 10 has failed and must be repaired without its removal in its entirety from the well bore. The tool described herein is to be employed in repairing the casing but first the upper portion of the faulty casing is cut out and removed in one or more sections in a manner well known to those skilled in the art. The casing 10 is cut on the transverse section 13 leaving a relatively clean, smooth end. The tool housing 16, carrying the parts to be hereinafter described, is lowered into the well on a section of new casing 12, which will extend to the upper end of the well bore. This new casing usually is of the same size as the old casing remaining in the well and is connected to the upper-most fitting 11 of the tool. As the tool is lowered over the old casing 10, it is rotated and the spiral shoe element 14 on the lower end of the tool serves to cut away the earth and debris so that the tool can advance downwardly.

Adjacent the upper end of housing 16 are longitudinally extending circumferentially spaced ribs 16a provided with a shoulder portion 15, which rests upon the open mouth of the casing at 13, limiting the depth to which the tool can be lowered. These ribs serve to axially align or center the tool casing. When the tool has been seated upon the casing, a well known type of cementing tool, which forms no part of this invention, may be inserted to form a seal which plugs the open mouth of the old casing and the lower end of the new casing. This cementing tool provides a flow passage communicating with the annulus between the old casing and the repair tool. Through this device cement is pumped into the annulus and flows downwardly between the ribs 16a, thence downwardly through the opening 17 and the passages 18, which are disposed radially outwardly of the packing element 19; thence around the outside of the packing element 19; thence down through the passage 20 within the tool; thence through the openings 21 between the tool centering lugs 22 carried internally of housing 16, and often times even through the lower end of the tool itself when this is required.

It is to be understood, in viewing Figs. 1, 2 and 3, that the casing 10 has not always been shown in section due to the fact that it would obscure the showing of the other parts in the tool. However, Figs. 4, 5 and 6 do show the casing 10 in the position it occupies with respect to the tool.

The tool is provided with an anchoring assembly or securing means to secure it to the casing. This assembly consists mainly of a plurality of slips 23 arranged circumferentially about the old casing 10 and adapted to grip the same when the tool is pulled upwardly. The slips are surmounted by a spring member 30, confined between elements 31 and 32, which in turn are secured to the upper ring member 24. The elements 31 and 32 are in turn surmounted by a ring element 33 detailed in Fig. 10, which in turn, through its lugs 34, is supported by the ribs 18' spaced longitudinally and radially outwardly of the members 19, 24 and 26, defining passages 18. As illustrated in Figure 10, the lugs 34 are less in number than the ribs 18' and each lug has a transverse width which is greater than the space between the ribs, whereby an inclined lower shoulder 34a on each lug engages the upper inclined ends of the ribs; each lug is also formed with an inclined upper surface 34b which engages an internal shoulder 17a within the bore of the tool housing 16 adjacent the passages 17, which

4

passages are formed by the spaces between the lugs 34. Thus the ring element 32 is confined against longitudinal movement within the housing and functions as a stop to limit upward movement of the anchoring assembly with respect to the housing. The slips 23 grip the old casing and prevent upward movement of the element 24 termed the upper packing compressing ring whereby further upward pull upon the tool shears the frangible member or pin 25. The tool housing will then move upwardly with respect to the upper compression ring 24, the packing 19 and the lower compression ring 26. Compression rings 24 and 26 are spaced apart by packing element 19 and the parts of the packing assembly are united to each other through fastening rods 35. Parts 19, 24 and 26 are ring like or annular in shape and surround the casing 10.

The compression ring 24 is provided with a plurality of auxiliary slips 27 which are adapted to cooperate with the internal serrated zone 28 in the tool housing. The upward movement of the tool is continued for a sufficient distance to engage the auxiliary slips with the serrated zone 28. When in this lower-most locked position, a downward force is exerted on the tool, the upper compression ring 24 is urged downwardly. The lower compression ring 26, at this time, is held against downward movement as it substantially fills the annulus between the casing and tool housing and serves as a piston being forced upwardly by the cement within the annulus. Thus, the web of packing material 19 is compressed and expanded radially. The packing material preferably is formed of synthetics that are less subject to decay or corrosion than is cement.

When expanded, packing 19 forms a tight seal in the annulus and prevents back flow of the cementing material which has been forced into the casing. In this connection it is pointed out that the compression ring 24 can be used without the packing 19 and compression ring 26 to serve as a sealed member to block the back flow of cement within the annulus. The ring is of such size that a close fit is provided between the tool housing and the casing. However, it is preferred to use the entire packing assembly and thus to positively seal off the annulus rather than merely restrict the flow there-through.

In the modification shown in Figs. 11 to 13 inclusive, another embodiment of the invention is shown whereby the flow passages by-passing the anchoring and packing assembly are provided by use of a modified element 36 between the upper packing carrier 24 and ring member 32 in lieu of the element 31 shown in Figs. 2 and 5. This element 36 is formed with external longitudinal ribs or splines 36a. These splines serve to position the anchoring assembly and packing means concentrically within the section 37 of the tool housing. This section of housing does not have the longitudinal internal splines or ribs shown at 18' in Fig. 2. In other words, the spacer splines are formed on the anchoring assembly itself whereby by-passing flow passages are provided. The operation of the modified embodiment of the invention is the same as that shown in Figs. 1 to 10 inclusive.

In the lower portion of the tool are a plurality of spring members 29 which bear against the old casing and serve as guides or centering means for the tool.

It will be seen that the objects of this invention have been accomplished. There has been provided a method and apparatus for repairing

5

faulty well casing wherein provision is made for a seal preventing back flow of cementing material within the annulus between the tool housing and the casing. The arrangement is such that continuous flow passages are provided externally of the anchoring assembly and sealing means permitting nonrestricted flow of cementing material through the annulus. The construction is such that the anchoring and sealing assembly, in its upper-most position relative to the tool housing permits flow of cementing material through the annulus between the casing and tool housing and when in its lower-most position in the tool housing, blocks the annulus against back flow of cementing material.

Summarizing, the primary features of the invention are:

1. The passageways 18 are located radially outwardly from the slips 23, forming flow passages which by-pass the slips;

2. The provision of a ring 24 connected by a frangible member to the tool housing which on shearing of the frangible member is slidable in the housing on upward movement thereof to substantially close the annular passage between the tool and the old casing;

3. The provision of a packing assembly which may be expanded when the cement is poured to form a positive seal and prevent back flow of the cement.

Having described my invention, I claim:

1. A tool for repairing damaged well casing by extending the portion of a cut casing which remains within a well bore comprising a tool housing adapted to be lowered around the well casing, means slidably mounted within the housing for securing the tool to the casing, rib means disposed between the securing means and the housing for centering the securing means relative to the housing and casing and providing unrestricted flow passages externally of the securing means.

2. A tool for repairing damaged well casing by extending the portion of a cut casing which remains within a well bore comprising a tool housing adapted to be lowered around the well casing, means for securing the tool to the casing, said means being releasably carried within the tool and when released slidable to a lower position therein, and internal ribs on a portion of the housing providing slide ways for and fluid passages around the securing means, the housing having an internal sealing surface therein below the ribs said securing means in the lower position sealingly engaging said sealing surface to close the flow passages.

3. A tool for repairing damaged well casing by extending the portion of a cut casing which remains within a well bore comprising a tool housing adapted to be lowered around the well casing, means for securing the tool to the casing, said means being releasably carried within the tool and when released slidable to a lower position therein, and external ribs on the securing means providing slide ways for and fluid passages around the securing means, the housing having a sealing surface which is disposed opposite the securing means when the latter is in a lower position within the housing, said securing means in the lower position sealingly engaging said sealing surface to close the flow passages.

4. A method of repairing a damaged well casing comprising the steps of removing from the well bore the portion of the casing above the

6

failure, lowering a tubular member around and over the upper portion of the well casing to provide a flow space therebetween, flowing cementing material through said space to seal the tubular member relative to the casing and permanently sealing the flow space with a resilient material to prevent further flow of the cementing material and provide a partition within the cementing material which is relatively impervious to decay.

5. A casing repairing device for extending the portion of a cut casing which remains within a well bore including, a tubular housing adapted to be lowered around the upper end of said cut portion of the well casing, means within the interior of the housing and operable upon upward movement of the housing relative to the casing for securing the device to the well casing, said device having a flow passage extending therethrough between the securing means and the wall of the housing, and means within the housing operable upon downward movement of the housing and securing means to close said flow passage.

6. A method of repairing a damaged well casing as set forth in claim 4, together with the additional step of locking the tubular member to the well casing.

7. A device for extending the portion of a cut casing which remains when in a well bore including, a cylindrical housing adapted to be secured to the lower end of a casing extension and lowered thereby into a well bore to telescopically surround the upper end of a casing to be extended, longitudinal centering elements within the housing and engaging the exterior of the casing extension to center the same within the housing, an annular slip carrying member slidably mounted within the housing, stop means having flow passages therethrough within the housing in spaced positions therein and limiting the sliding movement of the slip carrier between an upper and a lower position within the housing, means for releasably securing the slip carrier in its upper position within the housing, longitudinal centering ribs having flow passages therebetween disposed between the slip carrier and the housing for centering the carrier relative to the housing and for providing a by-pass past the carrier, slip means mounted in the carrier for engaging the well casing to attach the carrier thereto and additional slip means engageable with the housing when the releasable securing means is released for connecting the housing to the slip carrier, and means secured to the slip carrier for closing the by-pass passages around the carrier when the slips of said carrier are connected with the casing and with the housing.

8. A device as set forth in claim 7, wherein the sealing means is an expansible packing assembly which is arranged to engage a sealing surface within the housing below the longitudinal centering ribs.

9. A device as set forth in claim 7, wherein the lower stop means within the housing comprises longitudinal rib members spaced around the bore of the housing and having flow passages therebetween, and wherein the upper stop means comprises an annular ring having spaced lugs with flow areas between said lugs.

10. A device as set forth in claim 7, wherein the means for releasably securing the carrier in position is a frangible pin.

11. A device for extending the portion of a cut casing which remains within a well bore com-

7

prising a cylindrical housing adapted to be secured to the lower end of a casing extension and lowered thereby into a well bore to telescopically surround the upper end of a casing to be extended, an assembly with a substantially cylindrical outer periphery slidably mounted within the housing, projections within the bore of the housing above and below the assembly for limiting the sliding movement of the assembly within the housing between upper and lower positions, means for releasably securing the assembly in its upper position within the housing, means between the housing and assembly and secured to one of them to center the assembly relative to the housing, additional means within the housing to center the housing with respect to the cut casing, longitudinal passages through the assembly-centering means communicating with the interior of the housing both above and below the assembly with the assembly in any but its lowermost positions, said assembly including means for anchoring the device to the casing adjacent its cut end, and a radially expansible packer adapted to be selectively expanded upon release of the assembly and downward shifting of the assembly relative to the housing to provide a seal between the housing and the cut casing.

12. A device as set forth in claim 11, together with means to lock the assembly in packing-expanded position within the housing.

13. A tool for repairing damaged well casing comprising a tool housing adapted to be lowered around the well casing, means for securing the

8

tool to the casing, said means being slidably carried within limits in the housing, a packing assembly mounted on the securing means including upper and lower gland rings and an annular web of packing material intermediate the rings, circumferentially spaced ribs between the housing and securing means providing a flow passage by-passing the securing means and packing assembly whereby in operation when the tool is secured to the casing and the packing gland is in its lowermost position upward application of force to the tool expands the packing to seal off the flow passage, and locking means between the packing assembly and housing operable to hold the packing in its lowermost position within the tool housing.

CICERO C. BROWN.

REFERENCES CITED

20 The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
25 1,489,797	Sutton	Apr. 8, 1924
1,528,560	Myers et al.	Mar. 3, 1925
1,926,017	Wells	Sept. 5, 1933
2,017,451	Wickersham	Oct. 15, 1935
2,054,353	Yowell	Sept. 15, 1936
30 2,137,997	Bendeler	Nov. 29, 1938
2,347,726	Auld et al.	May 2, 1944
2,495,352	Smith	Jan. 24, 1950