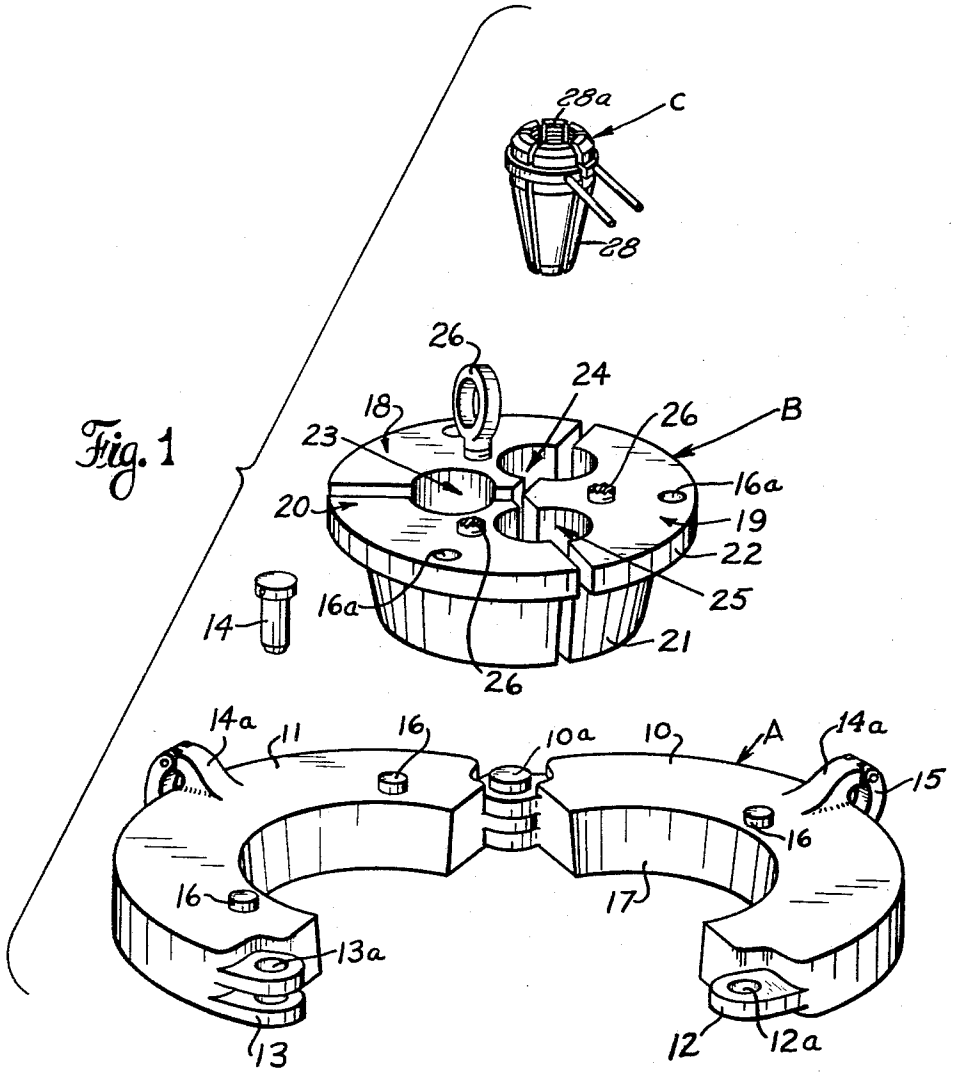
July 11, 1967 E. C. CHAMBLEE 3,330,354

PIPE HANGER ASSEMBLIES AND METHODS OF RUNNING AND REMOVING MULTIPLE STRINGS IN WELL BORES

Filed Jan. 19, 1959 4 Sheets-Sheet 1

Fig. 1



ELIJAH C. CHAMBLEE
INVENTOR.

BY Vincent Martin
Jos E Edwards
M. Harvey Gay
ATTORNEYS

July 11, 1967 E. C. CHAMBLEE 3,330,354

PIPE HANGER ASSEMBLIES AND METHODS OF RUNNING AND REMOVING MULTIPLE STRINGS IN WELL BORES

Filed Jan. 19, 1959 4 Sheets-Sheet 2

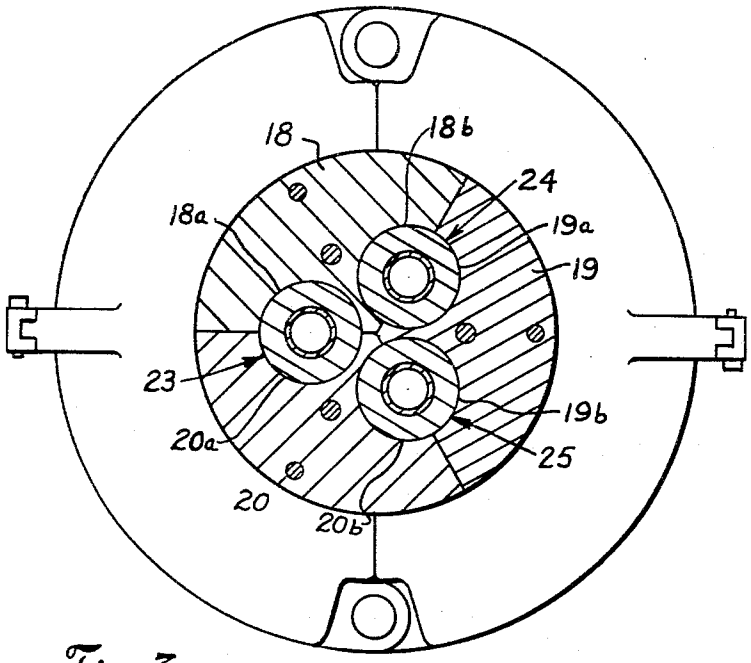


Fig. 3

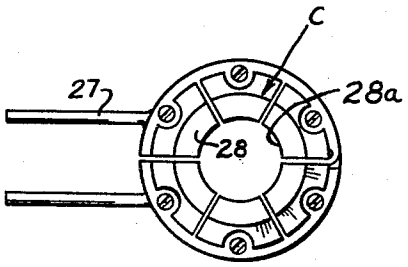


Fig. 4

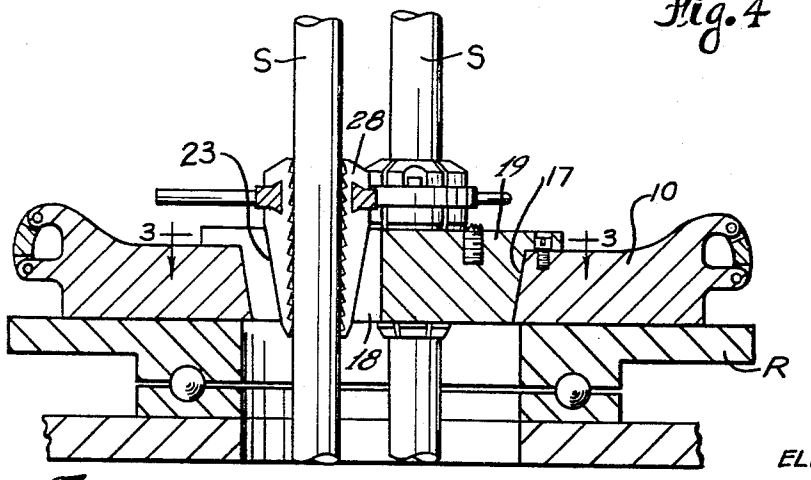
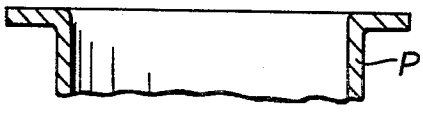


Fig. 2



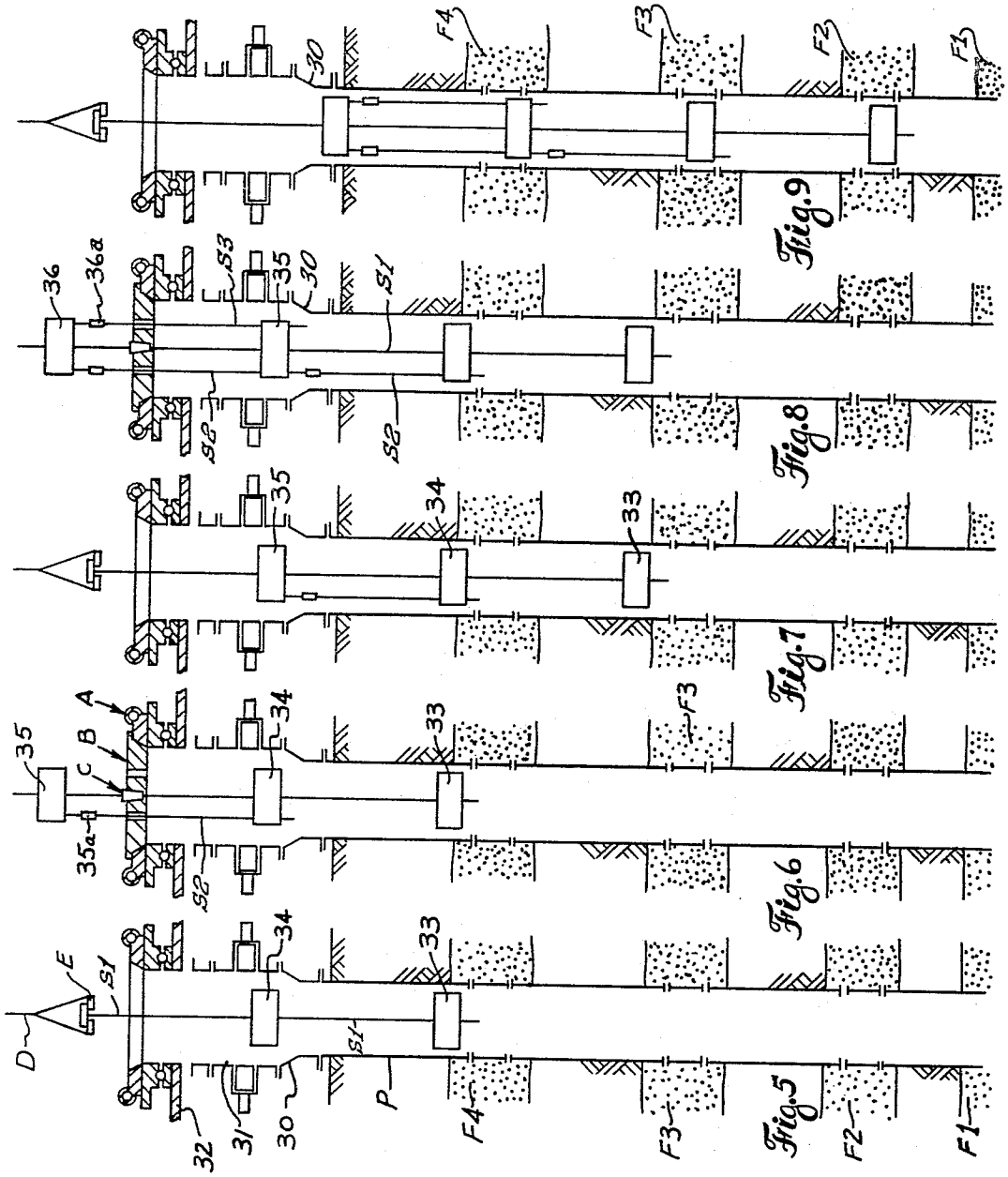
ELIJAH C. CHAMBLEE
INVENTOR.

BY Vincent Martin
Joe E Edwards
M. Harvey Gay
ATTORNEYS

July 11, 1967 E. C. CHAMBLEE 3,330,354

PIPE HANGER ASSEMBLIES AND METHODS OF RUNNING AND REMOVING MULTIPLE STRINGS IN WELL BORES

Filed Jan. 19, 1959 4 Sheets-Sheet 3



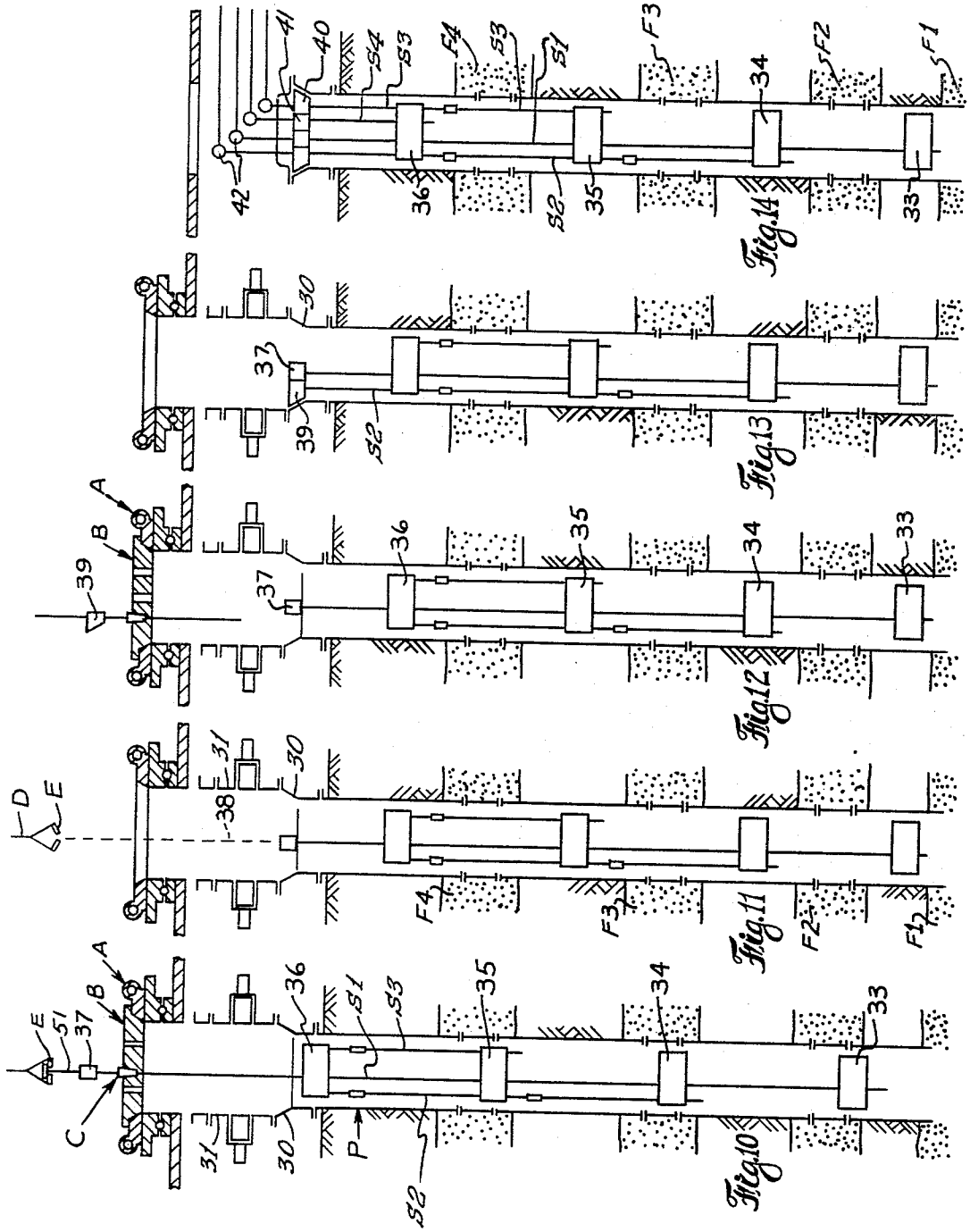
ELIJAH C. CHAMBLEE
INVENTOR.

BY Vincent Martin
Jos. D. Edwards
M. Harvey Gay
ATTORNEYS

July 11, 1967 E. C. CHAMBLEE 3,330,354

PIPE HANGER ASSEMBLIES AND METHODS OF RUNNING AND REMOVING MULTIPLE STRINGS IN WELL BORES

Filed Jan. 19, 1959 4 Sheets-Sheet 4



ELIJAH C. CHAMBLEE
INVENTOR.

BY Vincent Martin
Jos. B. Edwards
M. Harvey Gay
ATTORNEYS

United States Patent Office 3,330,354
Patented July 11, 1967

3,330,354

PIPE HANGER ASSEMBLIES AND METHODS OF RUNNING AND REMOVING MULTIPLE STRINGS IN WELL BORES

Elijah Charles Chamblee, Houma, La., assignor, by mesne assignments, to Brown Oil Tools, Inc., Houston, Tex., a corporation of Texas

Filed Jan. 19, 1959, Ser. No. 787,511
4 Claims. (Cl. 166—46)

This invention relates to new and useful improvements in pipe hanger assemblies and methods of running and removing multiple strings in well bores.

There are in general use various types of temporary pipe hangers or supports which are adapted to support a well pipe or tubing which is being run into or removed from a well bore and usually such hangers are associated with the rotary table or are located on the derrick floor. Since there is only a single cable which depends from the usual crown and traveling blocks capable of handling heavy loads, it is the practice to utilize this cable to lower the sections of the pipe and as each section is lowered, the pipe is temporarily supported by a hanger device. This permits detachment of the cable from the pipe string so that another section may be picked up and placed in position for connection into the string, after which the temporary support is removed and the cable utilized to again carry out the subsequent lowering operation.

The general type of temporary hanger or support is adapted to support only a single pipe and no provision is made for passing a packer or other large element which may be connected to the pipe through said hanger; instead, the hanger is completely removed when it is desired to pass a packer or other large diameter element on the pipe string into the well.

Production from multiple zones in a single well bore is being accomplished and the apparatus required for such multiple production operation involves the use of several packers properly connected to several tubing strings. Because only a single cable is available for handling the pipe, the problem of temporarily supporting the various strings and the problem of passing the spaced packers into the well bore have presented themselves and the usual type of temporary hanger is not satisfactory for this purpose.

It is, therefore, one object of this invention to provide an improved hanger device which may be employed to temporarily support multiple pipe strings as other sections of tubing or other connections are made, whereby all operations may be carried out by use of the regular rig equipment and by means of the single available cable.

An important object of the invention is to provide an improved hanger device which is so constructed that the supporting means for the multiple pipe strings may be completely removed from a base member of the assembly, with the opening through said base member being of sufficient size to readily pass a packer or other large diameter unit which may be connected in the pipe string.

A further object is to provide an improved method of running a plurality of pipe strings and packers into a well bore, whereby all of the packers may be properly located so that production from multiple zones in the well may be accomplished with production from each zone through its separate pipe string. Other objects will hereinafter appear.

The construction designed to carry out the invention will be hereinafter described, together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof,

wherein an example of the invention is shown, and wherein:

FIGURE 1 is an exploded view of an improved hanger assembly constructed in accordance with the invention;

FIGURE 2 is an enlarged transverse sectional view of the pipe hanger assembly illustrating a pair of pipe strings supported therein;

FIGURE 3 is a horizontal cross-sectional view taken on the line 3—3 of FIGURE 2;

FIGURE 4 is a plan view of one of the supporting slip members; and

FIGURES 5 to 14 are schematic views illustrating the improved method of running quadruple pipe strings and four packers into the well bore and employing the improved hanger assembly.

In the drawings the letter A designates a base which is constructed of two generally semicircular sections 10 and 11 which are hinged at 10*a*. As clearly shown in FIGURE 1, the section 10 has a lug 12 which is adapted to fit between ears 13 when the sections are in closed position. The lug 12 has an opening 12*a* which aligns with opening 13*a* in the ears whereby a locking pin 14 may be inserted to maintain the two sections in closed position. Each section is formed with a cable handling loop or eye 14*a* which loop may be readily opened by a pivoted latch element 15, whereby suitable cables (not shown) may be attached to said loops 14 to handle the base A. The upper surface of each of the sections 10 and 11 has an upwardly extending aligning pin 16 which is adapted to co-act, as will be explained, with a split hanger assembly B. When the sections 10 and 11 are swung to close position, they form an annular base having a central bore or opening 17 which is substantially as large as the bore of the well surface pipe P into which tubular strings are to be lowered. As shown in FIGURE 2, the wall of the opening 17 is inclined to form a seating surface.

The hanger assembly B is constructed of three sections or segments 18, 19 and 20 which are substantially identical in construction. Each section has a body 21 formed with a flange 22 at its upper end and as shown in FIGURE 2, the three sections 18, 19 and 20 of the assembly B are insertable within the inclined seat or bore 17 of the base A; when so inserted, the outer surface of the body portions of the hanger sections engage said seat while the flange 22 rests upon the upper surface of the base. To interlock the hanger assembly with the base, the peripheral portion of the flanges 22 of each hanger section has openings 16*a* which receive the upstanding aligning pins 16 on the base member. Thus when the hanger assembly is in position within the base, the three sections of the assembly B co-act with each other to form a hanger body which is nonrotatably supported within the base.

With the hanger sections 18, 19 and 20 seated within the base (FIGURE 3), a recessed portion 18*a* in section 18 coacts with a recessed portion 20*a* in section 20 to form a slip receiving opening or seat 23. Similarly, a recess 18*b* in the section 18 coacts with a recess 19*a* in section 19 to form a second slip receiving opening or seat 24. A recessed portion 19*b* in the section 19 co-acts with a recessed portion 20*b* in section 20 to form a third slip receiving opening or seat 25. As clearly shown in FIGURE 3, the three slip receiving openings or seats 23, 24 and 25 are preferably spaced equally about the hanger assembly and each has its wall inclined to form a seating surface. For readily handling the sections of the hanger assembly, each section is formed with an eye bolt 26 to which a handling line or cable may be attached.

After the hanger assembly B is in position within the base, it will be evident that the openings 23, 24 and 25 extend therethrough and the pipe strings which are to be lowered into the well casing or pipe P may be passed or may extend through said openings. For supporting each

pipe string S within the hanger assembly, a slip element C is provided for each of the openings **23**, **24** and **25**. This slip element is of usual construction as illustrated in FIGURES 1 and 4 and comprises a plurality of segmental members **28** suitably hinged together and arranged to be opened by means of handles **27**. The inner surface of the slip element is provided with the usual toothed gripping slips **28***a*.

The base A may be supported upon the derrick floor or as illustrated in FIGURE 2 may be supported upon the upper end of the usual rotary table R. Its weight is sufficient to hold it in place with its bore **17** in alignment with the opening through the rotary table. After the base is in position, the hanger assembly B is mounted within the bore **17** of the base and at this time the openings **23**, **24** and **25** in the hanger assembly are in alignment with the bore of the well pipe P. One of the pipe strings S may then be passed downwardly through one of said openings and upon reaching the position at which it is to be supported, the slip element C is engaged around the pipe through manipulation of the handles **27** and is then moved downwardly to engage the inclined wall of one of the openings **23**, **24** or **25** as the case may be. The outer surface of the slip element C is inclined to firmly seat within the opening and thus the inner pipe string S will be supported. Since three openings are provided in the hanger assembly, it is evident that three independent pipe strings S may be simultaneously supported by their respective slip elements C. When it is desired to further lower the multiple strings, the slip elements C are removed and the usual pipe handling cable of the rig may be employed to lower said pipe strings.

If a packer or other enlarged diameter tool has been connected to one or more of the multiple strings, then the hanger assembly B is removed from the base. This may be readily accomplished by removing the individual sections **18**, **19** and **20** since each may be handled independently through its eye bolt **26**. With the assembly B removed from the base, the full opening of the bore **17** of the base is available for passage of the packer or other enlargement and lowering of the multiple strings can be accomplished. When it is again desired to support the strings, it is only necessary to replace the sections of the hanger assembly B within the base and apply the slip elements to the individual pipe strings.

In FIGURES 5 to 14 an improved method of running multiple pipe strings such as well tubing and multiple packers is illustrated. In these views a well bore W is illustrated as traversing four producing formations F1, F2, F3 and F4. To accomplish production from each of these four zones through an independent tubing string, it is necessary to lower into the well four well packers and four strings. As is well known, the well packers will seal between each of the producing formations and each of the strings will carry production from one of the zones to the surface. The particular structure of the well packers is subject to variation and any well-known packer available on the open market may be employed. An example of one type of packer which may be used is shown in the Brown Patent No. 2,903,066.

The upper end of the well casing or pipe P has a tubing head **30** mounted thereon and a blowout preventer **31** is secured in place above said tubing head in the usual manner. As is usual practice, the tubing head and blowout preventer are below the floor **32** of the derrick and the various pipe strings, as will be explained, are lowered into the well casing through this equipment. Of course, the rams of the blowout preventer are normally retracted and are of such construction as to seal off around the string or strings when said rams are operated which would be at a time that the possibility of a blowout is present.

In carrying out the method, a first production string S1 has a first packer **33** connected near its lower end and a second packer **34** is also mounted on the string S1, being

spaced from the lower packer a predetermined distance in accordance with the distance between the lowermost formations. The usual cable D is then connected to the first string S1 through the elevators E whereby said string S1 and packers **33** and **34** may be lowered to the position at which a third packer is to be connected in the string S1. This position is, of course, controlled by the spacing between the sub-surface formations and is illustrated in FIGURE 5.

When the parts reach the position of FIGURE 5, lowering of string S1 is halted and the hanger device of the present invention is utilized to support said string S1 whereby the cable D may be disconnected and used for other purposes. As shown, the base A is supported in position on the rotary table and the hanger sections **18**, **19** and **20** of the assembly B are then placed in position around the string S1; thereafter, the slip supporting element C is dropped into its opening in the assembly B to support the string S1 and packers **33** and **34**.

After the string S1 and the packers **33** and **34** are supported in the manner shown in FIGURE 6, the cable D of the drilling rig may be disconnected and used for running the lowermost stand or stands of the second string S2 into place, this being accomplished by running said second string S2 through one of the openings in the hanger assembly B. Following the running of the lowermost stand or stands of the second string and its attachment to the packer **34** (FIGURE 6) additional sections of the strings S1 and S2 are attached to the lower end of a third packer **35** after which said additional sections are connected to strings S1 and S2 by suitable couplings **35***a*. During this time, the entire apparatus is supported by the slip element C which is disposed within the opening in the hanger assembly B through which the first tubing string S1 extends. Of course, if desired, as soon as the lowermost portion of the second string S2 has been run and connected to the packer **34**, another slip element C may be placed around said string S2 to thereafter assist in supporting the apparatus.

After the third packer **35** is connected with the strings S1 and S2 in the manner shown in FIGURE 6, an additional section or sections of the first string S1 are connected to the upper end of the packer, the usual cable D being used for this purpose and during this time the hanger assembly is employed as the temporary supporting means. After the additional section or sections of string S1 are in position above the packer **35**, the entire apparatus is thereafter supported by the elevator E and cable D. The slip elements C and the hanger sections **18**, **19** and **20** are removed from the base A and lowering of the third packer **35** through the full open bore **17** of the base to the position of FIGURE 7 may be accomplished. As above noted, the hanger assembly B and one of the slip elements C may be used to temporarily support the apparatus as the additional stands or sections of the string S1 are added, the hanger being employed in the usual manner during handling and lowering of the pipe.

After the third packer **35** reaches the position of FIGURE 7, the upper portion of string S2 and the lowermost section of a third string S3 are to be connected and to accomplish this, the sections **18**, **19** and **20** of the hanger assembly are again positioned in the base A with the slip element C being utilized to support the first string S1 as well as the apparatus connected therewith. Thereafter, additional stands of the second string S2 may be run through one of the openings in the hanger assembly and then connected with the upper end of packer **35**. By means of another slip element, string S2 may also be supported in the assembly B.

Thereafter, the lowermost stands of the third string S3 may be run through the third opening in the hanger and also connected with the upper end of the third packer **35**, after which a slip element C may be engaged with said string S3 to support the same. It is noted that with

this arrangement the single drilling rig cable D may be used for handling the various pipe string sections.

After the additional sections of the second string S2 and the lowermost portion of string S3 are in place, a fourth packer **36** is connected to strings S1, S2 and S3 by couplings **36***a* (FIGURE 8). An additional section or sections of string S1 are thereafter attached to the upper end of packer **36**, the cable D is again reconnected to the string S1, the hanger sections are removed and the entire apparatus lowered to the position of FIGURE 9; of course, the packer **36** freely passes through the full open bore of the base A.

Upon reaching the position of FIGURE 10, the hanger sections are again inserted in the base and the slip element C is utilized to support the apparatus while a segment 37 of a segmental hanger is connected to string S1. This segment is adapted to seat within the bowl of the tubing hanger T. After the segment **37** is in place, the sections of hanger B are removed and cable D is utilized to lower the string S1 and packers to the position of FIGURE 11 which causes the segment **37** to seat in the head and thereby support the apparatus within the well bore with the packers properly positioned. The lowering pipe section, indicated by the dotted lines **38** in FIGURE 11 may then be removed and pipe string S1 is in final position.

Following seating of the first string, the assembly B is again mounted in base A and the uppermost section of string S2 is supported therein while a tubing hanger segment 39 is attached thereto. Thereafter, the uppermost section of string S1 is landed in the tubing head as shown in FIGURE 13.

The operations are repeated to lower and land the uppermost portion of the third string S3 and to lower and land a fourth string S4 which has its lower end connected to the uppermost or fourth packer. The string S3 has a tubing hanger segment **40** secured thereto while a similar segment **41** supports string S4.

When all segments **37**, **39**, **40** and **41** are finally seated in the tubing head **30**, as shown in FIGURE 14, the apparatus is properly located in the well with the packers **34** to **36** in proper position. After final landing, the hanger segments are locked down in the usual manner, the segments are packed off and the final tubing head connections made. The base A may be removed from the rotary table and at any time after its use is completed after final landing, the production strings S1, S2, S3 and S4 properly connect to discharge piping and control valves **42** in the usual manner and the well is under complete control. By employing hydraulically set packers, said packers may be selectively actuated by conducting pressure thereto through the respective strings and without requiring any movement of the strings which might disturb the final landed position.

The particular assembly makes it possible to temporarily support one or more tubing strings and thereby free the drilling rig cable for use in handling other pipe sections, packers or equipment. Also, with the entire apparatus supported by one of the slip elements C engaging the first production string S1, the various stands of the other strings may be successively lowered through the hanger assembly, with such strings being handled by the drilling rig cable.

Although three openings have been illustrated in the hanger assembly B, it is evident that said hanger could be provided with two openings where it is desired to handle only two strings of tubing or could be provided with four openings so that additional production strings could be handled in the manner set forth. The device is simple in construction and by splitting the hanger assembly into sections in the manner shown, it is possible to quickly and easily place the assembly B in position to remove said assembly from position around a plurality of pipes. Also, by hinging the base member A, said member may be placed in position upon or removed from its supporting surface while the pipe strings are extending upwardly from the well bore.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction, may be made within the scope of the appended claims without departing from the spirit of the invention.

What I claim is:

1. The method of running a plurality of well pipe strings and packers into a well bore by means of the usual drawworks cable and wherein a hanger device comprising a base, a sectional hanger assembly having a plurality of openings therein and a pipe-engaging slip element adapted to seat within each opening is employed at various stages throughout the method, said method including, connecting a lower packer to a first pipe string, lowering the packer and a predetermined length of said first pipe string into the well bore a predetermined distance by means of the drawworks cable, placing the sectional hanger assembly in position at the upper end of the well whereby the first string extends through one of the openings therein, placing a pipe-engaging slip element in said opening to support the first string and lower packer, utilizing the drawworks cable to handle an intermediate packer and place it in position for connection to the first string, connecting the intermediate packer to the first string while the string is supported from the hanger assembly, thereafter again attaching the drawworks cable to the upper end of the first pipe string, removing the sectional hanger assembly to permit lowering of the intermediate well packer into the well bore, thereafter adding stands to the first pipe string to locate the lower and intermediate packers in a new position within the bore, replacing the sectional hanger assembly at the upper end of the well bore so that the first pipe string again extends through one of the openings in said assembly, replacing the pipe engaging slip element to again support the first pipe string, utilizing the drawworks cable to handle and run in the lowermost portion of a second pipe string, said lowering being through one of the other openings in the hanger assembly while the first pipe string remains in supported position, connecting the lowermost portion of said second string to the intermediate packer, thereafter utilizing the cable to handle and connect an upper packer to both the first pipe string and to that portion of the second string which is extending between the intermediate and upper packers, removing the sectional hanger assembly, utilizing the cable to handle and connect additional stands to the first pipe string and to lower all three packers downwardly into the well bore to another predetermined location, thereafter again positioning the sectional hanger assembly to again support the first pipe string, running in the second pipe string through the hanger assembly and connecting it with the upper packer, running in the third pipe string through the hanger assembly and connecting it with the upper packer, connecting tubing head supporting elements to the first, second and third pipe strings, thereafter removing the sectional hanger assembly, and finally lowering the pipe strings by means of the drawworks cable to finally land the tubing head supports within a tubing head.

2. The method of running a plurality of well pipe strings and packers into a well bore by means of the usual drawworks cable and wherein a hanger device comprising a base, a sectional hanger assembly having a plurality of openings therein and a pipe-engaging slip element adapted to seat within each opening is employed at various stages throughout the method, said method including, connecting a lower packer to a first pipe string, lowering the packer and a predetermined length of said first pipe string into the well bore a predetermined distance by means of the drawworks cable, placing the sectional hanger assembly in position at the upper end of the well whereby the first string extends through one of the openings therein, placing a pipe-engaging slip element in said opening to support

the first string and lower packer, utilizing the drawworks cable to handle an intermediate packer and place it in position for connection to the first string, connecting the intermediate packer to the first string while the string is supported from the hanger assembly, thereafter again attaching the drawworks cable to the upper end of the first pipe string, removing the sectional hanger assembly to permit lowering of the intermediate well packer into the well bore, thereafter adding stands to the first pipe string to locate the lower and intermediate packers in a new position within the bore, replacing the sectional hanger assembly at the upper end of the well bore so that the first pipe string again extends through one of the openings in said assembly, replacing the pipe engaging slip element to again support the first pipe string, utilizing the drawworks cable to handle and run in the lowermost portion of a second pipe string, said lowering being through one of the other openings in the hanger assembly while the first pipe string remains in supported position, connecting the lowermost portion of said second string to the intermediate packer, thereafter utilizing the cable to handle and connect an upper packer to both the first pipe string and to that portion of the second string which is extending between the intermediate and upper packers, removing the sectional hanger assembly, utilizing the cable to handle and connect additional stands to the first pipe string and to lower all three packers downwardly into the well bore to another predetermined location, thereafter again positioning the sectional hanger assembly to again support the first pipe string, attaching one section of a tubing head support to the first pipe string, removing the sectional hanger assembly from its position at the upper end of the well bore, lowering the first pipe string with its tubing head support by means of the drawworks cable and landing said section of the support in a tubing head to locate the packers in final position, thereafter running

the remainder of the second tubing string into the well and connecting its lower end to the upper packer, connecting a section of a tubing head support to the second string and landing said section in a tubing head simultaneously with the making of the connection to the upper packer, running a third string into the well bore and connecting its lower end to the upper packer, attaching a section of the tubing head support to the third string and landing the same in position within a tubing head simultaneously with the making of a connection with the said third string with the upper packer, and finally connecting flow control valves in each of the pipe strings above the tubing head to control flow therethrough.

3. The method as set forth in claim 1, followed by the step of setting the packers into sealing engagement with the wall of the well bore.

4. The method as set forth in claim 2, followed by the step of setting the packers into sealing engagement with the wall of the well bore.

References Cited

UNITED STATES PATENTS

1,009,998	11/1911	Savoie	285—141 X
1,502,628	7/1924	Hanna	255—23 X
1,708,645	4/1929	Wright	166—85 X
2,179,814	11/1939	Conaghan	285—148
2,335,355	11/1943	Penick	166—89 X
2,768,007	10/1956	Brenner	166—89
2,934,148	4/1960	Allaire	166—75

CHARLES E. O'CONNELL, *Primary Examiner.*

BENJAMIN BENDETT, BENJAMIN HERSH, JAMES LEPPINK, *Examiners.*

D. C. BLOCK, C. O. THOMAS, *Assistant Examiners.*