Dec. 16, 1958 E. BURNS 2,864,450

MULTIPLE UNIT PACKING CASING BOWL

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FIG. 1.

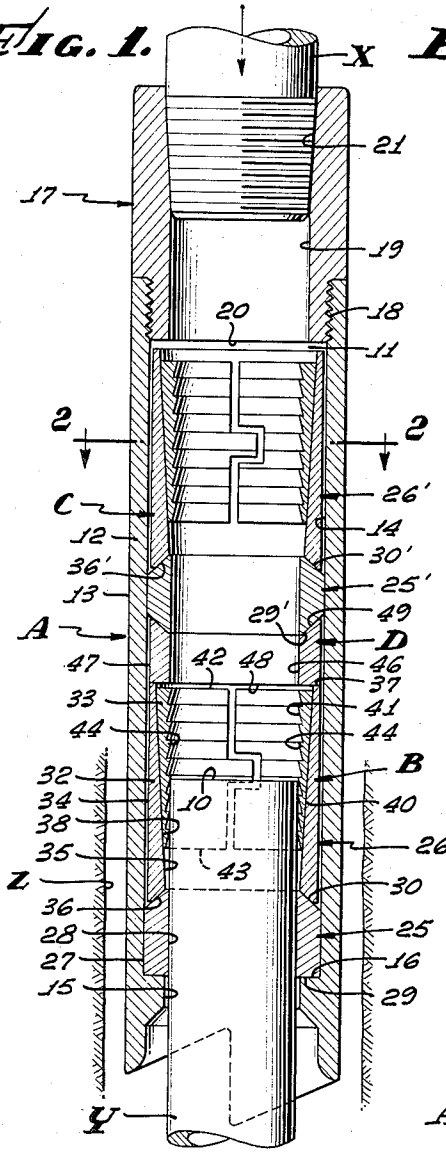


FIG. 3.

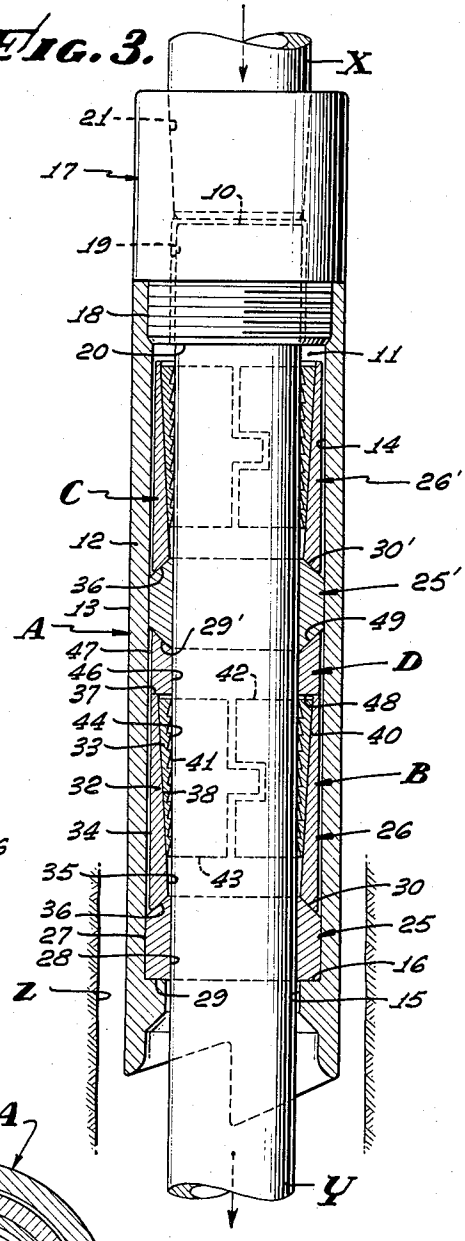
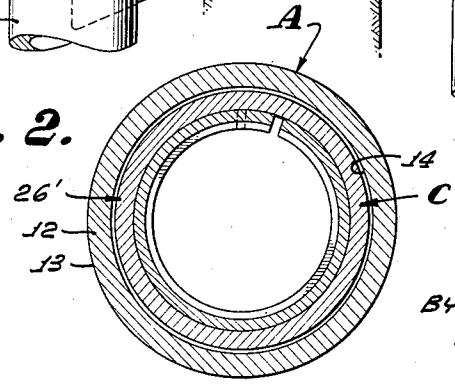


FIG. 2.



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MULTIPLE UNIT PACKING CASING BOWL

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2 Claims. (Cl. 166—218)

This invention has to do with a tool for repairing damaged or split sections of a casing string or like tubular element in a well and is particularly concerned with a multiple unit packing casing bowl. It is a primary object of this invention to provide a structure of the character referred to that has increased holding and packing characteristics and which conforms to the irregularities of the exterior of the casing sections to which it is connected.

A feature of this invention is to provide a tool for the purpose above referred to that has a multiplicity of anchoring and packing units in a series so that one unit is supported by another. The independent gripping action of one unit causes the unit to be forced into pressure engagement with another unit that also independently grips the casing to be supported.

Another feature of this invention is to provide a tool of the character referred to with a multiplicity of independently operating self-aligning packing and gripping units for engaging the exterior of a casing section. The units that I have provided independently operate to align with and grip and pack with the exterior of the casing to be connected with the tool.

It is an object of this invention to provide a multiple unit packing casing bowl that has full gripping action of two independent tools of the ordinary design and at the same time is only a small amount larger than ordinary tools of the type under consideration.

The various objects and features of my invention will be fully understood from the following description of a typical preferred form and application of my invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a detailed sectional view showing the tool of the present invention in the process of being engaged with a section of casing. Fig. 2 is an enlarged sectional view taken as indicated by line 2—2 on Fig. 1, and Fig. 3 is a view similar to Fig. 1 showing the tool that I have provided in working position and operated to pack with and grip with the section of the casing.

A section of casing or the like is often severed and removed from a well leaving a lower section of casing standing in the bottom of the well. The multiple unit packing casing bowl of the present invention is adapted to be applied to the lower end of a replacement section of casing that is run into the well to take the place of the section removed from the well and which replacement section is joined to the said lower section of the original casing. The casing bowl that I have provided operates to join the replacement section of casing to the original lower section of casing and includes means to grip the lower casing section and means to seal with the lower casing section.

The casing bowl involves generally, a body A adapted to be carried by the replacement casing section X and engageable over a lower casing section Y standing in the well Z, a lower packing and anchoring unit B supported by the body A, an upper packing and anchoring unit C supported by the unit B, and a spacer D between the units B and C and separating them. The packing and anchoring units B and C are provided to pack between the exterior of the lower casing section Y and the body A of the tool and to couple the body A and replacement X to the lower casing section Y.

The casing sections X and Y are typical casings or tubular elements and are made up of like tubular elements with end portions that are threaded together. The damaged section of casing (not shown) that is removed from the well Z is severed from the lower casing section Y by means of any suitable cutting instrument or tool leaving the upper end of the section Y open and terminating in an end face 10 in a plane normal to the vertical axis of the casing. The lower casing section Y is, therefore, left standing substantially vertical in the well Z though it may lie toward one side of the well. It will be apparent that the casing section Y is left intact and is not disturbed in any manner to affect the production zone of the well.

The body A is an elongate tubular element carried by the replacement section X and has a chamber 11 that accommodates and properly orients and relates the parts of the units B and C. The body A is characterized by an elongate cylindrical shell 12 having an outer wall 13 and an inner wall 14. In practice, the inner wall 14 is somewhat larger in diameter than the exterior of the casing section Y forming an annular chamber 11 surrounding the casing and for receiving the parts of the units B and C. The lower end of the body A is provided with a bore 15 sufficient in diameter to freely pass the upper end of the casing section Y which bore terminates in an upwardly facing shoulder 16 adapted to support the units B and C. The shoulder 16 is in a plane normal to the vertical axis of the tool.

The upper end of the body A is provided with a coupler 17 threadedly engaged with the shell 12 at 18. The threaded connection at 18 is preferably left-handed so that the casing bowl that I have provided can be quickly disconnected from the replacement string by rotating the said string in a right-handed direction. The closure 17 is provided with a central longitudinal bore 19 of lesser diameter than the chamber 11, but of sufficient diameter to freely pass the upper end of the casing section Y. The lower end of the coupler 17 terminates in the chamber 11 to define a downwardly facing annular shoulder 20 adapted to confine the parts and elements of the units B and C to the chamber 11. The coupler 17 is provided with coupling threads at 21 adapted to be threadedly engaged with the lower end of the replacement section of casing X. The lower end of the body A is formed and shaped in a manner common to tools of the type under consideration so that the tool is easily applied over the upper end of the lower casing section Y. The inner wall 14, shoulder 16, and shoulder 20 define the chamber 11 that accommodates the units B and C.

The packing and anchoring units B and C are substantially alike and are carried in the chamber 11 one above the other. As shown, the packing and anchoring unit B involves, generally, a packing element 25 and an anchoring element 26. The packing element 25 is formed of a simple body of relatively soft, malleable material, preferably lead, and is, therefore, referred to as a lead packer or lead seal. The packing element 25 is annular in form and is adapted to surround and have sealing engagement with the exterior of the lower casing section Y and has an outer wall 27 having substantial clearance from and engageable with the wall 14. The packer also has an inner wall 28 having substantial clearance from and engageable over the casing section Y, as clearly shown in Fig. 1 of the drawings. The bottom of the element 25 terminates in a flat face 29 normal to the

vertical axis of the tool while the top of the element terminates in an upwardly and inwardly inclined face **30**. The face **29** has flat supporting engagement with the shoulder **16** on the body A above described. It will be apparent that the packing element **25** freely passes the upper end portion of the lower casing section Y.

The anchoring element **26** is an annular element adapted to be carried by the body A through the supporting packing element **25** and to grip and support the casing section Y. The element **26** involves, generally, a supporting sleeve **32** and a slip **33**. The sleeve **32** is a tubular part and has an outer wall **34** engageable within the wall **14** with substantial clearance and has an inner wall **35** engageable over the casing Y with substantial clearance as clearly shown in Fig. 1 of the drawings. The bottom of the element **26** terminates in an upwardly and inwardly inclined face **36** while the top thereof terminates in a flat face **37** normal to the vertical axis of the tool. The inclined face **36** has wedging and supporting engagement with the face **30** of the packing element **25** when tension is applied to the tool as hereinafter described. The supporting sleeve **32** is characterized by a seat **38** that is tapered downwardly and inwardly from the top of the sleeve **32** to the bottom portion thereof. The seat **38** forms an annular wedge-shaped surface for receiving and actuating the slip **33**.

The slip **33** is a circular part and is adapted to be actuated into gripping engagement with the lower casing section Y. The slip **33** is carried within the sleeve **32** and has a downwardly and inwardly tapered outer wall **40** and a cylindrical inner wall **41**. The slip **33** is a split element having an opening extending longitudinally between the top **42** and the bottom **43** thereof and along one side thereof. In accordance with the invention, the diameter of the inner wall **41** is somewhat smaller than the exterior diameter of the casing section Y so that the slip **33** will expand and slide over the upper end portion of the lower casing section Y. As shown, the inner wall **41** is characterized by upwardly facing grippers or teeth **44** that present sharpened gripping points or edges. The slip **33** is somewhat less in vertical extent than the sleeve **32**, and it will be apparent that downward movement of the slip relative to the sleeve **32** will cause constricting of the slip so that the teeth **44** are operated into gripping engagement with the exterior of the casing section Y.

The spacer D is a ring-shaped element located between the units B and C and is adapted to retain the slip **33** in the sleeve **32** of the anchoring element **26** and to support the packing and anchoring unit C. The spacer D has inner and outer walls **46** and **47** having substantial clearance with the wall **14** and exterior of the casing section Y, respectively. The bottom **48** of the spacer D is flat and in a plane normal to the vertical axis of the tool and seats on the face **37** of the anchoring element **26** and confines the slip **33** to the sleeve **32**. The top **49** of the spacer D is downwardly and inwardly inclined and has wedging and supporting engagement with the packing element **25'** of the unit C hereinafter described.

The packing and anchoring unit C is carried in the chamber **11** above the unit B and is supported by the unit B through the spacer D. The unit C involves, generally, a packing element **25'** and an anchoring element **26'**. The packing element **25'** is carried on the top inclined face **49** of the spacer D and is essentially the same in construction as the packing element **25** above described, except that the lower face of bottom **29'** is downwardly and inwardly inclined to have seating engagement with the inclined face **49** of the spacer D.

The anchoring element **26'** is preferably identical with the element **26** above described and has a bottom face **36'** inclined upwardly and inwardly and having wedging and seating engagement with the face **30'** of element **25'** which is also inclined.

As shown in Fig. 1 of the drawings, the parts of the structure are merely assembled in proper order as above described so that they form a stack of parts occupying the chamber **11**. The parts thus assembled fit somewhat loosely within the wall **14** of the chamber **11** and are retained in the chamber by the closure **17** which is threaded onto the body A. It will be apparent that the assembly of parts is easily accomplished, there being no fastening together or threading and interconnecting of parts required.

In Fig. 3 of the drawings, the tool is shown in the operated condition in which case the threads at **21** are coupled with the lower end of the replacement casing section X. The tool is engaged over the lower casing section Y so that the upper end thereof extends or projects up and into the chamber **11** to be surrounded or encompassed by the parts and elements of the units B and C. As the upper end of the lower casing section Y passes through the slips, the slips expand and slide over the exterior of the casing Y. The other parts pass over the exterior of the casing Y with suitable clearance. When it is desired to set the tool that I have provided, upward tension is applied to the replacement section of the casing X whereupon the teeth or grippers of the slips bite into the exterior of the casing Y. With the teeth engaged with the exterior of the casing Y, the slips are wedged tightly into pressure engagement with the casing section and the pressure applied to the parts acts to compress the packing elements **25** and **25'** so that the malleable material of which they are formed is caused to flow in all directions and to fill any cavities or interstices and to provide a reliable seal between the body A and the exterior of the casing section Y.

From the foregoing it will be apparent that I have provided an extremely simple, inexpensive casing bowl which is easily assembled and which reliably operates to grip and pack with the exterior of a section of casing. With the parts formed with the clearance above referred to, and with the elements of malleable material, the individual parts and units of the structure independently operate to grip and seal with the exterior of the casing to be engaged, with the result that each of the parts or elements involved operates properly and is not affected by the operation or alignment of other parts. With the construction that I provide, the parts will, therefore, individually align with and operate against casing sections having imperfect or irregular exterior surfaces, with the result that the tool can be safely relied upon to affectively grip and seal with any casing.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention, I claim:

1. A packing casing bowl of the character described including, an elongate, vertically disposed body with a cylindrical chamber therein, an upwardly facing shoulder at the lower end of the body, a coupler with a bore of lesser diameter than the chamber engaged in the upper end of the body to establish a downwardly facing annular shoulder and adapted to be coupled with a section of casing, the lower end of the body being open to the chamber to receive the end portion of a second casing section, upper and lower packing and anchoring units carried in the chamber, and adapted to initially freely receive the said upper portion of the second-mentioned casing section, the lower unit including, a malleable packing ring slidably engaged in the chamber and carried by the shoulder at the lower end of the body and anchoring means including, a longitudinally shiftable supporting sleeve with a downwardly and inwardly inclined bore slidably engaged in the chamber and supported by the top of the packing ring and an annular series of contractable segmental wedge-shaped slips slidably positioned within and carried by the supporting sleeve and adapted

to be actuated into substantially stationary gripping engagement with the second casing when an upward pull is put on the first-mentioned casing to hold the sleeve stationary whereby the packing ring is compressed between the shoulder and the sleeve and is urged into tight sealing engagement with the wall of the chamber and about the exterior of the second casing, the upper unit including a spacer ring slidably engaged in the chamber and supported by the top of the sleeve of the lower unit, a second malleable packing ring slidably engaged in the chamber and supported by the spacer ring and anchoring means including, a second longitudinally shiftable supporting sleeve having a downwardly and inwardly inclined bore slidably engaged in the chamber and supported by the top of the second packing ring and a second annular series of contractable segmental wedge-shaped slips slidably positioned within and carried by the second sleeve and adapted to be actuated into substantially stationary gripping engagement with the second casing when an upward pull is put on the first-mentioned casing to hold the second sleeve stationary whereby the second packing ring is compressed between the spacer and the second sleeve and seals between the inner chamber wall and the second casing, the spacer ring of the upper unit acting on the sleeve of the lower unit to assure and aid actuation of the lower unit.

2. A packing casing bowl of the character described including, an elongate, vertically disposed body with a cylindrical chamber therein, an annular upwardly facing internal shoulder at the lower end of the body, a coupler with a bore of lesser diameter than the chamber engaged in the upper end of the body to provide a downwardly facing annular shoulder and adapted to be coupled with a section of casing, the lower end of the body being open to the chamber to receive the end portion of a second casing section, upper and lower packing and anchoring units carried in the chamber, and adapted to initially freely receive the said upper portion of the second-mentioned casing section, the lower unit including, a malleable packing ring having a downwardly and outwardly inclined top slidably engaged in the chamber and carried by the shoulder at the lower end of the body and anchoring

means including, a longitudinally shiftable supporting sleeve having a downwardly and inwardly inclined bore slidably engaged in the chamber and supported by the top of the packing ring and an annular series of segmental circular slips having downwardly and inwardly inclined outer walls positioned within and slidably carried by the supporting sleeve and adapted to be actuated into substantially stationary gripping engagement with the second casing when an upward pull is put on the first-mentioned casing to hold the sleeve stationary whereby the packing ring is compressed between the shoulder at the lower end of the body and the sleeve and seals between the inner wall of the chamber and the second casing, the upper unit including a spacer ring with a downwardly and inwardly inclined top supported by the top of the sleeve of the lower unit, a second malleable packing ring slidably engaged in the chamber and having a downwardly and inwardly inclined bottom and a downwardly and outwardly inclined top, supported by the spacer ring and anchoring means including, a second longitudinally shiftable supporting sleeve with a downwardly and inwardly inclined bore slidably engaged in the chamber and supported by the top of the second packing ring and a second annular series of segmental circular slips with downwardly and inwardly inclined outer walls slidably engaged within and carried by the second sleeve and adapted to be actuated into substantially stationary gripping engagement with the second casing when an upward pull is put on the first-mentioned casing to hold the second sleeve stationary whereby the second packing ring is compressed between the spacer and the second sleeve and seals between the inner wall of the chamber and the second casing, the spacer ring of the upper unit acting on the sleeve of the lower unit to assure and aid actuation of the lower unit.

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