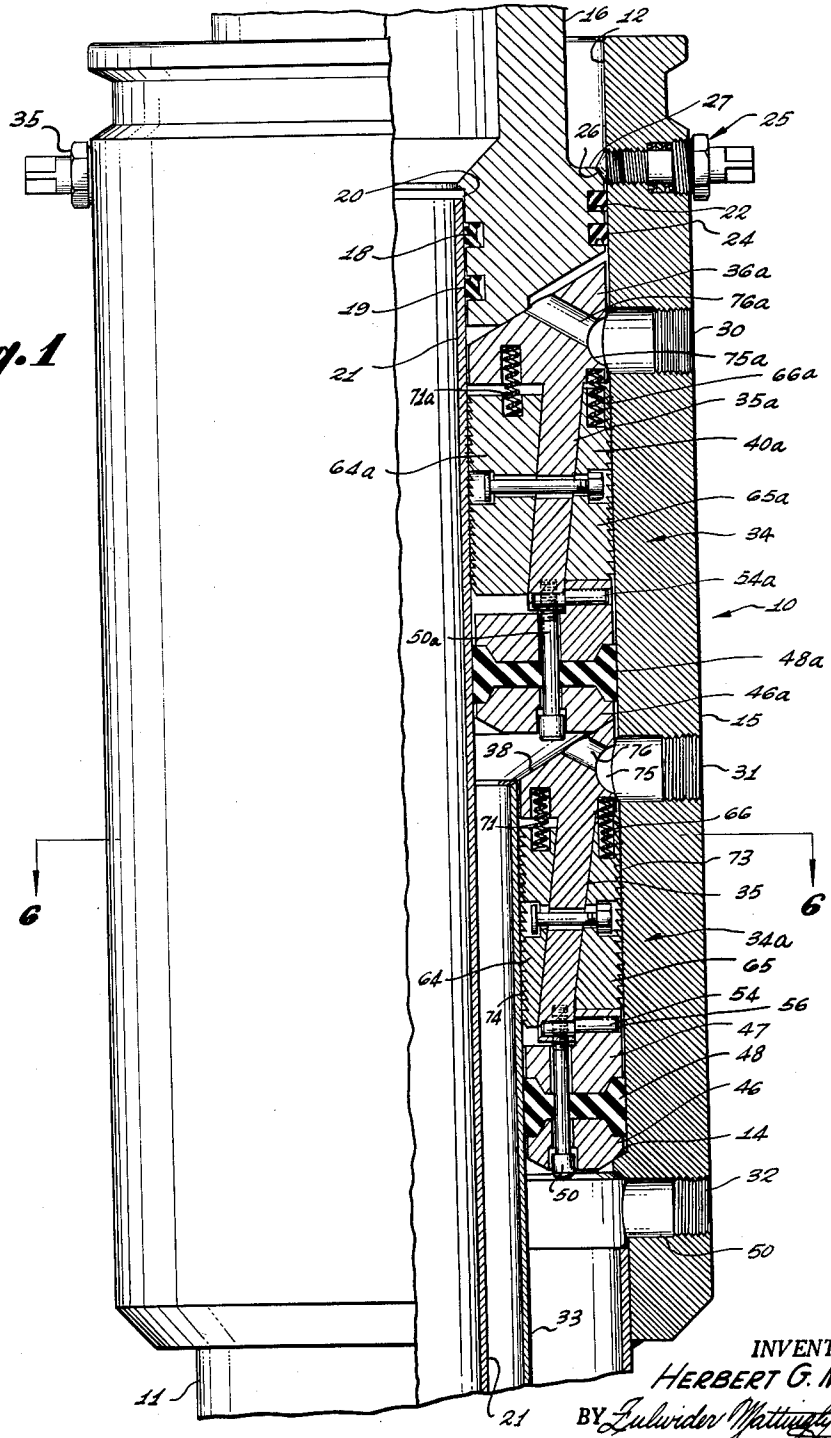
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CASING HEAD

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Fig. 1



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CASING HEAD

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Fig. 2A

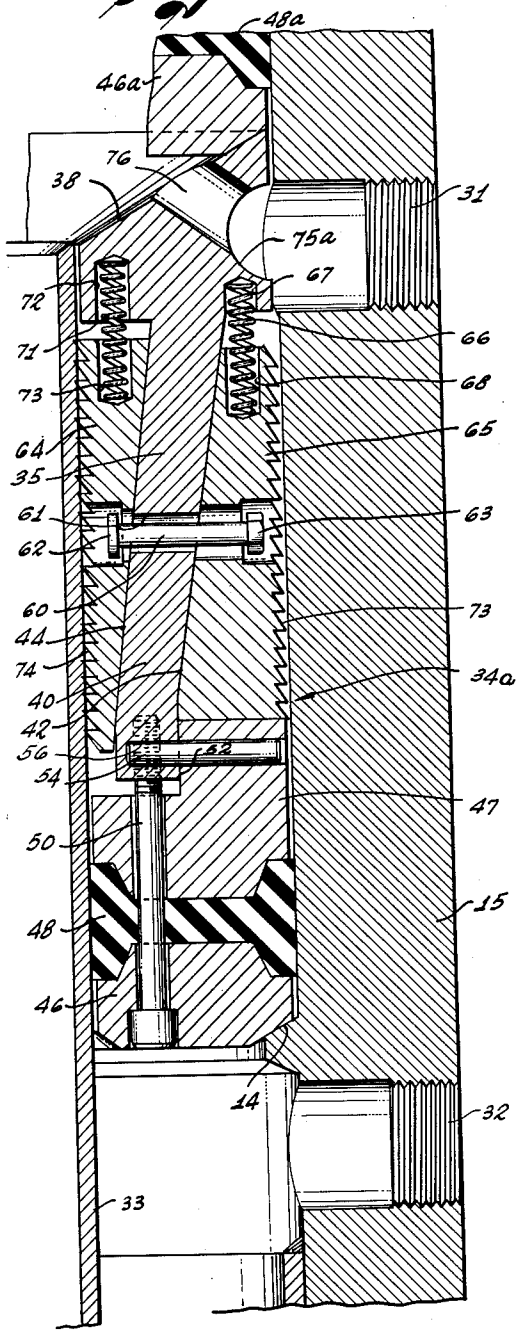
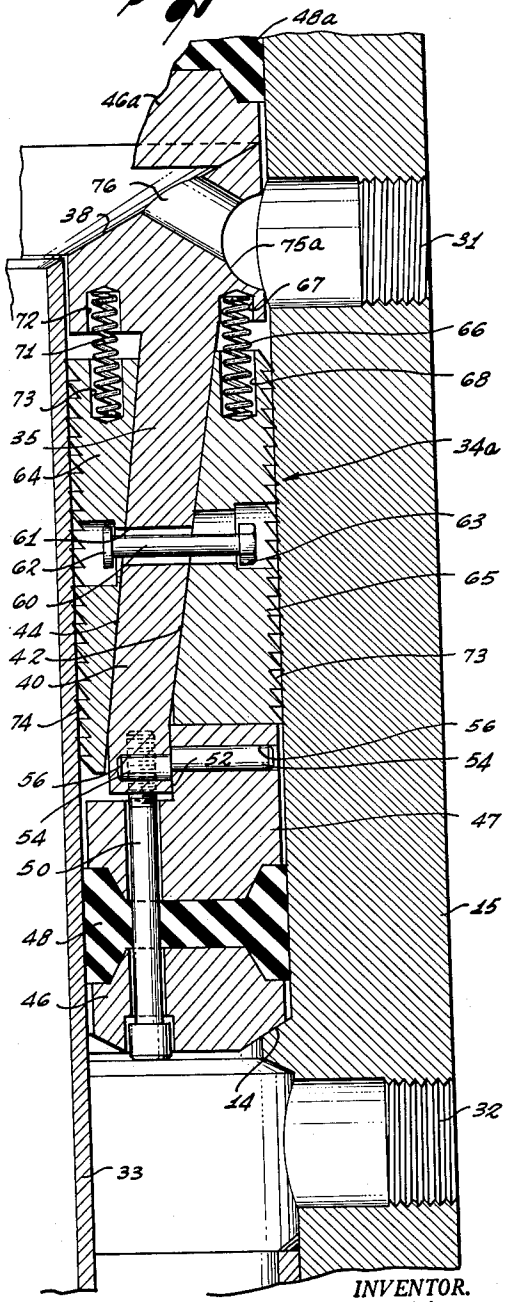


Fig. 2B



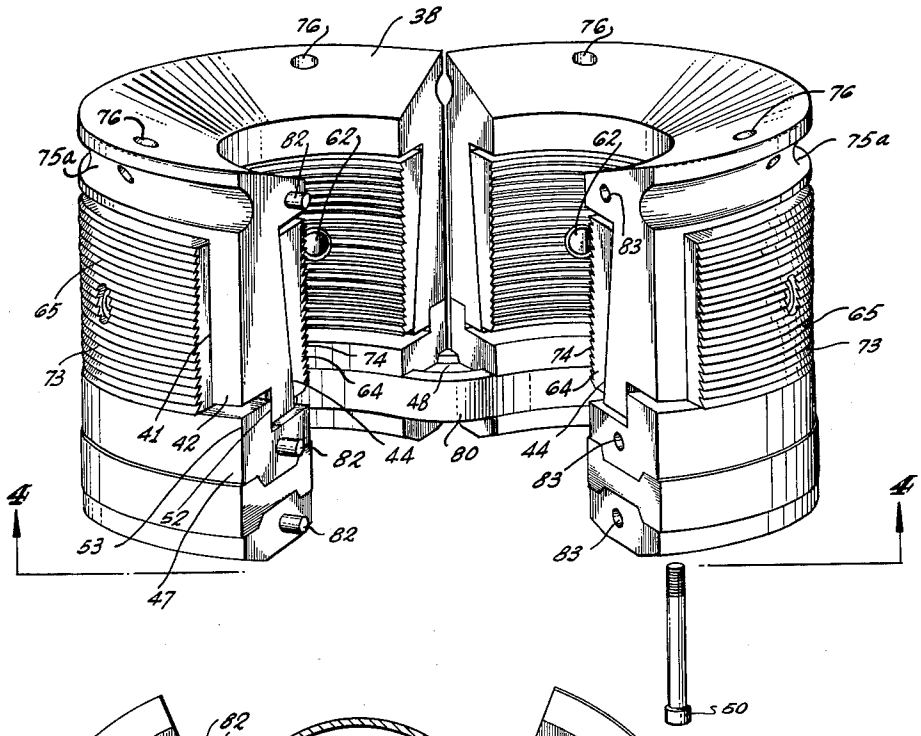
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Fig. 3



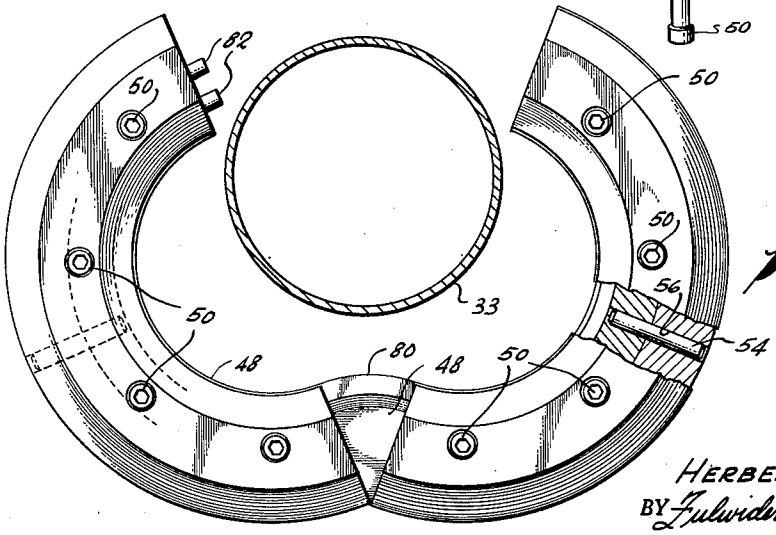


Fig. 4

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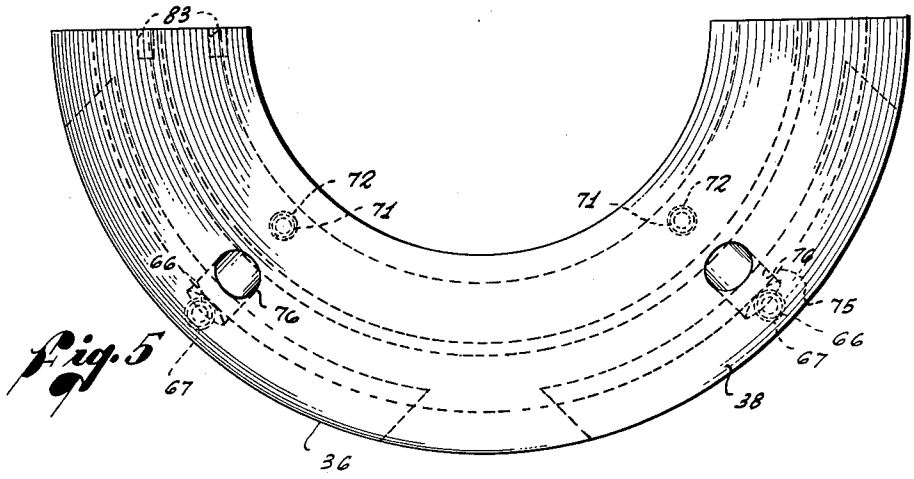


Fig. 5

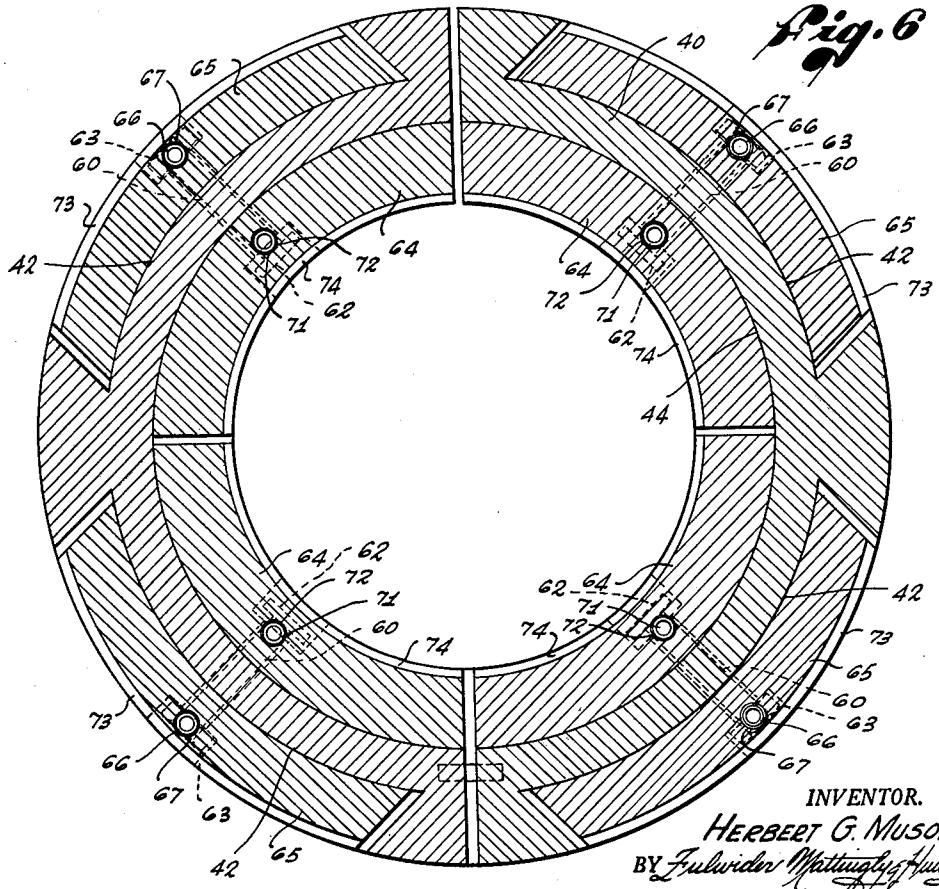


Fig. 6

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3,134,610

CASING HEAD

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Filed Jan. 3, 1961, Ser. No. 80,177
12 Claims. (Cl. 285—3)

This invention relates to well casing head assemblies and more particularly to devices for supporting multiple casings in a well and for providing seals between the casings and the casing head of the well.

Heretofore, conventional practice has required the addition to the casing head assembly of a separate casing head housing spool for each string of casing set in the well. Each such housing spool had to be of a different size and diameter as compared to the preceding spool in order to accommodate the differently sized casing supporting and packing means required for each such successively different sized casing. Thus, each time a well casing was run and set in the well it was necessary to unflange, disconnect and remove the usual well head fittings such as blowout preventers, master gates and associated piping and mechanical connections, add a housing spool having a bore of a lesser inside diameter than that of the preceding housing spool and then readapt and reconnect all of the aforesaid equipment to the newly added housing spool. Each time the foregoing operations are performed the well head assembly must be tested to the rated working pressure of both the drilling blowout preventer assembly and the last installed casing head unit. If the packing seal of the added housing spool and associated connections do not prove to be free of leakage, unflanging and reworking of the leaking seal members and reconnecting of the flanging must then be reperformed. Such procedure is costly in rig time, and furthermore, the well is vulnerable to blowout and fire each and every time any of the foregoing well head installation operations are performed.

Also, with the casing head assemblies heretofore employed, several different kinds of packing devices have been utilized for packing off between well casings and the casing head housing, which for various reasons have not been entirely satisfactory. For example, in one form of casing head pack-off device the casing supporting function was entirely independent of the packing or sealing action and in such cases the pack-off seal was usually provided by separate, manually adjusted means to compress an annular packing body longitudinally thereby to expand it laterally into sealing engagement between the casing and the internal surface of the casing head housing. With such manually operated packing devices it was often difficult to obtain the required fluid-tight seal between the casing and the casing head housing, and such devices had the added disadvantage that the operation and adjustment thereof was complicated and time consuming.

In other types of casing head installations the entire weight of the suspended casing has been employed to apply the longitudinal compressive force and resultant lateral expansion of the sealing element between the casing and surrounding casing head housing. In the latter arrangement, excessive forces were often applied to such packing elements with the result that they were damaged and sometimes extruded from the area in which they should be contained and sometimes the excessive expanding force of the packing element even results in inward collapse of the casing. Such collapse of the casing was sometimes sufficient to preclude the passage of full hole tools into the well.

Casing head assemblies heretofore employed have also, as beforementioned, required a rather large number of separate parts such as flange bolts, nuts, seal rings, clamps, and other connections and fittings.

It is accordingly, therefore, an object of this invention to provide an improved well casing head structure and assembly which has fewer parts, is less expensive to manufacture, and is less time consuming and potentially safer in its assembly and installation in connection with well drilling and completion operations than casing head structures heretofore employed.

Another object of this invention is to provide a casing head assembly in which a plurality of different sized, concentric casings can be run into the well, landed, set and packed-off in a single, initially installed casing head housing and without the necessity of coupling together, one upon another, a corresponding number of coaxial housing spools.

Another object of this invention is to provide a casing head arrangement in which a plurality of concentric casings can be landed, set and packed-off with only one uncoupling and recoupling, disassembly and reassembly operation which has been heretofore impossible.

Another object of this invention is to provide an improved means for effecting the pack-off seal between the casing and the surrounding casing head housing.

Another object of this invention is to provide a casing head in which the pack-off is effected between casing and casing head housing by the action of weight of the suspended casing, but with automatic control of and limitations in the amount of such weight applied to the packing seal.

The objects of this invention are accomplished, in general, by employing a single, one-piece cylindrical casing head housing, having a uniform inside diameter from top to bottom, and the utilization of casing supporting and pack-off unit assemblies for each casing string which have the same outside diameter whereby they may all be successively installed one above the other, in self-supporting position within the single casing head housing.

The objects of the invention are also accomplished in part by employing such pack-off assemblies as beforementioned, in which releasable or frangible control means are employed for automatically applying a limited, controlled amount of the suspended casing weight on the annular packing body for sealing off between the particular casing involved and the adjacent surrounding wall of the casing head housing.

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

In the drawings which illustrate a preferred embodiment of the invention and in which like referenced characters designate the same or similar parts throughout the several views:

FIGURE 1 is a view partially in elevation and partially in vertical section of the casing head assembly apparatus of the invention, illustrating its appearance in connection with the setting of a surface string and two concentric casing strings;

FIGURE 2A is an enlarged vertical sectional view of a portion of the apparatus of FIGURE 1 illustrating the condition of the casing suspension and packing assembly

apparatus for one of the casings just prior to the final setting;

FIGURE 2B is an enlarged vertical sectional elevation of the same portion of the apparatus shown in FIGURE 2A, illustrating the condition of the casing suspension and packing assembly apparatus after final landing and setting of the casing;

FIGURE 3 is a view, in an opened perspective, of the casing suspension and packing seal unit assembly shown in FIGURES 1, 2A and 2B;

FIGURE 4 is a bottom view of the apparatus of FIGURE 3 as viewed from line 4—4;

FIGURE 5 is an enlarged, fragmentary top view of the bowl of FIGURE 3; and

FIGURE 6 is an enlarged, cross-sectional view taken on line 6—6 of FIGURE 1.

The apparatus is as follows:

Referring first primarily to FIGURE 1, 10 designates generally the casing head assembly mounted in a conventional manner upon the upper end of an outer string of casing 11, such as the usual surface pipe of a well. The casing head assembly of this invention departs from the generally conventional form by having a single housing 15 having an internal bore 12 of uniform inside diameter throughout its length except for an inwardly projecting, beveled annular shoulder 14 located adjacent the lower end thereof for supporting a portion of the casing setting assembly contained within the housing, as hereinafter more fully described.

The upper end of the cylindrical housing 15 contains and is closed by a tubing suspension mandrel housing 16 to which well tubing (not shown) may be connected and from which it may be suspended in the well. A pair of annular packing rings contained in inwardly facing annular ring grooves as shown at 18 and 19, serve to form a fluid-tight seal between the inner bore 20 of the tubing suspension mandrel housing 16 and the exterior upwardly extending portion of a casing 21 suspended in the casing head housing. Another pair of annular rings contained in outwardly facing annular ring grooves as shown at 22 and 24 serve to make a fluid-tight seal between the exterior, cylindrical surface of the tubing suspension mandrel housing 16 and the inner wall surface of the bore 12 of the housing 15. The tubing suspension mandrel is retained against upward movement in the upper end portion of the bore 12 of the housing 15 by means of a plurality of locking screws 25, threaded laterally through the wall of the housing 15 and having beveled inner ends which make locking engagement with a corresponding annular bevel 26 extending around the periphery of a shouldered portion 27 of the exterior of the tubing suspension mandrel housing 16.

A plurality of longitudinally spaced-apart, threaded outlet openings are provided through the wall of the housing 15, as shown at 30, 31 and 32, each of which communicate with an annulus between the casings set in the casing head housing, and which are adapted for making connection to exterior piping comprising the valve controls as is conventional practice.

By way of illustration of the apparatus of this invention as best shown in FIGURE 1 two different sized concentric casings 21 and 33 are shown set and supported within the casing head housing 15 by upper and lower casing supporting and packing unit assemblies designated generally by the numerals 34 and 34*a* respectively, which in the assembly of the casing head are inserted through the top of the housing 15 into the annular clearance spaces between the beforementioned casings 21 and 33 and the inner wall of the bore 12.

Considering first the lowermost one of the composite casing suspension and packing unit assemblies 34*a* for supporting and packing-off casing 33, this assembly has, as the main structural element thereof, a so-called slip bowl designated generally at 35. The slip bowl, together with other portions of the unit assembly such as the packing ring and packing compression rings hereafter to be described, are preferably although not necessarily, each formed in two semi-cylindrical halves, as best shown in FIGURES 3 and 4. However, the slip bowl, and the aforesaid rings, may, with some sacrifice in convenience of installation, be made in the form of individual annular bodies.

The slip bowl 35, comprising two half sections as first beforementioned, is formed, when closed together in assembled form, with an annular upper end portion 36 having an inwardly beveled upper end surface, as shown at 38, and an integral, lower generally cylindrical downwardly extending slip-supporting bowl member 40. The outer surface of the bowl member 40 has formed in it a plurality, namely four as herein illustrated, circumferentially spaced-apart rectangular slip recesses 41 each formed with an inner slip-supporting wall surface 42 of a downwardly, inwardly converging, frusto-conical shape. The inner surface 44 of the bowl member 40 is of a downwardly converging, frusto-conical shape, substantially coextensive with the outer slip-supporting surfaces 42. The slope of the aforesaid outer frusto-conical slip supporting surfaces 42 are preferably, as best shown in FIGURES 2A and 2B, of a slightly greater slope relative to the longitudinal axis of the bowl than the inner surface 44, for reasons which will be hereinafter described.

The lower portion of the casing suspension and packing assembly is composed of a lower packing compression ring or packing supporting ring 46, an upper packing compression ring 47 and an intermediate resilient packing ring 48, all three such rings being positioned coaxially in the annulus formed between the exterior of casing 33 and the inner surface of bore 12 of the housing 15. A plurality of downwardly extending cap screws 50, threaded at their upper ends into circumferential spaced-apart threaded holes in the lower end portion of the bowl member 40, pass relatively loosely through correspondingly spaced holes in the rings 46 and 47 and packing ring 48, and serve initially to retain the aforesaid rings and packing body together in coaxial assembly with the bowl 35.

The marginal portion of the outer surface of the bowl member 40, adjacent the bottom end thereof, has a coaxial, cylindrical shape as shown at 52, which fits in axially slidable engagement within a corresponding, inwardly-facing cylindrical surface formed around an upwardly-extending annular portion 53 of the compression ring 47. The bowl member 40 and the compression ring 47 are initially restrained against axial sliding movement relative to one another along surface 52 by means of a plurality of shear pins 54, which extend through aligned, radial drill holes 56 and 58 in the annulus 53 of the compression ring 47 and the lower marginal portion of the slip-supporting bowl member 40, respectively.

The bowl member 40 carries a plurality of external, upwardly tapered slips 65, each such slip being contained in one of the beforementioned slip recesses 41 in the bowl member and each adapted to slide longitudinally on one of the frusto-conical surfaces 42 thereof, but biased in an initial, downward position thereon by means of a spring 66. The upper end of each spring 66 is secured in an upper cylindrical recess 67 in the annular portion 36 of the bowl member 40, and the lower portion of each is contained in a corresponding cylindrical recess 68 in the upper end portion of the slip 65. The slip-supporting bowl member 40 also carries a plurality of internal, downwardly tapered slips 64, each adapted to slide longitudinally on the internal, frusto-conical surface 44 of the skirt member but biased in an initial, downward position thereon by means of a spring 71. The upper end portion of each spring 71 is contained in a cylindrical recess 72 in the annular portion 36 of the bowl member 40, and the lower portion of each is contained in a corresponding cylindrical recess 73 in the upper end of the slip 64.

A plurality of radial bolts, as shown at **60**, extend loosely through circumferentially spaced-apart holes **61** in the mid section of the slip-supporting bowl member **40** and in longitudinally elongated holes in the inner and outer slips **64** and **65** thereon. Each of said bolts have an inner head **62** and an outer nut **63** contained in suitable recesses in the inner and outer slips **64** and **65**, respectively. Such bolts serve initially to retain the slips **64** and **65** and the slip-supporting bowl member **40** in a loosely assembled relation to facilitate the insertion of the assembly in the casing head housing together with a string of casing to be set and suspended thereby.

The outer slips **65** are provided with exterior, downwardly directed serrations or wickers, as shown at **73**, adapted to make gripping engagement with the inner wall surface of the bore **12** of the housing **15** and thereby resist downward movement thereof with respect to the cylindrical housing. Likewise, the inner slips **64** are provided with inwardly, upwardly projecting serrations or wickers as shown at **74**, adapted to make gripping engagement with the exterior surface of casing **33** and resist downward movement of the casing with respect to said slips **64**.

The upper annular portion **36** of the bowl member **40** is provided with an outwardly facing circumferential groove **75** positioned to register with an outlet such as the outlet **31** through the wall of the housing **15**, and serves by way of the inwardly extending duct **76** to provide communication between the exterior of the housing **15** and the annulus between the casings **21** and **33**, and through which fluid may be introduced into or produced from the well.

The upper casing supporting and packing unit assembly **32**, as shown in FIGURE 1, is of substantially the same construction as that hereinbefore described for the lower unit assembly **34***a*, except that the upper assembly **34** has a smaller inside diameter and an overall annular thickness greater than that of the lower assembly to accommodate the wider annular space between the smaller sized inner casing **21** and the bore **12** of the housing **15**. The packing supporting ring **46***a* of the upper assembly **34** is supported upon the beveled upper end surface **38** of the bowl **40** of the lower complete assembly **34***a*.

The upper annular portion **36***a* of the upper bowl member **40***a* is similar to the annular portion **36** of the lower bowl member **40**, and is provided with an outwardly-facing, circumferential annular groove **75***a* which connects on its inner side with ducts **76***a* and registers on its outer side with the outlet opening **30** extending through the wall of the housing **15**. When still another string of casing (not shown) is set within the casing **21**, then the ducts **76***a* serve to communicate, as in the case of duct **76**, with the annulus between such casings.

Referring again to the slip bowl and packing unit assembly, as seen particularly in FIGURES 3 and 4, the slip bowl member **40**, lower packing compression ring or supporting ring **46** and upper packing compression ring **47** are split diametrically into two semi-circular halves. The outer slip recesses **41** and both the inner and outer segmented slips **64** and **65** are positioned on the slip bowl in such manner as to permit the aforesaid division without intersection of any slip or slip recess. The packing ring **48** is preferably split on only one side, whereby the sealing ring will serve somewhat as a flexible hinge member at the point indicated at **80**, which will allow the assembly to be opened and closed for application to and removal from casing. The adjacent ends of the adjoining halves of the bowl member **40** and of the packing supporting and packing compression rings **46** and **47**, respectively, are provided with cooperating sets of dowels as shown at **82**, and holes as shown at **83**, adapted to engage one another to prevent relative misalignments between the elements when the segments of the unit are closed about a casing.

The operation of the apparatus of the invention is as follows:

The hereinbefore described casing supporting and packing unit **34***a*, initially opened as illustrated in FIGURES 3 and 4, is applied to and closed about the casing being lowered into setting position in the well, it being understood that the casing will previously have been inserted into the well through the cylindrical casing head housing **10** and usually through a series of previously installed, conventional well head fittings, such as blowout preventers, master gates and the like (not shown) which will ordinarily be coupled in position on top of the casing head housing. At this initial stage of the operation, the casing, for example casing **33**, will usually be suspended in the well derrick from the usual elevators and hoisting and lowering equipment (not shown).

When the casing supporting and packing unit **34***a* including the bowl member **40** and the attached packing elements, rings and slips have been closed about the casing, the unit **34***a* will be allowed or caused to slide down the casing and enter into the annular space between the casing and the inside wall of the bore **12**, of the housing **15**, and come to rest at the position shown in FIGURE 2A. As the unit **34***a* reaches the aforesaid position in the housing **15**, the lower packing compression or supporting ring **46** will seat upon the shoulder **14** in the lower portion of the bore **12** of the housing **15**, thereby, initially supporting the weight of the whole unit assembly at that position through the lower supporting or compression ring **47**, packing ring **48**, upper compression ring **47** and shear pins **54**. During the before described downward sliding movement of the casing supporting and packing unit assembly **34***a*, the inner slips **64**, by reason of their weight and the downward force exerted thereon by the springs **71**, will have tended to slide downwardly and inwardly along the inclined surface **44** of the bowl member **40** such that the wickers **74** thereof were retained in sliding engagement with the outside surface of the casing **33**.

After the unit has reached its seated position in the annulus, on the shoulder **14** as beforementioned, any subsequent downward movement of the casing **33**, relative to the casing head housing as by slacking off of the derrick lines and lowering of the casing elevators by means of which the casing is suspended in the well, will tend further to move the inner slips **64** downwardly along the sloping surface **44** in the bowl member **40**, thereby wedging the slips **64** firmly in gripping engagement with the casing **33**, and thereby anchoring the casing against further downward movement relative to bowl member **40** of assembly **34***a*. Upon further downward movement of the casing, a portion of the weight of the casing will then be transferred through the slips **64** to the bowl member **40** which will, therefore, tend to move downwardly in the casing head housing **15**. The load thus transferred to the bowl member **40** will then, in turn, be transferred through the shear pins **54** to the upper compression ring **47**, and thence through the packing ring **48** and the supporting ring **46** to the shoulder **14** of the casing head housing **15**. The weight thus transferred from the casing through the packing ring **48** will commence to compress it longitudinally and thus expand it radially into sealing engagement between the adjacent outside surface of the casing **33** and the inside wall surface of the bore **12** of the housing **15**, thereby packing-off the annular space between the casing and the casing head housing.

Upon still further slackening off of the casing supporting lines and resultant lowering of the casing elevator in the derrick, the casing **33** will be permitted to move a still further increment of distance downward in the well thereby further increasing the load and resultant force transferred from the casing through the bowl member **40**, shear pins **54** and through the packing ring **48** until the compression force applied to the packing ring is sufficient to shear the pins **54**, as shown in FIGURE 2B. The maximum longitudinal compressive force which is thus

applied to the packing ring 48 upon completion of the pack-off is limited to the total force required to shear the several shear pins 54, and thereafter further lowering of the casing 33 results in no additional force being applied to the packing ring 48, but results only in downward telescoping displacement of the bowl member 40 relative to the lower compression or supporting ring 47 along the marginal cylindrical surface 52.

Upon shearing of the shear pins 54, as aforesaid, the outer slips 65, the lower ends of which rest on the upper annular end portion 53 of the upper packing compression ring 47, are, by reason of the beforementioned relative movement between the bowl member 40 and the compression ring 47, moved upwardly and outwardly along the outer inclined surfaces 42 of the slip recesses 41 of the bowl member 40 into contact with the inside surface of the bore 12 of the housing 15. Following this, still further downward movement of the casing 33 is transferred through the slips 65 to the bowl member 40 resulting in downward movement of the bowl member 40, relative to the slips 65, thereby wedging the slips 65 outwardly into gripping engagement with the wall of bore 12 of the casing housing 15 and finally transferring the remaining casing load to be supported—other than the portion of the load taken through the compression ring 47, packing ring 48 and supporting ring 46 to the casing head housing by way of the inner slips 64, bowl member 40 and outer slips 65.

The setting of the inner casing 21 is similar to that hereinbefore described in connection with setting of casing 33, except that the upper casing supporting and pack-off unit 34 is lowered about the casing 21 until the lower packing supporting ring 46*a* thereof comes into seating position upon the upper conical surface 38 of the upper portion 36 of the bowl member 40. Thereafter, upon lowering of the casing 21, the casing load transferred therefrom through the unit 34 is supported through the lower bowl member 40 and the outer slips 65 up to a maximum which is that required to shear the shear pins 54*a* of the upper unit 34. Thereafter, the balance of the load from the casing 21 is transferred from the inner slips 64*a* through the bowl member 40*a* and through the outside slips 65*a* to the casing head housing 15, in the same manner as hereinbefore described in connection with the lower unit 34*a*. The compressive force applied to the upper packing ring 48*a* of the upper unit 32 is thus limited to a predetermined maximum in the same manner as hereinbefore described in connection with the packing ring 48 of lower unit 34*a*.

This operation may be repeated in continuation for as many casing strings as may be required.

Following the beforedescribed installation of the upper unit 34, or the last such unit installed if there are more than the two units herein illustrated, the tubing suspension mandrel is lowered into the remaining upper portion of the bore 12 of the housing 15 and secured in place by the locking screws 25.

As hereinbefore mentioned, the outside slip-supporting surfaces 42 of the bowl member 40 preferably have slopes which are greater relative to the axis of the slip bowl member 40, than that of the inner slip-supporting surface 44, in order to obtain the outward motion of the outer slips 65 required for initial engagement with the inside surface of the housing bore 12, by the relatively limited longitudinal motion available between the bowl member 40 and the packing compression ring 47 upon shearing of the pins 54. Also, this slope is made greater to limit the radial stress exerted by these slips upon the housing 15 since they support, in addition to the weight of the casing of that particular unit, the force applied through the packing of the next above, superimposed casing-supporting unit.

While, by way of illustration, the apparatus and mode of operation of this invention has been described in connection with the setting of only two concentric casing strings, it is obviously applicable to the setting of a lesser or greater number of concentric strings, with a corresponding number of casing supporting and packing unit assemblies in a single casing head housing, the number of casing strings which may be so set in the casing head being limited only by the convenient and practical length and diameter of the casing head housing which would be required.

It is to be understood that the foregoing is illustrative only and that the invention is not limited thereby, but may include various modifications and changes made by those skilled in the art without distinguishing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. Well head casing suspension and packing apparatus comprising: a generally annular slip bowl member, said bowl member being formed with interior and exterior, substantially longitudinally coextensive, downwardly converging surfaces; outer, upwardly tapered slip means slidably positioned on said exterior surface of said bowl member for grippingly engaging the interior surface of the bore of a surrounding cylindrical housing upon downward movement of said bowl member relative to said slip means; inner, downwardly tapered, segmental slip means slidably positioned on said interior surface of said bowl member for grippingly engaging the exterior surface of a casing to be supported thereby in such housing, the aforesaid bowl member and slip means thereby being adapted to be disposed in the annular space formed between the inside surfaces of such bore and the external surface of such casing.

2. Well head casing suspension and packing apparatus comprising: a housing having a longitudinal bore therethrough of substantially uniform inside diameter; a generally annular slip bowl member contained in said bore, said bowl member being formed with interior and exterior, substantially longitudinally coextensive, downwardly converging surfaces; outer, upwardly tapered, segmental slip means slidably positioned on said exterior surface of said bowl member for grippingly engaging the interior surface of said bore upon downward movement of said bowl member relative to said slip means; resilient means urging said outer slip means to slide downwardly on said exterior surface relative to said bowl member thereby tending to retain said outer slip means inwardly retracted; inner, downwardly tapered, segmental slip means slidably positioned on said interior surface of said bowl member for grippingly engaging the exterior surface of a casing to be supported thereby in said housing; resilient means urging said inner slip means to slide downwardly on said exterior surface relative to said bowl member thereby tending to retain said inner slip means in extended, casing-gripping position, the aforesaid bowl member and slip means thereby being disposed in the annular space formed between the inside surface of said bore and the exterior surface of such casing.

3. Well head casing suspension and packing apparatus comprising: a cylindrical housing having a longitudinal bore therethrough of substantially uniform inside diameter; a generally annular slip bowl assembly contained in said bore, said slip bowl assembly including a bowl member formed with an annular end portion and an integral coaxial, longitudinally extending body portion, said body portion having interior and exterior, substantially longitudinally coextensive, coaxial, downwardly converging, slip-supporting surfaces, a plurality of outer, upwardly tapered, segmental slips slidably positioned on said exterior surfaces of said body portion for grippingly engaging the interior surface of said bore upon downward movement of said bowl relative to said slips; a plurality of inner, downwardly tapered, segmental slips slidably positioned on said interior surfaces of said body portion for grippingly engaging the exterior surface of a casing

to be supported thereby in said housing, the aforesaid bowl and slips thereby being disposed in the annular space formed between the inside surface of said bore and the external surface of such casing.

4. Well head casing suspension and packing apparatus comprising: a cylindrical housing having an inner longitudinal bore therethrough of substantially uniform inside diameter; a generally annular slip bowl contained in said bore, said bowl being formed with an annular end portion and an integral, coaxial, longitudinally extending body portion, said body portion having interior and exterior, substantially longitudinally coextensive, downwardly converging, slip-supporting surfaces; outer, upwardly tapered, segmental slip means slidably positioned on said exterior slip-supporting surface of said body portion for grippingly engaging the interior surface of said bore upon downward movement of said bowl relative to said slip means; resilient means urging said outer slip means to slide downwardly on said exterior surface relative to said body portion thereby tending to retain said outer slip means inwardly retracted; inner, downwardly tapered, segmental slip means slidably positioned on said interior slip-supporting surface of said body portion for grippingly engaging the exterior surface of a casing to be supported thereby in said housing; resilient means urging said inner slip means to slide downwardly on said interior slip-supporting surface relative to said body portion thereby tending to retain said inner slip means in extended, casing-gripping position, the aforesaid bowl and slip means thereby being disposed in the annular space formed between the inside surface of said bore and the external surface of such casing.

5. Well head casing suspension and packing apparatus comprising: a cylindrical casing head housing having a longitudinal bore of substantially uniform inside diameter extending therethrough; a generally annular slip bowl assembly contained in said bore, said bowl being formed with interior and exterior substantially longitudinally coextensive, coaxial, downwardly converging surfaces; outer, upwardly tapered, slip means slidably positioned on the said exterior surface of said bowl for grippingly engaging the interior surface of said bore upon downward movement of said bowl relative to said slip means; inner, downwardly tapered, slip means slidably positioned on the said exterior surface of said bowl for grippingly engaging the exterior surface of a casing to be supported thereby in said housing, the aforesaid bowl and slip means thereby being disposed in the annular space formed between the inside surface of said bore and the external surface of such casing; a packing assembly positioned coaxially in said annular space below said slip bowl, said assembly having a lower packing compression ring and a resilient packing ring thereon; supporting means within said bore for supporting said compression ring at a predetermined longitudinal location within said housing; and means to transfer longitudinal force from said bowl through said packing ring and said compression ring to said supporting means, thereby to compress longitudinally and expand laterally said packing ring into sealing engagement between said housing bore and such casing.

6. Well head casing suspension and packing apparatus comprising: a casing head housing having a longitudinal bore of substantially uniform inside diameter extending therethrough; supporting means adjacent the lower end portion of said housing; a generally annular slip bowl assembly contained in said bore, said bowl being formed with interior and exterior substantially longitudinally coextensive, coaxial, downwardly converging slip-supporting surfaces; outer, upwardly tapered, segmental slip means slidably positioned on the said exterior slip-supporting surfaces of said bowl for grippingly engaging the interior surface of said bore upon downward movement of said bowl relative to said slip means; a plurality of inner, downwardly tapered, segmental slip means slidably positioned on the said exterior slip-supporting surfaces of said bowl for grippingly engaging the exterior surface of a casing to be supported thereby in said housing, the aforesaid bowl and slip means thereby being disposed in the annular space formed between the inside surface of said bore and the external surface of such casing; a packing assembly attached coaxially to the lower portion of said bowl, said assembly having an upper packing compression ring, a lower packing compression ring and a resilient packing ring therebetween, said packing ring and said lower compression ring having limited freedom for longitudinal motion with respect to said bowl, and said lower compression ring normally being supported upon said supporting means; and releasable connecting means initially longitudinally immovably interconnecting said upper packing compression ring and said bowl, said connecting means being adapted to be released upon application of a predetermined maximum longitudinal force therethrough from said bowl through said upper compression ring, said packing ring and said lower compression ring to said supporting means, thereby to compress longitudinally and expand laterally said packing ring into sealing engagement between said housing bore and such casing under a predetermined maximum force.

7. Well head casing suspension and packing apparatus comprising: a casing head housing having a longitudinal inner bore of substantially uniform inside diameter extending therethrough from the top thereof to an inwardly extending shoulder adjacent the lower end portion thereof; a generally annular slip bowl assembly contained in said bore, said bowl being formed with interior and exterior substantially longitudinally coextensive, coaxial, downwardly converging slip-supporting surfaces; outer, upwardly tapered, segmental slip means slidably positioned on the said exterior slip-supporting surfaces of said bowl for grippingly engaging the interior surface of said bore upon downward movement of said bowl relative to said slip means; a plurality of inner, downwardly tapered, segmental slip means slidably positioned on the said exterior slip-supporting surfaces of said bowl for grippingly engaging the exterior surface of a casing to be supported thereby in said housing, the aforesaid bowl and slip means thereby being disposed in the annular space formed between the inside surface of said bore and the external surface of such casing; a packing assembly positioned coaxially in said annular space below said bowl, said assembly having an upper packing compression ring, a lower packing compression ring and a resilient packing ring therebetween, said packing ring and said lower packing compression ring having limited freedom for longitudinal motion with respect to said bowl, and said lower compression ring normally being supported upon the upper surface of said shoulder; and releasable connecting means initially longitudinally immovably interconnecting said upper packing compression ring and said bowl, said connecting means being adapted to be released upon application of a predetermined maximum longitudinal force therethrough from said bowl through said upper compression ring, said packing ring and said lower compression ring to said shoulder, thereby to compress longitudinally and expand laterally said packing ring into sealing engagement between said housing bore and such casing under a predetermined maximum force.

8. Well head casing suspension and packing apparatus comprising: a casing head housing having a longitudinal bore of substantially uniform inside diameter extending from the top thereof to an inwardly extending shoulder adjacent the lower end portion thereof; a generally annular slip bowl contained in said bore, said bowl being formed with interior and exterior substantially longitudinally coextensive, coaxial, downwardly converging slip-supporting surfaces; a plurality of outer, upwardly tapered, segmental slips slidably positioned on such exterior surfaces of said bowl for grippingly engaging the interior surface of said bore upon downward movement of

said bowl relative to said slips; a plurality of inner, downwardly tapered, segmental slips slidably positioned on such interior slip-supporting surfaces of said bowl for grippingly engaging the exterior surface of a casing to be supported thereby in said housing, the aforesaid bowl and slips thereby being disposed in the annular space formed between the inside surface of said bore and the external surface of such casing; a packing assembly positioned in said annular space below said slip bowl and attached to the lower portion of said bowl with limited freedom for longitudinal motion with respect thereto, said assembly having an upper packing compression ring, a lower packing compression ring and a resilient packing ring therebetween, said lower compression ring normally being supported upon the upper surface of said shoulder, and the said outer slips additionally being supported upon said upper compression ring for movement thereby relative to said exterior surfaces of said slip bowl; and frangible means initially longitudinally immovably interconnecting said upper packing compression ring and said bowl, said frangible means being adapted to be disrupted upon application of a predetermined maximum longitudinal force therethrough from said bowl through said upper compression ring, said packing ring and said lower compression ring to said shoulder, thereby to compress longitudinally and expand laterally said packing ring into sealing engagement between said housing bore and such casing under said predetermined maximum force.

9. Well head casing suspension and packing apparatus comprising: a casing head housing having a longitudinal bore of substantially uniform inside diameter extending from the top thereof to supporting means adjacent the lower end portion thereof; a generally annular slip bowl contained in said bore, said bowl being formed with interior and exterior, substantially longitudinally coextensive, coaxial, downwardly converging slip-supporting surfaces; outer, upwardly tapered, segmental slips slidably positioned on such exterior slip-supporting surfaces of said bowl for grippingly engaging the interior surface of said bore upon downward movement of said bowl relative to said outer slips; inner, downwardly tapered segmental slips slidably positioned on such interior slip-supporting surfaces of said bowl for grippingly engaging the exterior surface of a casing to be supported thereby in said housing, the aforesaid bowl and slips thereby being coaxially disposed in the annular space formed between the inside surface of said bore and the external surface of such casing; a packing assembly positioned in said annular spaced below said slip bowl, said assembly having an upper packing compression ring, a lower packing compression ring and a resilient packing ring therebetween, said resilient packing ring and said lower packing compression ring being movable longitudinally with respect to said bowl, said lower compression ring normally being supported upon the said supporting means and the said outer slips being supported upon the said upper packing compression ring for movement thereby relative to the exterior slip-supporting surfaces of said slip bowl upon movement of said upper compression ring relative to said bowl; and releasable connecting means initially, longitudinally immovably interconnecting said upper compression ring and said bowl, said connecting means being adapted to be released and thereby free said upper compression ring for longitudinal movement relative to said bowl, upon application of a predetermined maximum longitudinal weight from said bowl through said upper compression ring, said packing ring and said lower compression ring to said supporting means, said predetermined maximum weight being less than the whole weight of the casing to be supported in said housing, thereby to compress longitudinally and expand laterally said packing ring into sealing engagement between the said housing bore and such casing under a weight not greater than said predetermined maximum weight and thereby also to permit and cause downward movement of said bowl relative to said upper compression ring, thereby to move said slip bowl downwardly relative to said outer slips supported upon said upper compression ring, whereby said outer slips are moved outwardly into gripping engagement with said interior surface of said bore whereby the balance of the weight of such casing, in excess of the weight applied through said packing ring, is supported through said outer slips by said housing.

10. Well head casing suspension and packing apparatus comprising: a casing head housing having a longitudinal bore of substantially uniform inside diameter extending from the top thereof to an inwardly extending shoulder adjacent the lower end portion thereof; a generally annular slip bowl contained in said bore, said bowl being formed with interior and exterior, substantially longitudinally coextensive, coaxial, downwardly converging slip-supporting surfaces; a plurality of outer, upwardly tapered, segmental slips slidably positioned on such exterior slip-supporting surfaces of said bowl for grippingly engaging the interior surface of said bore upon downward movement of said bowl relative to said outer slips; a plurality of inner, downwardly tapered segmental slips slidably positioned on such interior slip-supporting surfaces of said bowl for grippingly engaging the exterior surface of a casing to be supported thereby in said housing, the aforesaid bowl and slips thereby being coaxially disposed in the annular space formed between the inside surface of said bore and the external surface of such casing; a packing assembly positioned in said annular space below said slip bowl and attached to the lower portion of said bowl, said assembly having an upper packing compression ring, a lower packing compression ring and a resilient packing ring therebetween, said resilient packing ring and said lower packing compression ring having limited freedom for longitudinal motion with respect to said bowl, said lower compression ring normally being supported upon the upper surface of said shoulder and the said outer slips being supported upon the said upper packing compression ring for movement thereby relative to the exterior slip-supporting surfaces of said slip bowl upon movement of said upper compression ring relative to said bowl; and frangible means initially longitudinally immovably interconnecting said upper compression ring and said bowl, said frangible means being adapted to be disrupted and thereby free said upper compression ring for longitudinal movement relative to said bowl, upon application of a predetermined maximum longitudinal weight therethrough from said bowl through said upper compression ring, said packing ring and said lower compression ring to said shoulder, said predetermined maximum weight being less than the whole weight of the casing to be supported in said housing, thereby to compress longitudinally and expand laterally said packing ring into sealing engagement between the said housing bore and such casing under a weight not greater than said predetermined maximum weight and thereby also to permit and cause downward movement of said bowl relative to said upper compression ring, thereby to move said slip bowl downwardly relative to said outer slips supported upon said upper compression ring, whereby said outer slips are moved outwardly into gripping engagement with said interior surface of said bore whereby the balance of the weight of such casing, in excess of the weight applied through said packing ring, is supported through said outer slips by said housing.

11. Well head casing suspension and packing apparatus comprising: a casing head housing having an inner longitudinal bore of substantially uniform inside diameter extending from the top thereof to an inwardly extending supporting means adjacent the lower end portion thereof; a first generally annular slip bowl contained in said bore, said first bowl being formed with interior and exterior substantially longitudinally coextensive, coaxial, downwardly converging slip-supporting surfaces; outer, up-

wardly tapered, slip means slidably positioned on said exterior slip-supporting surfaces of said slip bowl for grippingly engaging the interior surface of said bore upon downward movement of said first bowl relative to said outer slip means; inner, downwardly tapered, slip means slidably positioned on the said interior slip-supporting surfaces of said first bowl for grippingly engaging the exterior surface of a first casing to be supported thereby in said housing, the aforesaid first bowl and slip means thereon thereby being disposed in the annular space formed between the inside surface of said bore and the external surface of such first casing; a first packing assembly positioned coaxially in said annular space below said first slip bowl, said first packing assembly having a first lower packing compression ring and a first resilient packing ring thereon, said first compression ring normally being supported upon said supporting means, whereby a longitudinal force may be applied from said first bowl through said first packing ring and said first compression ring to said supporting means, thereby to compress longitudinally and expand laterally said first packing ring into sealing engagement between said housing bore and such casing; a second generally annular slip bowl contained in said bore, said second bowl being formed with interior and exterior substantially longitudinally coextensive, coaxial, downwardly converging slip-supporting surfaces; outer, upwardly tapered slip means slidably positioned on said exterior slip-supporting surfaces of said slip bowl for grippingly engaging the interior surface of said bore upon downward movement of said second bowl relative to said slip means; inner, downwardly tapered, slip means slidably positioned on the said interior slip-supporting surfaces of said second bowl for grippingly engaging the exterior surface of a second casing to be supported thereby concentrically within such first casing in said housing, the aforesaid second bowl and slip means thereon thereby being disposed in the annular space formed between the inside surface of said bore and the external surface of such second casing; a second packing assembly positioned coaxially in said annular space below said second slip bowl, said second packing assembly having a second lower packing compression ring and a second resilient packing ring thereon, said second lower compression ring normally being supported above and by the upper end portion of said first slip bowl, whereby a longitudinal force may be applied from said second bowl through said second packing ring and said second compression ring to said first slip bowl, thereby to compress longitudinally and expand laterally said second packing ring into sealing engagement between said housing and such second casing.

12. Well head casing suspension and packing apparatus comprising: a casing head housing having an inner longitudinal bore of substantially uniform inside diameter extending from the top thereof to supporting means adjacent the lower portion thereof; a generally annular first slip bowl contained in said bore, said first bowl being formed with interior and exterior substantially longitudinally coextensive, coaxial, downwardly converging slip-supporting surfaces; outer, upwardly tapered slip means slidably positioned on said exterior slip-supporting surfaces of said first bowl for grippingly engaging the interior surface of said bore upon downward movement of said first bowl relative to said outer slip means; inner, downwardly tapered, slip means slidably positioned on the said interior slip-supporting surfaces of said first bowl for grippingly engaging the exterior surface of a first casing to be supported thereby in said housing, the aforesaid first bowl and slip means thereon thereby being disposed in the annular space formed between the inside surface of said bore and the external surface of such first casing; a first packing assembly positioned coaxially in said annular space below said first bowl, said first packing assembly having a first upper packing compression ring, a first lower packing compression ring and a first resilient packing ring therebetween, said first resilient packing ring and said first lower compression ring being movable longitudinally with respect to said first bowl and normally being supported by said supporting means and said outer slips being supported by said first upper packing compression ring for movement longitudinally thereby relative to the exterior slip-supporting surfaces of said first slip bowl upon longitudinal movement of said first upper compression ring relative to said first bowl; and releasable first connecting means initially longitudinally immovably interconnecting said first upper compression ring and said first bowl, said first connecting means being actuatable to release and thereby free said first upper compression ring for longitudinal movement relative to said first bowl upon application of a predetermined maximum longitudinal weight from said first bowl through said first upper compression ring, said first packing ring and said first lower compression ring to said supporting means, said predetermined maximum weight being less than the whole weight of the first casing to be supported in said housing, thereby to compress longitudinally and expand laterally said first packing ring into sealing engagement between the said housing bore and such first casing under a weight not greater than said predetermined maximum weight and thereby also to permit and cause downward movement of said first bowl relative to said first upper compression ring, thereby to move said slip bowl downwardly relative to said outer slips supported by said first upper compression ring, whereby said outer slips are moved outwardly into gripping engagement with said interior surface of said bore and the balance of the weight of such first casing in excess of the weight applied through said first packing ring, is supported through said outer slips by said housing; a generally annular second slip bowl contained in said bore, said second bowl being formed with interior and exterior substantially longitudinally coextensive, coaxial, downwardly converging slip-supporting surfaces; outer, upwardly tapered slip means slidably positioned on said exterior slip-supporting surfaces of said second bowl for grippingly engaging the interior surface of said bore upon downward movement of said second bowl relative to said slip means; inner, downwardly tapered, slip means slidably positioned on said interior slip-supporting surfaces of said second bowl for grippingly engaging the exterior surface of a second casing to be supported thereby concentrically within such first casing in said housing, the aforesaid second bowl and slip means thereon thereby being disposed in the annular space formed between the inside surface of said bore and the external surface of such second casing; a second packing assembly positioned coaxially in said annular space below said second slip bowl, said second packing assembly having a second upper packing compression ring, a second lower packing compression ring and a second resilient packing ring therebetween, said second packing ring and said second lower compression ring being movable longitudinally with respect to said second bowl and normally being supported above and by the upper end portion of said first slip bowl, and said outer slips being supported by the said second upper packing compression ring for longitudinal movement thereby relative to the exterior slip-supporting surface of said second slip bowl upon longitudinal movement of said second upper compression ring relative to said second bowl; and releasable second connecting means initially longitudinally immovably interconnecting said second upper compression ring and said second bowl, said second connecting means being actuatable to release and thereby free said second upper compression ring for longitudinal movement relative to said second bowl upon application of a predetermined maximum longitudinal weight from said second bowl through said second upper compression ring, said second packing ring and said second lower compression ring to said first bowl, said predetermined maximum weight being less than the whole weight of such second casing to be supported in said

housing, thereby to compress longitudinally and expand laterally said second packing ring into sealing engagement between said housing bore and such second casing under a weight not greater that the said predetermined maximum weight and thereby also to permit and cause downward movement of said second bowl relative to said second upper compression ring, thereby to move said second bowl downwardly relative to said outer slips supported by said second upper compression ring, whereby said outer slips are moved outwardly into gripping engagement with said interior surface of said bore whereby the

balance of the weight of such second casing in excess of the weight applied through said second packing ring to said first bowl, is supported through said outer slips of said second bowl by said housing.

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