This invention relates to bridging plugs such as are frequently used in oil wells for sealing the well bore or casing at a desired location to prevent the flow of well fluid through the casing or part of the plug at such selected location. More particularly, the invention is directed to retrievable plugs which may be removed from the well bore or casing, after having served their desired sealing or packing function, with a minimum of effort and manipulation, such plug being retrievable without damage thereto so as to be capable of repeated use.

The invention also relates to means for manipulating such plugs, and particularly to a releasing and retrieving device therefor. Originally, bridging plugs were constructed and arranged for permanent setting in well bores or casings and were not designed for removal. However, it has been found expedient in many instances to subsequently continue operations beyond the plug, and in such instances a temporary plug was desired. As the demand for temporary bridging plugs and like packers increased, "drillable" plugs were designed which would shatter and fall apart under impact or drilling operations in order to facilitate clearing the well bore or casing from the obstruction of such plugs when their use was no longer desired. Obviously, such plugs were necessarily constructed of weaker materials to permit fracture and disassembly by drilling operations and were therefore less sturdy and dependable than plugs designed for permanent or repeated use. Destruction of such plugs by drilling operations cluttered the well with chips, fragments, and debris, which hampered subsequent operations. Retrievable plugs designed for release and removal from the well bore or casing without destruction have been proposed, but in most instances either such plugs were separable, leaving a released portion thereof to fall free and be salvaged by a separate operation, or their release required internal fracture, which rendered them incapable of repeated use. Furthermore, such constructions were expensive and complicated. In such retrievable devices no means were provided for the transmission of torque through the plug to facilitate dislodgment thereof, nor did such devices provide for the transmission of either up or down jarring operations, the impact of which might be transmitted to the entire plug.

It is therefore an object of the present invention to provide a novel and improved bridging plug in which the limitations and disadvantages of previously constructed plugs, as set forth above, are avoided.

More specifically, it is an object of the present invention to provide a novel and improved bridging plug which is fully retrievable, being adapted to be released and withdrawn from the well bore or casing as a whole without fracture or disassembly and with a minimum of manipulation.

A further object of the invention is to provide a retrievable plug through which torque may be applied and to which jarring impact may be imparted in both upward and downward directions.

Another object of the invention is to provide a plug of the character set forth having readily releasable means permitting relative longitudinal movement between the parts thereof whereby the setting force applied to the slips and packing element of the plug may be relieved to permit retraction of the slips and packing so as to allow the plug to free itself from the well bore or casing and be withdrawn therefrom.

It is also an object of the invention to provide a novel and improved releasing and retrieving means for the plug and to provide a unique combination of plug and releasing and retrieving means.

Numerous other objects and novel features of the invention will be apparent from a consideration of the following specification taken in connection with the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of the general assembly of the bridging plug ready for positioning in a well bore or casing;

Figure 2 is a longitudinal sectional view of a portion of the apparatus of Figure 1, showing the bridging plug after having been released from a setting condition and ready for withdrawal from the well;

Figure 3 is an enlarged detail perspective view of a portion of the apparatus of Figures 1 and 2;

Figure 4 is a transverse sectional view taken on the line 4--4 of Figure 1; and

Figure 5 is a longitudinal sectional view of a releasing and retrieving tool and its connection to the bridging plug apparatus of Figures 1 and 2.

The present inventive concept is characterized by the provision of a substantially conventional assembly comprising a packing element, actuating cones, and slips, which assembly is mounted on an extensible mandrel, the arrangement being such that, upon extension of the mandrel, separation of the actuating cones may take place to release the slips and the packing for retraction, thereby permitting withdrawal of the plug from the well bore or casing. In the present embodiment of the invention the mandrel is formed by telescopically joined upper and lower tubular sections interconnected by means of a bayonet joint whereby, after predetermined rotation of the sections relative to one another, relative longitudinal sliding movement may take place between the upper and lower tubular sections to permit separation of the slip cones and release of the slips and packing. An important feature of the invention is the provision of means for restraining the upper and lower sections against such initial relative rotation so that in originally locating and setting the mandrel acts in effect as a conventional one-piece mandrel. However, the restraining means is disruptable under predetermined force conditions to release the mandrel sections for rotation relative to one another to a position allowing their subsequent longitudinal extension. While relative rotation is permitted upon disruption of the restraining means, such rotation is limited by the bayonet slot so that, after such limited relative rotation has taken place, torque may be applied from one section to the other for rotation of the plug in its entirety. At least one end of the bayonet slot also provides for the transmission of longitudinal forces between the mandrel sections so that jarring in either upward or downward direction may be imparted from the upper mandrel section to the lower section.

While a wide variety of implements may be employed for engaging the present plug to cause extension of the mandrel and thus release of the setting pressure, a preferred construction of tool constituting part of the present inventive concept is here disclosed. In combination with the present plug this tool provides an instrumen-
tality by which torsion and jarring may be imparted to the plug to separate the mandrel sections. The present "fishing" tool is of the overshot type, being provided with plug-engaging fingers adapted to enter splines in a boss formed upon the plug, the ends of the splines provided for transmission of longitudinal thrust while permitting to an application be set forth in detail, fluid pressure generated within the tool itself is applicable to cause the fingers to engage the plug boss to form an operating combination therewith.

Referring now to the drawings for a detailed consideration of one illustrative embodiment of the invention, the mandrel is shown as comprising an upper tubular section 10 and a lower tubular section 11. The upper end of the lower section 11 has a portion 12 of reduced diameter, over which the lower end 13 of the upper section 10 is telescopically fitted. Space occurings 14 are seated in annular grooves 15 formed in the slidably interengaging surfaces of the upper and lower tubular sections. The upper portion 12 of the lower mandrel section 11 is provided with a pair of diametrically opposite disposed Z-shaped bayonet slots 16 through which extends a torque bar 17 fixed transversely across the lower end of the upper mandrel section 10. The upper end of the lower mandrel section 11 is preferably closer to a suitable means such as a Welch plug or a threaded diaphragm, as indicated at 18, to prevent admission of well fluid or other foreign matter into the hollow lower mandrel section.

The Z slots 16 are each formed with a central longitudinally extending run 19 which joins, at its upper end, a relatively short transverse passage 20 which in turn terminates in a relatively short, downwardly extending run 21. The lower end of each longitudinal run 19 enters a relatively short, bottom, transverse passage 22, the intermediate portion of which is preferably closed by a fracturable or disruptive bridge member 23. The bottom passages 22 extend beyond the bridges 23 to form terminal end recesses 24. The bridges 23 may be formed as part of the material of the tubular section 12, being of such thickness and depth as to permit fracture or deformation thereof to allow passage of the torque bar 17 through the mandrel, from the end recesses 24 to the longitudinal runs 19 of the Z slots 16 upon the application of predetermined rotational force or torque between the mandrel sections. More preferably, however, the bridges 23 may be separate, replaceable segments, as illustrated in Figure 3, and may be formed of sintere metal or such other material as may fracture and dislodge to permit passage of the torque bar upon application of force. The segments 23 may be press fitted into the bottom transverse slots 22.

In the original assembly of the device, the mandrel sections 10 and 11 are arranged in fully telescoped relation to one another, with the lower end of the upper section 10 abutting the upwardly facing, annular shoulder formed on the lower section at the lower end of its reduced portion 12, as illustrated in Figure 1. The angular relation of the mandrel sections 10 and 11 is initially such that the torque bar 17 is located in the bottom end recesses 24 of the passages 22 and is locked therein by the bridges 23, thus preventing accidental rotational movement or relative longitudinal movement between the upper and lower sections 10 and 11 of the mandrel. The parts are thus maintained in this fully telescoped relation during loading and setting of the plug. The mandrel sections are released until release and recovery of the plug is sustained. When the plug is to be released and withdrawn from the well bore, sufficient right-hand rotational torque is applied through the upper mandrel section 10 to the bar 17 in a direction against the bridges 23 to deform, fracture, or dislodge the same and permit the bar to enter the longitudinal portions 19, whereupon the upper and lower mandrel sections are freed to move longitudinally in opposite directions to effect an elongation of the mandrel and thereby to release the slips and the packing.
struction shown in the patent to Hart, No. 2,308,004, acts to exert an upward pull on the cap 45 and mandrel, while an equal downward force is applied to the sleeve 28 from the cylinder 50 to force the same downwardly with respect to the mandrel. By such setting operation, the entire mandrel and bull plug 25 move upwardly relative to the sleeve 28.

When the plug is to be lowered into a well bore or casing, the parts are arranged as indicated in Figure 1, with a setting tool, such as disclosed in the Hart patent above referred to, connected to the plug. The outer cylindrical casing 56 of the tool fits over the lower section 49 of the lock sleeve 28, while the pull rod 47 of the setting tool is pin-connected within the boss 46, as before described. In this relationship, the upper and lower mandrel sections 16 and 11 are in fully telescoped condition, with the lower end of the upper mandrel section 16 resting upon the shoulder of the lower mandrel section 11. The ends of the torque bar 17 are located in the lateral runs 24 of the Z slots 16, and rotational movement of the mandrel sections relative to one another is prevented by the slot bridges 23. As originally assembled prior to setting, the locking sleeve 28 is located near the top of the upper mandrel section 10 without exerting any compressive pressure upon the slip, cone, and packing assembly. The packer is in relaxed cylindrical form, the cone base ends 38 abut but do not compress the ends 41 of the packing, and the slips 30 and 31 are secured by shear screws 37 to the inner ends of the cones 34 and 35 without radial pressure being applied thereto.

In this condition, the plug and the setting tool are lowered into the well.

When the setting tool is actuated, the rod 47 pulls upwardly, while the cylinder 50 pushes equally and oppositely in a downward direction on the sleeve 28. Since the upper end of the mandrel sections are locked together during such setting operation, due to the confinement of the bar 17 in the recesses 24 by the bridges 23, the entire mandrel moves upwardly with respect to the sleeve 28. The shoulder 27 of the bull plug 25 pushes the lower slips upwardly and with it the lower slip cone 35, which thus exerts upward pressure on the packing 40. Simultaneously therewith the ring 28 forces the upper slips 30 downwardly upon the upper slip cone 34, which in turn exerts downward pressure on the upper end of the packing element 40 in a direction opposite to the pressure exerted by the cone 35. Thus the packing sleeve is longitudinally compressed between the cones and is thereby caused to expand outwardly into sealing engagement with the inside surface of the well bore or casing. With the expansion of the packing, the shear screws 37 are broken, and the slips slide up on the sloping surfaces of the slip cones 34 and 35, thus being forced radially outward to cause their wickers 33 to bite into the well bore or casing to securely lock the plug in the selected location.

To secure the plug parts in the before-described set position, the external surface of the upper mandrel section 10 is provided with annular buttress-shaped serrations or wickers 51. The wickers 51 are disposed on the upper mandrel section 10 about mid-distance between the upper and lower ends thereof. Thus the wickers 51 are spaced downwardly from the sleeve 28 when the plug is in the unset condition as shown in Figure 1. For cooperation with the wickers 51, the sleeve 28 is formed with an internal annular counterbore 52 in which is retained a split ring 53 having internal buttress-shaped wickers 54 adapted to ratchet over the wickers 51 on the mandrel when the plug is set. The wickers 54 are directed upwardly, while the wickers 51 are directed downwardly. Thus, when the wickers are ratched into engagement with one another, the ring 25 and mandrel sections 10 and 11 are locked against reverse longitudinal movement of the mandrel upward through the sleeve. Setting force is continued to be applied to the plug by the setting tool, as before described, until the tension in the pull rod 47 exceeds the shearing strength of the shear pin 55. Upon shearing of the shear pin 55, the setting tool is thereby disconnected from the plug and may then be removed from the well bore, carrying with it the cylinder 50 and pull rod 47 and leaving the plug set in the well. Thus, after setting, the setting tool may be removed, and the parts of the plug will retain their set position until release in a manner now to be described.

When it is desired to terminate the sealing function of the plug, complete removal thereof, intactly, is made possible by virtue of the extensible character of the composite mandrel construction. Drilling, fracturing, or disassembly of the plug parts is not required in reopening the well bore or casing past the original location of the plug. To release the plug from its set condition and remove it from the well bore, the overshot tool is lowered down the borehole or suitable pipe, into engagement with the boss 46, as shown in Figure 5. Torque is first applied to the upper mandrel section 10 and with it to the torque bar 17 in a direction to move the torque bar toward the bridges 23, fracturing or deforming the bridges sufficiently to permit the torque bar to enter the longitudinal runs 19 of the Z slots 16. Thereafter, tension is applied through the overshot to the upper mandrel section 10 to move it upwardly with respect to the lower mandrel section 11, while the torque bar 17 moves upwardly in the runs 19 of the Z slots 16. As the mandrel slides longitudinally, the setting tension therein is thereby relieved, thereby in turn removing the setting pressure on the upper and lower slips 30 and 31. With the completion of the elongation of the mandrel as before described, the upper section 10 of the mandrel may move upwardly through the sleeve 28, thereby carrying the mandrel serrations 51 upwardly and out of the ring 53 and bringing an annular groove 56 formed in the mandrel section 10 into registry with a spring or snap ring 57 carried in an annular groove 58 in the sleeve 28. At this point the ring 53 snaps into the mandrel groove 56, thereby locking the sleeve and mandrel section 10 together against further longitudinal sliding movement relative to one another. After the sleeve 28 and upper mandrel section 10 have been thus locked together, continued upward movement of the mandrel carries the sleeve 28 upwardly with it and lifts the slips 30 off the slip cone 34. With the elongation of the mandrel sections thus caused to move down their respective slip cones into retracted position out of engagement with the well bore or casing, and the packing may then resume its cylindrical form. With the packing thus in an expanded cylindrical form, as shown in Figure 1, and with the slips retracted, the entire plug may be retrieved by continued upward pull on the upper mandrel section. It will be noted, of course, that, by virtue of the longitudinal runs 19 of the Z slots 16 terminating at their upper ends in the transverse passages 20, relative longitudinal motion between the upper and lower mandrel sections is limited. At the termination of such limited motion, further upward motion of the upper mandrel section tends to lift with it the whole plug assembly.

In certain instances the collapse of the packing and withdrawal of the slips may not be automatic upon release and extension of the mandrel section, and in such instances jarring of the plug may be desirable to loosen the parts. In the present construction such jarring may be readily accomplished by a further rotation of the upper mandrel section after the torque bar 17 has reached the upper ends of the vertical runs 19. By such further rotation, the torque bar traverses the lateral runs 20 and enters the longitudinal runs 21. With the torque bar so located, a jarring action, applied downwardly through the upper mandrel section 10, will be transmitted from the torque bar 17 through the lower ends of the longitudinal runs 21 and to the lower mandrel section 11 and thence through the bull plug 25 and dovetails 27 to move
the lower slips 31 downwardly, freeing them from the borehole wall or casing and from the lower cone 35, which cone may then move downwardly and permit packing element 40 to elongate. Thus, it may be seen that, while the present construction provides for limited separation and extension of the plug and for limited relative rotation between the mandrel sections, both upward and downward jarring as well as rotary motion in either direction may be imparted to the entire plug when desired. For manipulating the upper mandrel section in the manner referred to for retrieving the plug, various types of tools may be employed. In particular, fishing tools of the overshot type may be employed to engage the boss 46. As an exemplification of one type of tool particularly adapted for the manipulation of the present plug, reference may be had to Figure 5, in which a novel and improved tool is disclosed, which tool forms with the plug of the present invention a unique combination. The tool disclosed in Figure 5 and forming a part of the present invention comprises an overshot type fishing tool adapted to engage the plug and transmit torsion as well as jarring forces to the plug, and adapted to be releasable from the plug when desired. The tool comprises a cylindrical body 60 having an upper end 61 threadedly secured thereto. The upper end 61 is internally threaded at 62 to receive drill pipe or tubing for which, in some cases, an adapter as indicated at 63 may be employed. Seated within the open upper end 61 of the tool is a centrally apertured bulkhead 64 through which extends a firing pin 65 projecting centrally from an impact plate 66 disposed transversely within bore 67 in member 62. As indicated at 68, an O ring or the like packing is mounted in the annular recess formed at the bottom of the threads 62 between the body portion 61, adapter 63, and the bulkhead 64 to adequately seal the same. Communicating with the open end 61 through the aperture of the bulkhead 64 is a firing chamber 68' within which a charge 69, such as, for example, a "Breeze" cartridge, is mounted in such position as to be fired by downward movement of the firing pin 65 when a "go-devil" or like device dropped down the well strikes the impact plate 66. The lower end of the firing chamber 68 opens into a cylinder 70 in which is slidably mounted a piston 71 having compression rings 72 and O rings 73. The lower skirt portion of the piston 71 has two diametrically opposite, longitudinal slots, as shown at 71a, and has threaded to its lower end a ring member 74 of slightly greater outside diameter than that of the piston. The ring member is threadable longitudinally with a counterclockwise extending outwardly from the bore of the cylinder 70. The lower end of the ring 74 is preferably beveled as at 76. The piston 71 is slidable mounted on a ram bridge 77 which is supported within the piston 71 by means of a transverse pin 78 which passes through the piston slots 71a and extends into the cylindrical body 60. Thus, the ram bridge 77 is held stationary with respect to reciprocation of the piston 71 and is fixed with respect to the body 60. The ram bridge has a downwardly directed, open end bore 79 in which is secured a rubber or like resilient bumper 79 which is adapted to receive the upper surface of the boss 46 of the plug and to be deformed and compressed slightly thereby when the retrieving tool has been secured to the plug, as shown in Figure 5. Pivotally mounted within longitudinal slots 80 at the lower end of the body 60 are plug boss engaging fingers 81. The fingers 81 are pivotally mounted at their upper ends on pins 82, while their lower ends are formed with upwardly inclined, inwardly directed hooks 83 having flat side faces. Resilient bumpers 84 retained in slots 80 by means of pins 85 normally retain the fingers 81 with their hooked ends in inwardly biased position. As seen more clearly in Figure 5, the upper ends of the spines 48 of the boss 46 of the plug are undercut, as at 86, to receive and retain the upwardly directed ends of the hooks 83 of the fingers 81. The upper end of the boss 46 is preferably beveled as at 87, to facilitate spreading of the fingers against the resiliency of the bosses 84 when the tool is lowered over the boss of the plug.

In order to manipulate the plug for release and retrieval thereof after its packing function has served its purpose, the tool, as shown in Figure 5, is lowered into the well bore or casing by means of the tubing attached to the upper end 61 of the boss 60. As the tool approaches the plug, the beveled end 87 of the plug boss 46 enters the beveled end 88 at the lower end of the body 60 and passes upwardly therethrough to engage and compress the bumper 79 as the tool continues its downward movement over the plug. With the continuation of such downward movement, the hooked ends 83 of the fingers 81 are cammed outwardly by the beveled end 87 of the boss 46 against the force exerted by bumpers 84 and thereafter enter the spines 48, the bumpers 84 urging the finger hooks toward seating position within the spines. Slight rotation of the tool relative to the plug as the tool is lowered will assure the fingers 81 entering the spines 48. As before noted, the downward movement of the tool over the boss 46 results in a deformation and compression of the rubber 79 which prevents the boss downwardly, thus locking the hooks under the undercut 86 of the spines 48. With the present tool thus lowered over the boss 46 of the plug, torsion may be applied through the tool, as from tubing or drill pipe or any suitable equivalent by means of which the tool is lowered into the well, to the fingers 81 and thence to the plug mandrel through the seating of the flat-sided hooks 83 within the spines 48 of the plug boss 46. Upward pull may also be exerted through the tool, either as a steady pull for extending the plug mandrel after relative rotation of the mandrel sections or for retrieving the plug, or by upward impact for jarring the plug. Thus, the tool may impart all the desired manipulations and forces required for releasing the mandrel sections for extension, and retrieving the plug, as well as for jarring and rotating the plug to dislodge it from the well bore or casing.

An important feature of the present retrieving tool is the ability to disengage it from the plug while the plug and tool arc within the well bore or casing, as, for example, when the plug becomes so firmly held or "frozen" in the casing or well bore that it cannot be removed by means of the retrieving tool without jeopardizing the whole tubing or pipe string upon which it is lowered and by which it is manipulated. Since the tool is precluded into secure engagement of its fingers with the spines of the boss, disengagement requires positive means for retraction of the fingers from the spines 48. Such means is supplied by the charge 69, which may be fired, as hereinbefore indicated, by impact plate 66. When the cartridge is fired, the explosive gases enter the top of the cylinder 70 through the opening 88, forcing the piston 71 downwardly so that the ring 74 engages the inner surfaces of the fingers 81 to pivot them outwardly in opposition to the forces of the resilient bumpers 84 and withdrawing them from the spines 48 so as to release the boss 46 and disconnect the tool from the plug. The extent of downward movement of the piston 71 within the cylinder 70 is limited by the pin 78 and the bridge member 77 and controlled by a pressure relief valve 90, the port of which is uncovered by downward movement of the piston to permit relief of the gases above the piston. For returning the piston 71 to its extended position to maintain the fingers disengaged, a spring-urged latch 91 is secured in body 60 and is received in locking engagement with recess 92 when the piston 71 reaches its maximum downward displacement. In this manner the piston 71 is prevented from returning to its upper position, and the tool is retained in its boss-releasing position after discharge of the charge 69.

After a consideration of the foregoing disclosure of the
tool of the present invention, it will be seen that the same or similar functions may be provided for by various retrieving or fishing tools in which the structure and operation are changed and modified and in which equivalents are substituted for certain features herein shown. The invention is in no way limited to the specific structural features herein shown by way of illustration. It will also be understood that, although the plug of the present invention is admirably suited for manipulation by a tool of the type set forth and that such tool forms a new and improved combination with the plug of the invention, the plug may be manipulated by other types of tools, and the tool may be used on other types of plugs, packers, or drilling tools.

Throughout the present disclosure one practical embodiment of the invention is shown and described, but it will be understood that the invention is in no way restricted or limited to this particular structural arrangement, and that the invention may be practiced by the use of various changes and substitutions and the full use of equivalents without departure from the spirit or scope of the present invention as outlined in the appended claims.

What is claimed is:

1. A well bore or casing bridging plug comprising: a mandrel having an upper section and a lower section telescopically joined together; means for permitting limited telescopic sliding movement between said sections; means interconnecting said sections for initially restraining said sections from said limited telescopic sliding movement; a slip, slip cone, and packing assembly longitudinally slidable mounted on said mandrel; a ring member slidable on said mandrel to apply by sliding movement relative to said mandrel expanding force to said assembly; means for locking said ring member on said mandrel in force-applying position; and means for actuating said means for restraining said sections to release said mandrel sections to permit relative telescopic sliding movement longitudinally therebetween to relieve the said force applied to said assembly by said ring member.

2. In a bridging plug for oil wells or the like: a mandrel having an upper section and a lower section mounted together for limited longitudinal sliding movement relative to one another; a slip and packing assembly slidable mounted on said mandrel; a ring member moveable over one said section to apply by such movement expanding pressure through said assembly to the other said section; means for locking said ring member on said one section in pressure-applying position; releasable means for initially restraining said mandrel sections against said longitudinal movement relative to one another when said pressure is applied by said ring member; and means for releasing said sections to permit said longitudinal movement relative to one another to relieve the said pressure applied by said ring member.

3. A bridging plug as set forth in claim 2 in which the said means for releasing said mandrel sections comprises a bayonet-type slot and pin coupling between said mandrel sections.

4. A device of the character set forth comprising: a mandrel including telescopic sections mounted together for limited longitudinal movement relative to one another; releasable means for initially restraining said sections against said longitudinal movement relative to one another; a shoulder fixed on one of said sections; a ring member slidable on the other of said sections; and a packing assembly mounted on said mandrel between said shoulder and said ring member, said ring member being slidable toward said shoulder to apply expanding pressure to said packing assembly between said ring member and said shoulder, means for locking said ring member on said sections in pressure-applying position, said sections being longitudinally movable upon release to permit movement of said shoulder in a direction away from said ring member to relieve such applied pressure.

5. A device of the character described comprising: a mandrel having an upper section and a lower section; a bayonet-type slot in said lower section; a bar carried by said upper section and extending into said bayonet-type slot; a shoulder on said lower section; a ring member slidable on said upper section; and a packing mounted on said mandrel between said shoulder and said ring member, whereby pressure to expand said packing may be applied by movement of said ring member toward said shoulder; means for locking said ring member on said upper section against movement in a direction away from said shoulder, whereby such pressure may be relieved only by longitudinal movement relative to one another between said sections permitted by actuation of said bar and said bayonet-type slot.

6. A device as set forth in claim 5 in which said means for locking comprises interengaging wickers provided between said ring member and said upper mandrel section to lock said ring member to said section against retrograde sliding movement after expanding pressure has been applied therewith to said packing.

7. A device as set forth in claim 5 in which the bayonet slot is interrupted by a disruputable bridge to restrain said bar from movement therein.

8. A device as set forth in claim 5 in which means are provided to lock said ring to said mandrel against sliding movement thereon in a direction away from said shoulder after the application of expanding force therewith to said packing, and in which means are provided for initially restraining movement of said bar in said bayonet slot.

9. A well bore or casing bridging plug including a composite mandrel, comprising: an upper mandrel section having a central boss at its upper end adapted to receive the pull rod of a setting tool and to be engaged by a fishing tool to be raised and/or turned thereby; up wardly facing wickers on said upper mandrel section; a torque bar extending across said upper mandrel section adjacent its lower end; a ring slidable mounted on said upper mandrel section having wickers engageable with the wickers of said upper mandrel section to permit movement of said ring downwardly over said upper mandrel section and to preclude retrograde movement therebetween; a lower mandrel section telescopically engaging said upper mandrel section; a bayonet slot formed in the upper end of said lower mandrel section and receiving said torque bar therethrough, said slot having a disruputable bridge in one transverse leg thereof; a shoulder formed on said lower mandrel section facing said ring; and a packing assembly mounted on said mandrel between said shoulder and said ring.

10. A bridging plug for a well casing, comprising in combination a two-section, telescopically articulated mandrel, each section thereof having thereon slips and a slip actuating cone, a packing on said mandrel between said cones adapted to be expanded when said slips are set, slip setting means longitudinally slidable on one of said sections having locking engagement therewith when in set position, and interlocking means for said mandrel sections restraining longitudinal sliding movement of said mandrel sections relative to one another but actuable to permit longitudinal movement of said sections relative to one another to release said slips and said packing.

11. A bridging plug for a well casing, comprising in combination a two-section, telescopically articulated mandrel, each section thereof having thereon slips and an actuating cone, a packing on said mandrel between said cones adapted to be expanded when said packing is set, slip setting means longitudinally slidable on one of said sections and having locking engagement therewith when in set position, and interlocking means for said mandrel sections restraining longitudinal sliding movement of said mandrel sections relative to one another but actuable.
to permit longitudinal movement of said sections relative to one another to release said slips and said packing, said last means including a bayonet slot in one of said sections and a torque bar in the other section movable in said slot.

12. A bridging plug for a well casing, comprising in combination a two-section, telescopically articulated mandrel, each section thereof having thereon slips and a slip actuating cone, a packing on said mandrel between said cones adapted to be expanded when said slips are set, slip setting means longitudinally slidable on one of said sections and having locking engagement therewith when in set position, and interlocking means for said mandrel sections restraining longitudinal sliding movement of said mandrel sections relative to one another but actuable to permit longitudinal movement of said sections relative to one another to release said slips and said packing, said interlocking means including a bayonet slot in one of said sections and a bar in the other section movable in said slot, said slot having therein a bar movement restraining web flangible upon the application of predetermined force thereagainst by said bar.

13. A bridging plug for a well casing, comprising in combination a two-section, telescopically articulated mandrel, each section thereof having thereon slips and a slip actuating cone, a packing on said mandrel between said cones adapted to be expanded when said slips are set, slip setting means longitudinally slidable on one of said sections and having locking engagement therewith when in set position, and interlocking means for said mandrel sections restraining longitudinal sliding movement of said mandrel sections relative to one another but actuable to permit longitudinal movement of said sections relative to one another to release said slips and said packing, said slip setting means comprising a sleeve slidable freely longitudinally in a slip setting direction on said mandrel.

14. A bridging plug for a well casing, comprising in combination a two-section, telescopically articulated mandrel, each section thereof having thereon slips and a slip actuating cone, a packing on said mandrel between said cones adapted to be expanded when said slips are set, slip setting means longitudinally slidable on one of said sections and having locking engagement therewith when in set position, and interlocking means for said mandrel sections restraining longitudinal sliding movement of said mandrel sections relative to one another but actuable to permit longitudinal movement of said sections relative to one another to release said slips and said packing, said slip setting means comprising a sleeve slidable freely longitudinally in a slip setting direction on said mandrel, said sleeve carrying mandrel section having external wickers and said sleeve having a cooperative wicker-bearing locking ring.

15. A retrievable bridging plug for a well casing as described, comprising in combination a mandrel having upper and lower, longitudinally slidable telescoping sections, slips and a slip actuating cone therefor on each of said sections, a packing on one of said sections adapted to be expanded laterally by longitudinal compression between said cones, a self-locking sleeve longitudinally slidable on said upper mandrel section and contiguous to said upper slip, said slip actuating cones, packing, and upper slip being longitudinally slidable on their respective mandrel sections to set position by said sleeve with said sleeve locked against retrograde movement on said upper mandrel section, and means securing said sections against telescoping sliding movement relative to one another but adapted to be actuated to permit shifting of one of said sections relative to the other to lengthen the mandrel and release said slips and permit said packing to contract.

16. The invention according to claim 15 wherein said means is actuable to permit lowering of said lower mandrel section and the slip thereon.

17. The invention according to claim 15 wherein said upper mandrel section and the slip thereon have interengaging means effective to release said upper slip when said mandrel section is raised.

18. The invention according to claim 15 wherein said upper mandrel section and the slip thereon have interengaging snap ring and annular groove means engageable to release said upper slip when said mandrel section is raised.

19. The invention according to claim 15 wherein said means is adapted to be actuated by a retrieving tool when connected to said upper section.

20. The invention according to claim 10 wherein said interlocking means includes a substantially Z-shaped slot in the outer telescoping section and a torque bar carried by the inner telescoping section movable in said slot.

21. The invention according to claim 10 wherein said interlocking means includes a substantially Z-shaped slot in the outer telescoping section and a torque bar carried by the inner telescoping section movable in said slot, said slot having a main vertical run and a pair of horizontal runs extending from the ends thereof.

22. The invention according to claim 10 wherein said interlocking means includes a substantially Z-shaped slot in the outer telescoping section and a torque bar carried by the inner telescoping section movable in said slot, said slot having a main vertical run and a pair of horizontal runs extending from the ends thereof, and a second vertical run extending from the end of one of the horizontal runs and being relatively shorter than said main vertical run.

23. The invention according to claim 10 wherein said interlocking means includes a substantially Z-shaped slot in the outer telescoping section and a bar carried by the inner telescoping section movable in said slot, said slot having a main vertical run and a pair of horizontal runs extending from the ends thereof, and a second vertical run extending from the end of one of the horizontal runs and being relatively shorter than said main vertical run, the other of said horizontal runs having therein a bar restraining web initially confining said bar in the end of said horizontal run and flangible upon the application of predetermined force by said bar against said web to permit said bar to move into said main vertical run.

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