March 8, 1966 M. R. JONES 3,239,248

APPARATUS FOR DRILLING AND COMPLETING A WELL

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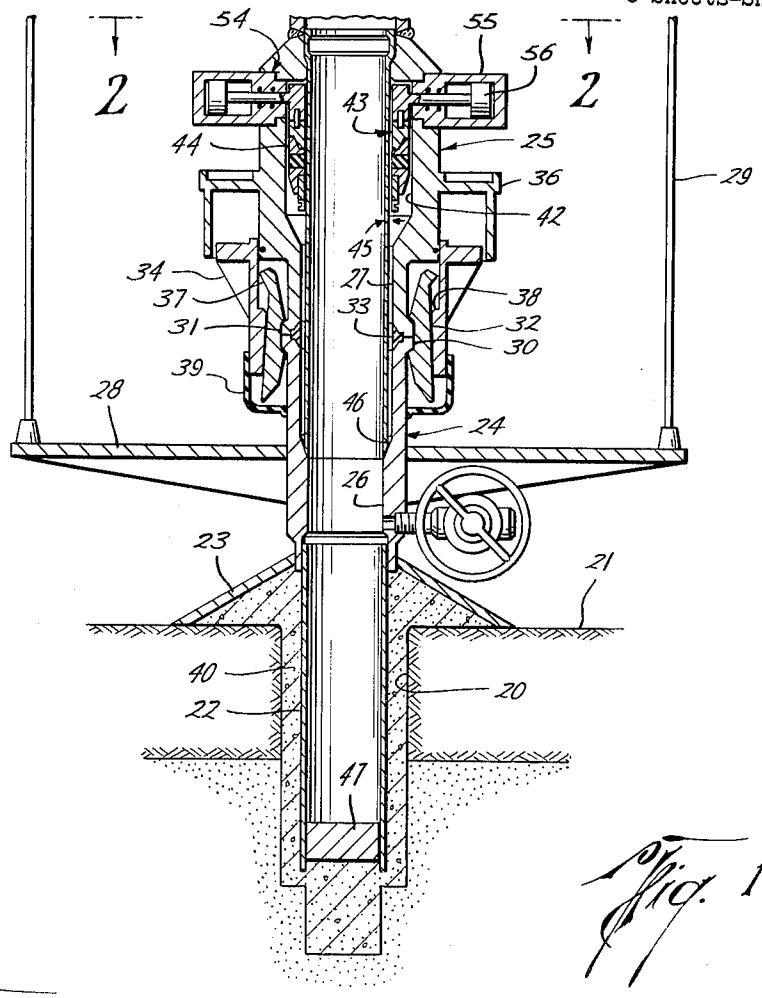
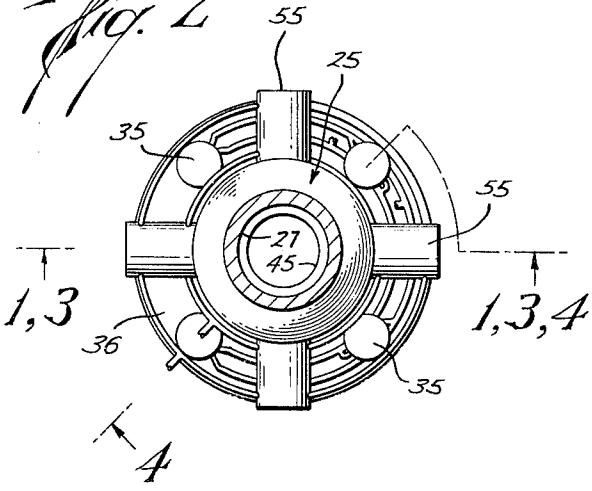


Fig. 1

Fig. 2



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APPARATUS FOR DRILLING AND COMPLETING A WELL

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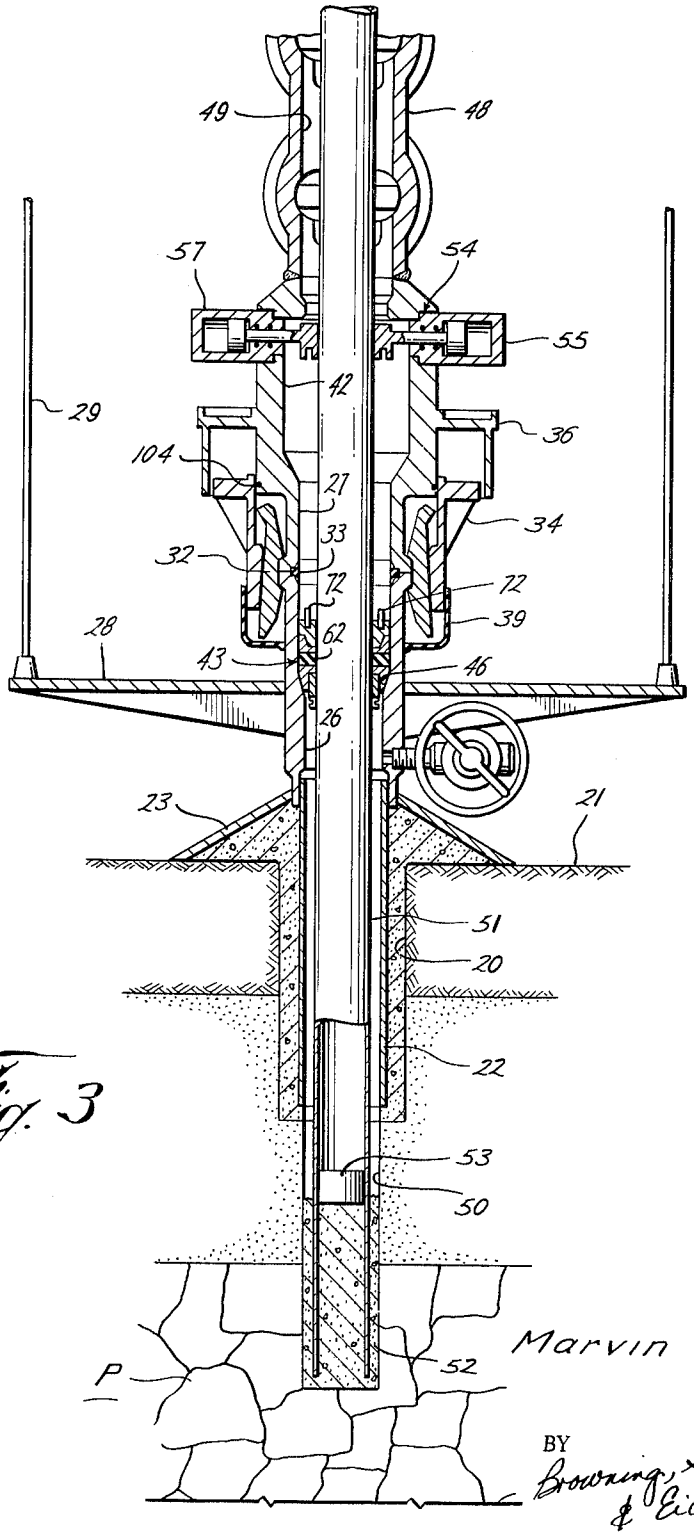


Fig. 3

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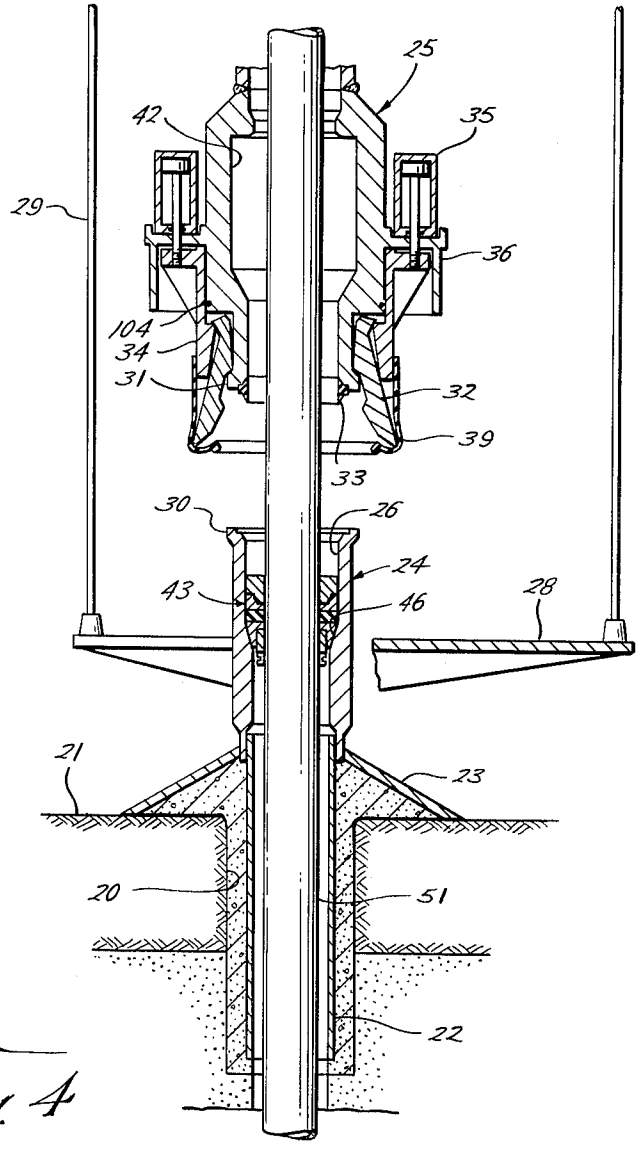


Fig. 4

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APPARATUS FOR DRILLING AND COMPLETING A WELL

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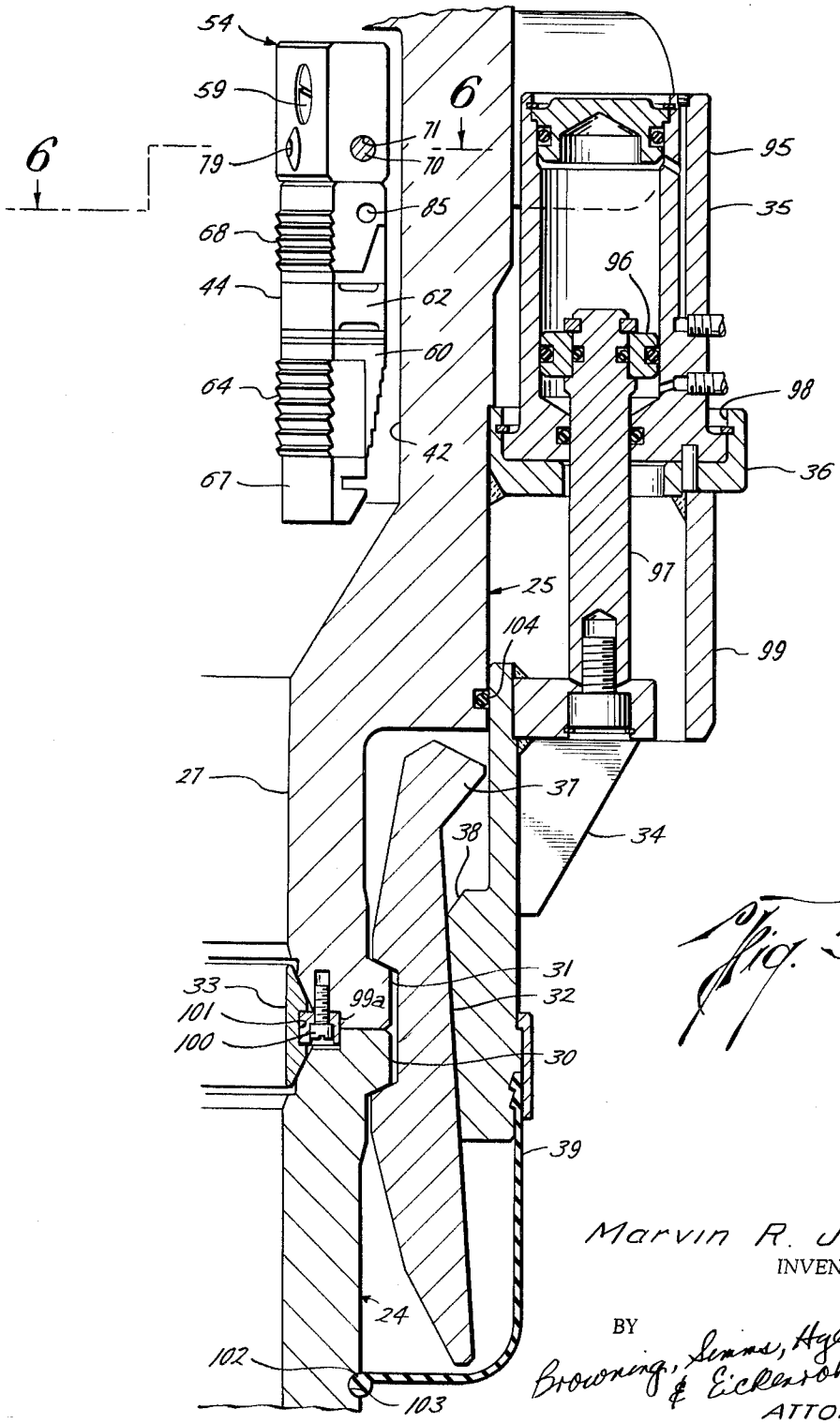


Fig. 5

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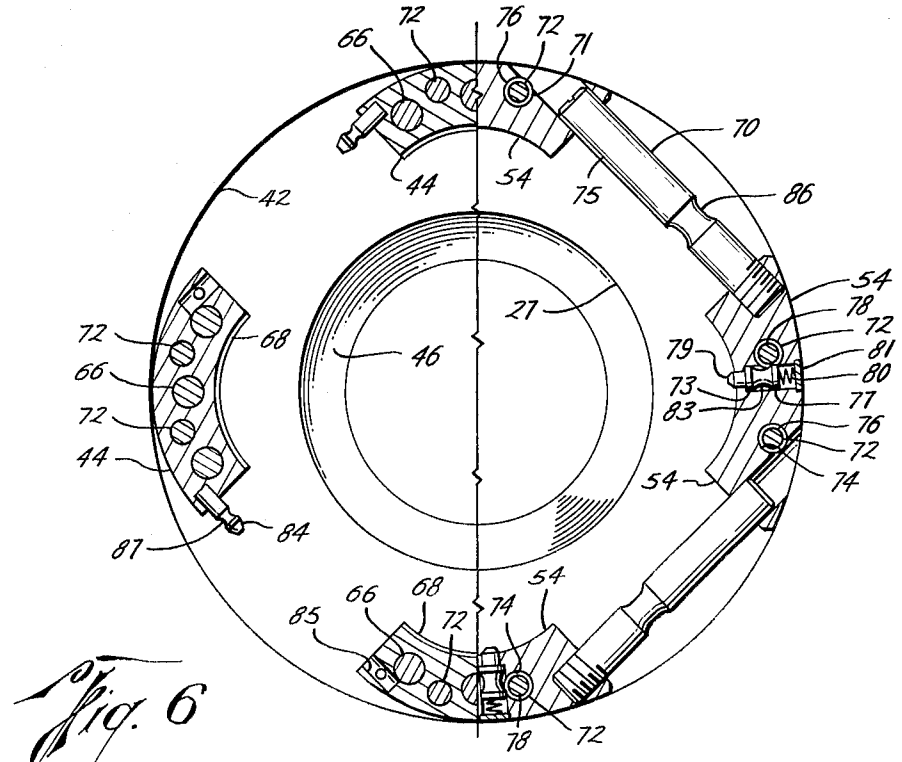


Fig. 6

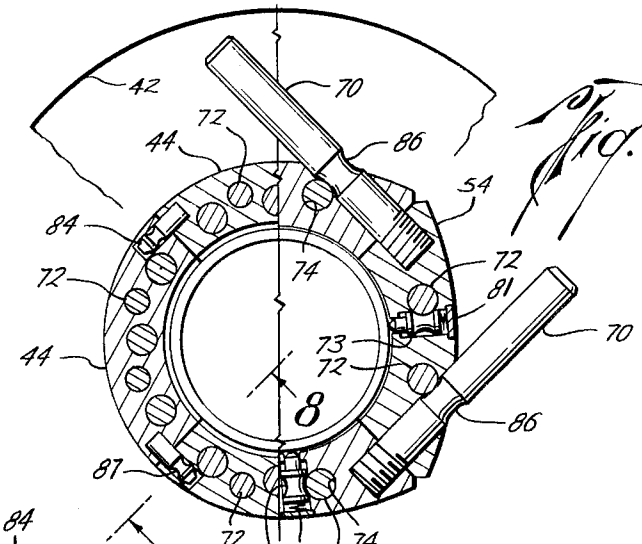
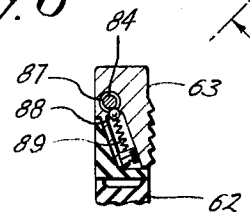


Fig. 7

Fig. 8



8

8

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Filed Jan. 18, 1962 6 Sheets-Sheet 6

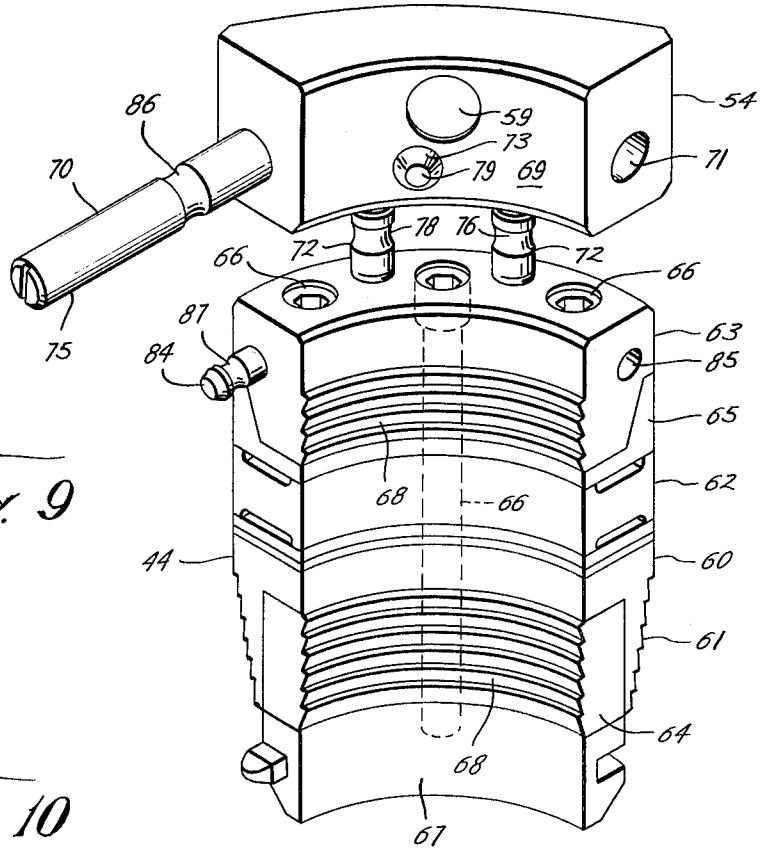


Fig. 9

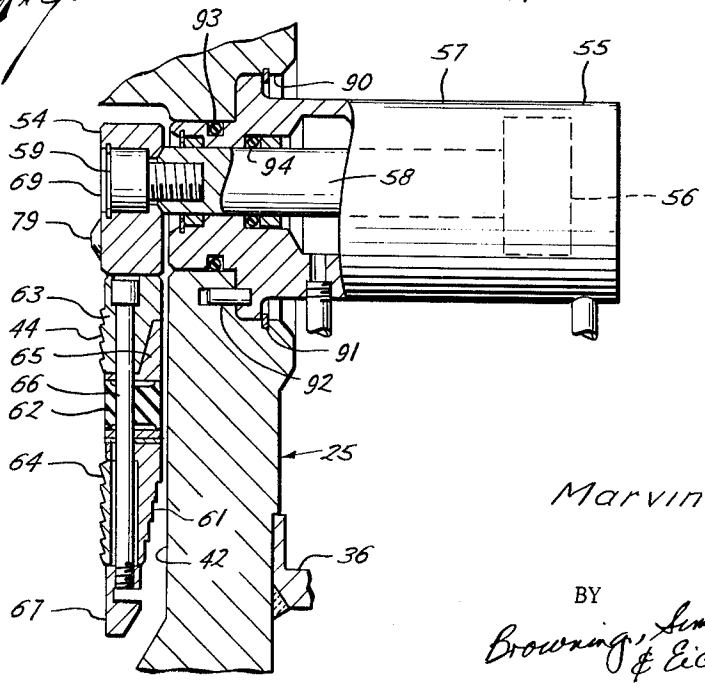


Fig. 10

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United States Patent Office 3,239,248
Patented Mar. 8, 1966

3,239,248
APPARATUS FOR DRILLING AND COMPLETING A WELL

Marvin R. Jones, Houston, Tex., assignor to Cameron Iron Works, Inc., Houston, Tex., a corporation of Texas

Filed Jan. 18, 1962, Ser. No. 167,018
14 Claims. (Cl. 285—145)

This invention relates to apparatus especially well suited for the drilling and completion of wells at underwater locations. More particularly, it relates to improvements upon the apparatus disclosed and claimed in a copending application, Serial No. 81,142, now patent 3,137,348 entitled, "Apparatus and Method for Drilling and Completing a Well," which was filed January 6, 1961, by Arthur G. Ahlstone and Marvin R. Jones, and which is assigned to the assignee of the present application.

In the earlier application, a tubular head carrying a casing hanger therein is mounted above and lowered with a casing to be anchored within a bore hole. The hanger is disposed within a recess in the bore of the head so that another casing may be lowered into the first-mentioned casing, and there is a bowl in the bore beneath the recess for seating the hanger when it is moved out of the recess and into the bore about the other casing. For this purpose, the hanger comprises a plurality of segments each of which is releasably connected to a radially reciprocable ram on the head for dropping freely onto the bowl to suspend said other casing therefrom when such segments are so moved. When the desired number of casings have been run in this fashion, the well is completed by the installation of a "Christmas Tree" above the head.

The above-described apparatus is especially advantageous when, for example, the casing is stuck in the bore hole, because, in this event, it would not be possible to land the conventional "boll weevil" type hanger on its seat in the head. Nevertheless, when the casing is not stuck, the "boll weevil" suspension is preferred because of its simplicity.

It is therefore an object of this invention to provide apparatus which are more flexible in application than those of the earlier application in that they make it practical for the operator to use the above-described hanger apparatus optionally when, for example, he is unable to make a "boll weevil" suspension because the casing is stuck.

Another object is to provide apparatus which is more reliable than that of the earlier application in that it prevents the hanger segments from being dropped inopportunely from the rams when, for example, there is no casing in the bore, the casing disposed therein is of the wrong size, or the hanger segments are not properly connected for movement downwardly together into the bowl.

A more particular object is to provide apparatus in which the hanger segments may be retracted back into the recess in the event one or more of the above-noted conditions are not satisfied, thereby rendering the apparatus effective for subsequent operation when such condition or conditions are subsequently satisfied.

A further object is to provide apparatus of this general type which is also more flexible than that of the earlier application in that it facilitates suspension of a casing from either of two hangers stacked one above the other, thereby permitting the operator to select the size of casing to be run.

These and other objects are accomplished, in accordance with the illustrated embodiment of the present invention, by wellhead equipment in which the casing hanger segments are carried within a recess in a tubular body

separate from a head having a bowl in its bore. Thus, the body is releasably connected above the head to form a housing therewith, and, as in the earlier application, the head is mounted above the casing for lowering with the casing into position to be anchored within the bore hole. In a preferred practice of the present invention, the body is connected to the head for lowering with the head and casing.

In the event the other casing lowered through the housing and first casing is stuck, so that it cannot be suspended from a "boll weevil," the hanger segments may be moved out of the recess in the body and into the bore for dropping freely onto the bowl in the head to suspend the other casing therefrom. Upon release of its connection with the head, the body may then be removed from above the head for use in the launching of other casing hanger segments. Since the body with the rams thereon is by far the most expensive portion of the housing, its recovery makes it practical for the operator to use this apparatus as an optional means of casing suspension.

In order to prevent the inopportune launching of the hanger of the present invention, each segment thereof is suspended from as well as connected to a ram for movement out of the recess into the bore, and is released from suspension by the ram for dropping freely onto the bowl only when a casing of proper size is disposed within the bore. In its preferred form, the means for so supporting and then releasing each hanger segment includes a part projecting a short distance inwardly from the hanger segment for engagement with and movement by the casing within the bore from suspending to releasing position. Thus, when there is no casing within the bore, or when the casing is over-sized, the projecting parts will not be engaged and moved in a manner to release the hanger segments from the rams. Also, none of these parts would be engaged and moved by a centrally disposed under-sized casing. Furthermore, even though an undersized and eccentrically disposed casing may engage and move a part for releasing one segment, each segment is suspended from its ram by additional means which is released only when all segments are connected together for movement downwardly with one another.

When the casing hanger segments are disposed within the recess, they are preferably disconnected from one another and are brought into connection for movement downwardly together only when moved closely together within the bore. For this purpose, the adjacent side edges of the hanger segments are provided with interconnecting means which lie within the concentric circles defined by the inner and outer radii of the arcuate segments, so that, in accordance with another purpose of this invention, they do not require any recess for their accommodation when in casing supporting position. That is, each casing hanger is free to drop any distance from a level adjacent its recess onto the bowl, and in the event one hanger is disposed in a recess above another, it may drop freely past the recess for the other hanger and onto the bowl.

In its preferred form, the above-mentioned means for suspending and then releasing the hanger segments only when they are so interconnected includes parts on rods which extend between adjacent rams for synchronizing their radial movement as well as the radial movement of the segments suspended therefrom. This synchronization also serves to center up any eccentrically mounted casing as the hanger segments are moved into position for release from the rams.

In summary then, I have provided improved wellhead equipment in which the casing hanger segments are prevented from prematurely dropping into the bowl either if the proper casing is not within the bore or if the hanger segments fail to interconnect with one another for move-

ment downwardly together. Furthermore, since I prevent this premature launching of the hanger segments by their release from the rams only upon the satisfaction of both of these conditions, I enable the segments to be withdrawn with the rams for subsequent operation when both such conditions are not met.

In the drawings, wherein like reference characters are used throughout to designate like parts:

FIG. 1 is a vertical sectional view of an offshore well site at which wellhead equipment including a head and body constructed in accordance with the present invention and connected above a first casing have been lowered with such casing into anchored position above a bore hole at the ground level;

FIG. 2 is a cross-sectional view of such equipment, as seen along broken line 2—2 of FIG. 1.

FIG. 3 is a view similar to FIG. 1, but wherein another casing has been lowered through the body, head and first casing into a further bore hole, and the hanger has been launched onto the bowl in the head for suspending such other casing therefrom;

FIG. 4 is a further vertical sectional view similar to FIG. 3, but taken along a different plane, as indicated by broken line 4—4 of FIG. 2, and in which the body has been released from connection with the head and is in the process of being raised to above the water level;

FIG. 5 is an enlarged vertical sectional view of a part of the equipment with the hanger in the position shown in FIG. 1, but taken along the same plane as FIG. 4;

FIG. 6 is a cross-sectional view of such equipment, taken along broken line 6—6 of FIG. 5;

FIG. 7 is another cross-sectional view similar to FIG. 6, but in which the hanger segments have been moved radially inwardly about the casing within the bore;

FIG. 8 is a detailed sectional view taken along broken line 8—8 of FIG. 7;

FIG. 9 is a perspective view of one casing hanger segment and the inner portion of its ram, with the segment released from such portion for purposes of illustration; and

FIG. 10 is a partial vertical sectional view similar to FIG. 1, but showing details of the construction of the ram.

With reference now to the details of the above-described drawings, and particularly to FIG. 1, a hole 20 has been drilled at a subsurface level 21, and a surface casing 22 has been lowered within the hole. Sunch casing is located at the desired elevation by means of a landing base 23 disposed about its upper end and adapted to rest upon the sub-surface level 21 surrounding the hole. This procedure is, of course, explained more fully in the earlier application.

As previously described, in a preferred practice of this invention, a casing head 24 is connected to and mounted above the surface casing 22, and a tubular body 25 is in turn connected above the head to form a housing which is lowered as a unit with the casing. The head has a bore 26 therethrough with a tapered bowl 46 therein and the body has a bore 27 with a recess 42 thereabout to receive the hanger 43 to be seated in the bowl, each bore forming a continuation of the other as well as a continuation of the inside diameter of the surface casing 22. The entire assembly is lowered into the position shown by means of a flange 28 mounted on the head 24 and suspended from the lower ends of flexible cables or lines 29 extending upwardly to above the water level. Obviously, these lines may be let out or taken up by any suitable hoisting means on a vessel at the water level for raising or lowering the assembly.

As also previously described, the connection of the body 25 to the head 24 is releasable so that such body may be retrieved upon launching of the hanger 43 carried within it onto the bowl 46. This releasable connection is preferably similar to one shown in a copending application, Serial No. 746,997, filed July 7, 1958, and assigned to the assignee of the present invention. Thus, as indicated generally in FIGS. 1, 3 and 4, and in more detail in FIG. 5, the head and body are provided with flanges 30 and 31, respectively, on their abutting ends, and a plurality of spaced-apart locking dogs 32 are carried by the flange 31 for swinging between the locking position of FIG. 1 and the releasing position of FIG. 4. As shown in more detail in FIG. 5, and as will be described to follow, when the body and head are locked together, the joint between the head and body is sealed by a delta ring 33 which has an inner diameter flush with their bores.

The locking dogs 32 are swung into and out of locking position by a ring 34 surrounding the dogs and reciprocated in a vertical direction by fluid actuators 35 shown in FIGS. 4 and 5 to be mounted upon a flange 36 about the body 25. As can be seen from the drawings, the interengaging outer sides of the dogs and inner side of the ring 34 are tapered downwardly for camming the dogs into locking position as the ring is moved downwardly. There is an outwardly projecting flange 37 on the upper end of each dog for engagement by an inner abutment 38 on the ring as the latter is moved upwardly, whereby the locking dogs may be cammed outwardly to the releasing position of FIG. 4. In this latter position of the locking dogs, as shown in FIG. 4, the body 25 is free to be lifted to above the water level.

As shown in FIG. 1, and as described in the earlier application, cement 40 is conducted downwardly through the housing and the casing 22 and into the annular space between the casing and the hole 20 so that when this cement has set, the casing is anchored within the hole. As also shown in FIG. 1, and again as described in the earlier application, the landing base 26 provides a shroud of generally conical shape for confining cement to the area on the subsurface level 21 surrounding the hole 20.

With the casing hanger 43 disposed within the recess 42, the segments 44 thereof are shielded from the cement conducted downwardly through the body 25 by means of a sleeve or liner 45 disposed across the recess and extending vertically from a position thereabove to seated position on the bowl. Thus, as can been from FIG. 1 the inner diameter of this sleeve provides a smooth continuation of the bore 26 of the head and the inner diameter of the casing 22 so that a conventional cement plug 47 may be formed downwardly therethrough. The sleeve 45 also serves as a bit guide to prevent damage to the hanger and the bowl 46 during drilling of the further hole 50 shown in FIG. 3. As described in the earlier application, the liner is removable upwardly through the housing by any suitable means so as to open the recess 42 and uncover the bowl 46 for seating the hanger thereon.

Suitable pressure control equipment 48 (see FIG. 3) is welded to and lowered with the upper end of the body 25, its bore 49 forming a continuation of the bore through the housing made up of the body and head. As well known in the art, this apparatus 48 may include a pair of vertically spaced-apart ram-type blowout preventers as well as related equipment. At any rate, with this pressure control apparatus installed as shown in FIG. 3, the further hole 50 may be drilled within the hole 20, and a casing 51 lowered through such apparatus and into the further hole, as shown in FIG. 3, for suspension from the casing head 24 by means of the hanger 43. This latter casing 51 may be a production casing, as shown in the illustrated embodiment of this invention, or an intermediate casing, as shown in one embodiment of the earlier application. In either event, the casing may become stuck in the hole so that it cannot be suspended by means of a "boll weevil" (not shown) seatable upon the bowl 46 and it becomes necessary for the operator to suspend the casing from the optional hanger 43.

Another cement plug 53 may be forced downwardly through the casing 51 to in turn force the cement 52 into the space shown in FIG. 3. Thus, when the cement 52

hardens, the casing 51 is anchored within the further hole 50 concentrically of the surface casing 22. In a manner to be described more fully hereinafter, the segments 44 of the casing hanger 43 are then moved out of the recess 42 in the head 25 and into the bore thereof for dropping freely onto the bowl 46, as shown in FIG. 3, to grip and suspend the surface casing 51 and seal between it and the head 24. Obviously, the casing 51 may be perforated in any suitable manner below the upper level of the production zone P, and a tubing may be lowered and packed off within the casing to produce such zone upwardly therethrough.

As shown in FIG. 4, and as previously described, when the casing 51 has been so suspended, the ring 34 is moved upwardly by the actuators 35 to swing the locking dogs 32 to a releasing position and permit the body 25 to be removed from above the head and lifted by any suitable means (not shown) to above the water level. In this manner, the body, including the actuators 35 and related parts, may be used at this or at another location for launching another casing hanger.

With reference now particularly to the details of the casing hanger 43, the segments 44 thereof are carried within the recess in equally spaced-apart relation, as shown in FIG. 6, for movement out of the recess and into the bore for disposal adjacent to one another to form and annular hanger body, as shown in FIG. 7. As in the case of the hanger of the earlier application, each hanger segment 44 is so moved out of the recess and into the bore by means of a ram 54 including an inner portion mounted on the body for reciprocation radially of the bore of the body 25 by means of fluid actuators 55 on the body similar to the actuators 35 for operating the ring 34. Obviously, both sets of actuators may be reciprocated by pressure fluid supplied from above the water level by suitable fluid lines connected to those shown in FIG. 2. Thus, each actuator 55 includes a piston 56 sealably slidable within a cylinder 57 and connected by stem 58 to the inner portion of the ram. As best shown in FIG. 10, the stem 58 extends sealably through the inner end of the cylinder for threaded connection by means of a nut 59 to the inner portion of the ram in the upper end of recess 42.

The slip segments 44 may be similar in construction to those which make up the casing hanger shown and described in U.S. Patent 3,011,806, issued to Herbert Allen on December 5, 1961. Thus, as best shown in FIG. 9, each such segment is arcuate in horizontal cross section and comprises a body 60 having an outer tapered surface 61 which seats on the bowl 46 in the head 24, when the segment is dropped into the bowl, and supports a seal element 62 above it for spanning the annular space between the casing 51 and the bore 26 of the head in such seated position of the hanger. Each segment has two sets of slips 63 and 64 supported by the body 60, one set 63 being supported above the seal element 62 on a ring 65, and the other set 64 being suspended upon a ring 67 by means of bolts 66 connected to the upper slip and extending downwardly through the seal ring 62, body 60, and lower slip 64 for threaded connection to the support ring 67.

As shown and described in the aforementioned patent, these slips are automatically operable, upon dropping of the segment 44 into the bowl, to cause teeth 68 on their inner faces to grip and thereby suspend the casing 51, while at the same time expanding the seal ring 62 circumferentially inwardly and outwardly to form the aforementioned seal between the casing and head. As will be appreciated from FIG. 7, when the hanger segments are disposed adjacent one another, the opposite ends of each seal ring 62 thereon will seal with respect to the opposite end of adjacent seal element. Obviously, other casing hanger constructions may be used and, for that matter, the means for sealing the annular space about the

casing may be separate from the slips for suspending such casing.

As can be seen from the drawings, the inner portion of each ram is also arcuate and substantially coextensive with the casing hanger segment it supports, both radially and circumferentially. Also, the front face 69 thereof is at least substantially vertically continuous with the front face of hanger segment 64 so as to engage and thereby center the casing 51 as the rams are moved inwardly to move the casing hanger segments out of the recess and into the bore.

As shown in FIGS. 6, 7 and 9, the rams 54 are interconnected to one another for synchronized movement radially of the bore by means of rods 70 threadedly connected to one side edge of each ram and extending therefrom for sliding within an opening 71 in the side edge of an adjacent ram. As a result, each ram is prevented from leading one or more of the other rams as the casing hanger segments are moved out of the recess and into the bore, so that the rams and casing hanger segments suspended therefrom will converge uniformly upon the casing 51 even though such casing be disposed eccentrically within the bore through the body 25. Although the ends of the rods 70 project outwardly from the outer radius of the arms and hanger segments in the contracted position thereof shown in FIG. 7, there is of course sufficient annular space within the body to accommodate them due to the fact that they are in the recess 42. Also, since it is only the casing hanger segments 44 which are dropped into the bowl, these projecting parts on the rods 70 do not interfere with the narrowing passage through the bore in the head.

Each hanger segment 44 is suspended from its ram 54 for movement inwardly therewith by a first pin 72 on the segment which is engaged and supported by a part on a radially extending pin 73 carried by each ram. At least prior to its movement out of the recess and into the bore, each hanger segment is also suspended from its ram by a second pin 72 which is engaged and supported by a part on the free end of the rod 70 slidable within the opening 71 in such ram. More particularly, the pins 72 are carried upon and extend upwardly from the top side of each hanger segment, as best shown in FIG. 9, for reception within holes 74 in the lower side of the inner portion of each ram. When the pins 72 are so received, and during the movement of the rams from within the recess into the bore, the outer free end 75 of each rod 70 will slide into an annular groove 76 about one such pin (the rightmost in FIG. 9), and the enlarged outer end 77 of each pin 73 will be disposed within a groove 78 about the other pin 72 (the leftmost in FIG. 9).

The inner end 79 of each pin 73 is normally urged into the inwardly projecting position shown in FIG. 6 by means of a coil spring 80 compressed between the outer end of the pin and a plug 81 carried on the back side of the inner portion of the ram 54. When urged against a casing 51 of the proper diameter, the pins 73 are free to move radially outwardly to a position in which a groove 83 about such pin 73 will be disposed opposite the pin 72 to disengage therefrom and free the pin and thus the hanger segment for downward movement.

As best shown in FIGS. 6, 7 and 9, each hanger segment carries a pin 84 for extension outwardly from one side edge thereof and has a hole 85 on the opposite side edge thereof to receive a pin 84 of an adjacent hanger. As can be understood from FIG. 6, there is a groove 86 in each rod 70 on each ram which moves into a position within the opening 71 of an adjacent hanger segment to disengage from and thereby release the second pin 72 of such segment for downward movement when the hanger segments are at least close enough together to be connected by the pins 84. Thus, when both pins 72 of the hanger segments are released from the rams, pins 84 connect the hanger segments to one another for movement downwardly together when released from the rams.

As previously mentioned, these pins and matching holes for receiving same are all disposed within concentric circles defined by the inner and outer radii of the hanger segments so that such segments are free to fall downwardly any desired distance into the bowl **46** for the purposes previously described.

As shown in FIG. 8, each pin **84** also has a groove **87** about its inner end to receive a detent ball **88** when such pin is fully extended into the opening **85** of an adjacent hanger. More particularly, the ball **88** is carried within a passage in the adjacent hanger which extends upwardly to intersect with the opening **85**, and the ball is pressed as by spring **89** into yieldable engagement with the groove **87**. Thus, these hanger segments are prevented from being accidentally disconnected as they are dropped into the bore.

From the foregoing, it is obvious that in the event there is no casing within the bore of the housing, the hanger segments will not be released from the rams, because the pins **73** on the rams will remain engaged with the first pins **72** on the hanger segments, even though the second pins **72** may be released from engagement by the guide rods **70**. In the event the casing **51** is too large, its outer diameter will first engage with the end edges of the hanger segments to prevent its engagement with the projecting ends **79** of such pins. Also, the over-sized casing will prevent the hanger segments from moving to the contracted position of FIG. 7, so that the rods **70** will not slide into the releasing position with respect to the second pins **72**. Thus, the hanger segments will remain suspended from the rams by means of both pins **72**.

In the event the casing **51** is too small, and further assuming that it is disposed axially within the bore of the housing, the first pins **72** of the hanger segments will not be released because the inner ends **79** of the pins **73** will not be engaged and moved to releasing position. This is true even though the guide rods **70** of the rams move to the releasing position of FIG. 7. Assuming, on the other hand, that the under-sized casing is disposed eccentrically with respect to the bore of the housing, the pin **73** of one ram may be moved inwardly to release the first pin **72** of the hanger suspended therefrom. However, by the time this hanger segment has moved out of the recess and into the bore, its second pin **72** will be engaged and supported by the guide rod **70** of the ram suspending an adjacent hanger, and this guide rod will not move to releasing position with respect to the second pin **72** until all of the hanger segments have been interconnected by means of the pin **84**. Consequently, even in the environment above mentioned, there will be no inopportune launching of any hanger segment.

As will be understood from FIG. 3 of the drawings, when the hanger has been launched and the rams have been retracted, the upper ends of the pins **72** will be disposed in position to be gripped by an elevator or the like lowered through the bore **27**. Thus, the operator may, if desired, lift the hanger **43** upwardly from its casing supporting position.

The actuators **55** for the rams **54** and the actuators **35** for the ring **32** are preferably similar in construction and releasably connected to the body **25**. Thus, as best seen in FIG. 10, the cylinder **57** of each actuator **55** has an inner end releasably received within a counterbore **90** about an opening on the outside of the body **25** by means of snap ring **91**. In seated position within the counterbore, the inner end of cylinder **57** is oriented with respect thereto by means of a pin **92**, and seal rings **93** and **94** on its outer and inner peripheries seal, respectively, with the body opening and the stem **58** on the piston **56**.

As shown in FIG. 5, each actuator **35** also comprises a cylinder **95** having a piston **96** reciprocable therein and connected to the ring **34** by means of a rod **97**. Still further, this cylinder **95** is releasably connected within a bore **98** in flange **36**, and the flange carries a skirt **99** for protecting the upper end of the arm **34**. One side of the cylinder **95**, as well as one side of the cylinder **57**, is thickened to receive suitable passages for directing pressure fluid to one side or the other of the piston within the cylinder.

As also shown in FIG. 5, the seal ring **33** is releasably connected to the flange **31** on the lower end of body **25** means of a split ring **99***a* connected to such flange by screws **100**. More particularly, the ring **99***a* is split for radial movement into and out of a groove **101** in the outer periphery of the ring **33**. This connection of the ring **33** with the body **25** permits the seal between the body and head **24** to be made up from a remote location, as would be necessary in underwater well completion.

As best shown in FIG. 5, there is a skirt **39** on ring **34** which extends downwardly and radially inwardly terminating in a thickened rib **102** fitting within a groove **103** about the head **24** and cooperating with an O-ring **104** about the body and slidably sealable with respect to the arm **34** to enclose the locking dogs **32** against corrosive substances in the surrounding water. This skirt is made of rubber or other elastic material so that while this rib will normally be retained within the groove, it is releasable therefrom to permit the skirt to be raised with the body **25** when the latter is removed from above the head **24**. In fact, and as indicated in FIG. 4, the lower ends of the dogs will engage and urge the skirt to released position as such dogs are cammed outwardly by the ring.

Although the invention has been illustrated and described in connection with a wellhead which is located at the ground level **21**, it will be understood that the wellhead may be disposed at any elevation between the level **21** and the water surface, in which event it would still be anchored in the drilled hole with the casing to which it is connected.

From the foregoing it will also be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the method and apparatus.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention wtihout departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. Wellhead equipment, comprising a housing having a bore therethrough and a recess about the bore, a bowl in the bore beneath the recess, a casing hanger within the recess, means on the housing for suspending the hanger and moving it inwardly of the bore, and means responsive to the presence of a casing of predetermined size within the bore for releasing the hanger from the suspending means to permit said hanger to drop freely into the bowl for suspending said casing therefrom.

2. Wellhead equipment, comprising a housing having a bore therethrough and a recess about the bore, a bowl in the bore beneath the recess, a casing hanger within the recess, means on the housing connected to the hanger for moving it out of the recess and into the bore, and means suspending the hanger from the moving means including means engageable with and movable by a casing within the bore, as the hanger is moved into said bore, to release said hanger from connection with said moving means for dropping freely into the bowl to suspend said casing therefrom.

3. Wellhead equipment, comprising a housing having a bore therethrough and a recess about the bore, a bowl in the bore beneath the recess, a casing hanger comprising a plurality of segments within the recess, means including a plurality of rams mounted on the housing for

movement radially of the bore, a first pin connecting each hanger segment to a ram for movement therewith out of recess and into the bore, a second pin engageable in one position with the first pin to suspend said segment from said ram, the end of the second pin projecting inwardly from said segment for engagement by the casing, as the segment is moved into the bore, and shifting into another position disengaged from the first pin to release said segment for dropping freely onto the bowl to suspend a casing therefrom, and means for causing the released segments to move downwardly together.

4. Wellhead equipment of the character defined in claim 3, wherein said second pin is carried by said ram, and said first pin is carried by and extends upwardly from the hanger so as to be positioned for gripping by an elevator when said ram is retracted.

5. Wellhead equipment, comprising a housing having a bore therethrough and a recess about the bore, a bowl in the bore beneath the recess, a casing hanger comprising a plurality of arcuate segments within the recess, rams reciprocably mounted on the housing and suspending the hanger segments therefrom for moving the segments out of the recess and into the bore and then dropping them freely onto the bowl to suspend a casing therefrom, and means connecting the segments for movement downwardly with one another as they drop onto the bowl, said means comprising parts which are engageable to connect the segments as they are moved into the bore and yieldably disengageable to disconnect said segments in response to retraction of the rams so as to permit said segments to be retracted with said rams into the recess in the event said segments are not dropped into the bowl.

6. Wellhead equipment, comprising a housing having a bore therethrough and a recess about the bore, a bowl in the bore beneath the recess, a casing hanger comprising a plurality of disconnected segments within the recess, means on the adjacent side edges of the hanger segments to connect them for movement downwardly with one another as they are moved into the bore, and reciprocable rams on the housing for moving said hanger segments out the recess and into the bore and releasing them for dropping freely through the bore and onto the bowl for suspending said casing therefrom, said connecting means being yieldable to permit said hanger segments to be disconnected in response to withdrawal of the rams so as to permit said segments to be withdrawn with the rams if said segments are not released from said rams.

7. Wellhead equipment, comprising a housing having a bore therethrough and a recess about the bore, a bowl in the bore beneath the recess, a casing hanger comprising a plurality of disconnected segments within the recess, means suspending the hanger segments for movement out of the recess and into the bore, means for so moving the segments, means interconnecting the suspending means for synchronizing the movement of said hanger segments out of said recess and into the bore, means for connecting the segments for vertical movement with one another after they are moved into the bore, and means for releasing said segments from the suspending means to drop freely onto the bowl when said segments have been connected together.

8. Wellhead equipment, comprising a housing having a bore therethrough and a recess about the bore, a bowl in the bore beneath the recess, a casing hanger comprising a plurality of disconnected segments within the recess, means on the adjacent side edges of the hanger segments to connect them for movement downwardly with one another when they are disposed within the bore, a plurality of radially reciprocable rams on the housing, means including a pin connecting each hanger segment to a ram for movement out of the recess and into the bore, and means engageable with said pin to suspend said hanger segment from said ram as the segment is moved into the bore and disengageable therefrom to release said segment for dropping freely into the bowl when it is connected to said other segments and prior to retraction of the rams from the bore into the recess.

9. Wellhead equipment, comprising a housing having a bore therethrough with a recess thereabout and connectable to the upper end of a well casing to form a continuation thereof, a bowl in the bore beneath the recess, a casing hanger comprising a plurality of arcuate segments within the recess, means on the housing for moving said hanger segments out of the recess and into the bore and responsive to the presence of a casing of predetermined size within the bore for dropping them freely into the bowl to suspend said last-mentioned casing therefrom within the first-mentioned casing, and means connecting the segments for movement downwardly with one another as they are dropped into the bowl, said means comprising parts disposed within concentric circles defined by the inner and outer radii of the hanger segments.

10. Wellhead equipment, comprising a housing having a bore therethrough and a recess about the bore, a bowl in the bore beneath the recess, a casing hanger comprising a plurality of disconnected segments within the recess, means on the adjacent side edges of the hanger segments to connect them for movement downwardly with one another as they are moved into the bore, a plurality of radially reciprocable rams on the housing, means for suspending each hanger segment from a ram for movement out of the recess and into the bore, and means responsive to the presence of a casing of predetermined size within the bore and the connection of said hanger segments to one another for releasing the hanger segments from the rams to permit them to drop freely into the bowl to suspend said casing therefrom.

11. Wellhead equipment, comprising a housing having a bore therethrough and a recess about the bore, a bowl in the bore beneath the recess, a casing hanger comprising a plurality of disconnected segments within the recess, means on the adjacent side edges of the hanger segments to connect them for movement downwardly with one another when they are disposed within the bore, a plurality of radially reciprocable rams on the housing, means including a pin connecting each hanger segment to a ram for movement out of the recess and into the bore, means engageable with said pin to suspend said hanger segment from said ram as the segment is moved into the bore and disengageable therefrom to release said segment for dropping freely into the bowl when it is connected to said other segments and prior to retraction of the rams from the bore into the recess, and a rod on each ram slidably interconnecting it with an adjacent ram for synchronizing their radial movement.

12. Wellhead equipment of the character defined in claim 11, wherein said means engageable and disengageable with a pin for each segment comprises parts on the rod of the ram connected to the adjacent segment, and said pin is carried by and extends upwardly from said hanger segment.

13. Wellhead equipment, comprising a housing having a bore therethrough and a recess about the bore, a bowl in the bore beneath the recess, a casing hanger comprising a plurality of disconnected segments within the recess, means on the adjacent side edges of the hanger segments to connect them for movement downwardly with one another as they are moved into the bore, a plurality of radially reciprocable rams on the housing, means for suspending each hanger segment from a ram for movement out of the recess and into the bore, and means for releasing the hanger segments from the rams to permit them to drop freely into the bowl to suspend a casing therefrom only when said casing is disposed within said bore and said hanger segments are connected to one another, said suspending means including interengageable pins on each hanger segment and ram, with

one pin projecting radially inwardly of said segment to engage the casing, and said releasing means including a part on said one pin movable in response to engagement with said casing to a position disengaged from said other pin.

14. Wellhead equipment, comprising a housing having a bore therethrough and a recess about the bore, a bowl in the bore beneath the recess, a casing hanger comprising a plurality of disconnected segments within the recess, means on the adjacent side edges of the hanger segments to connect them for movement downwardly with one another as they are moved into the bore, a plurality of radially reciprocable rams on the housing, means for suspending each hanger segment from a ram for movement out of the recess and into the bore, means for releasing the hanger segments from the rams to permit them to drop freely into the bowl to suspend a casing therefrom only when said casing is disposed within said bore and said hanger segments are connected to one another, and a rod on each ram slidably interconnecting

it with an adjacent ram for synchronizing their radial movement, said suspending and releasing means including a pin on each hanger segment and parts on the rod of an adjacent segment engageable with and disengageable from the pin.

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