

July 8, 1958

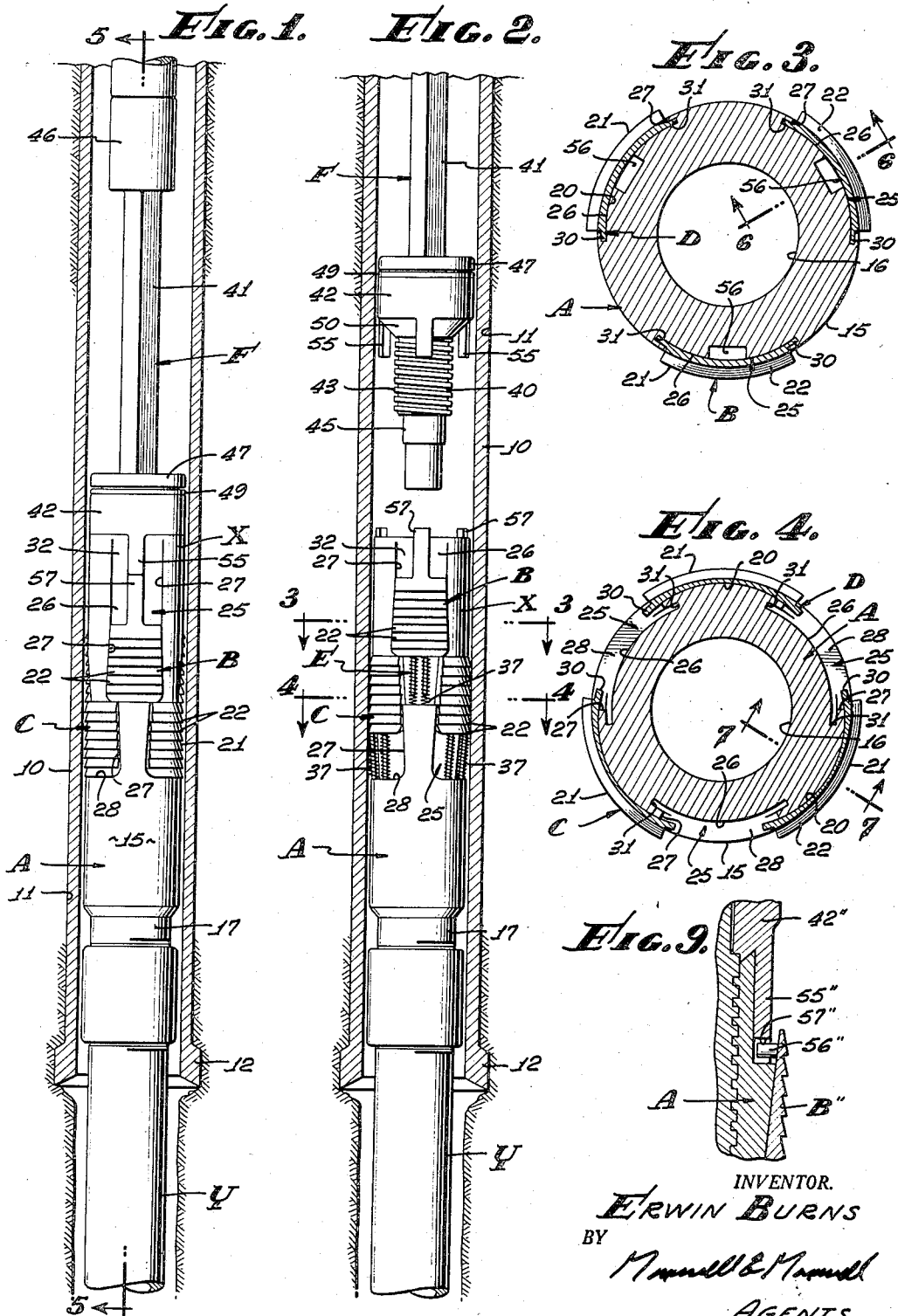
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2,842,213

MULTIPLE SLIP CASING HANGER

Filed May 13, 1955

2 Sheets-Sheet 1



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FIG. 5.

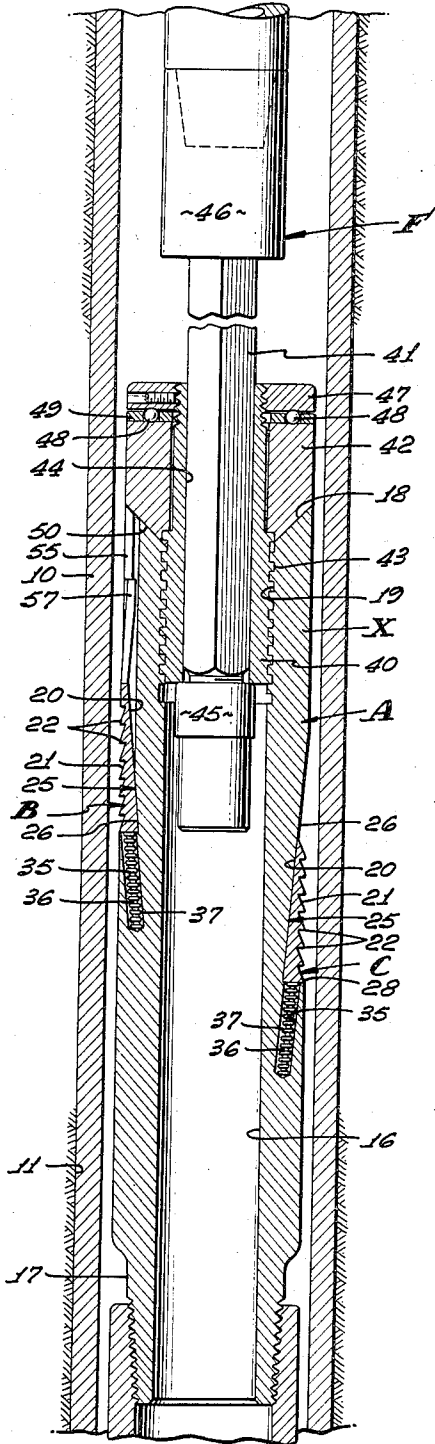


FIG. 6.

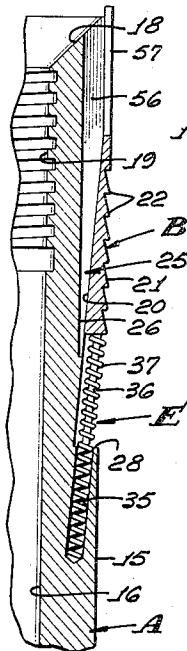


FIG. 7.

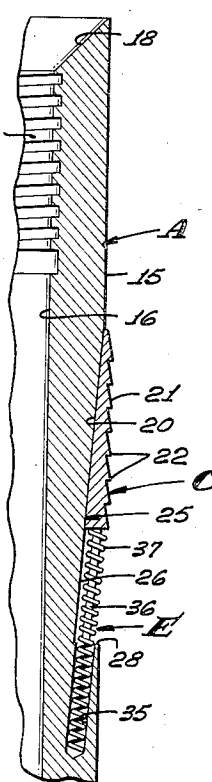
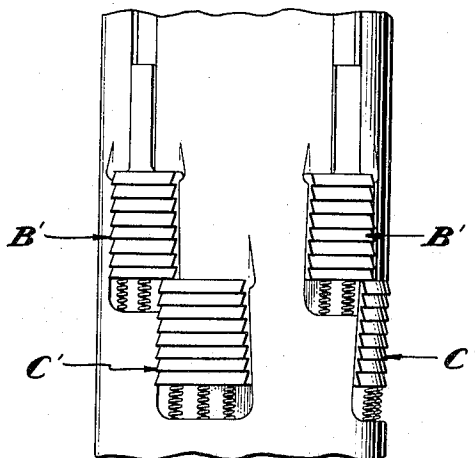


FIG. 8.



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MULTIPLE SLIP CASING HANGER

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5 Claims. (Cl. 166—208)

This invention has to do with a well tool employed for suspending pipe, tubing or casing, and is more particularly concerned with a liner hanger adapted to suspend strings of tubing in a well. The tool that I have provided may be used to suspend water strings, protective strings, oil strings or liner strings and the like, and is particularly useful in the suspending of a string of tubing within a well from the lower end of a previously set well casing, or the like.

The ordinary or conventional casing hanger is characterized by a plurality of circumferentially spaced slips that are adapted to have pressure gripping engagement with the interior of a casing, or the like. Considerable space occurs between adjacent slips of the ordinary casing hanger with the result that only partial contact is gained about the periphery of the tool. The spaced relationship of the slips about the ordinary casing hanger limits the gripping action of the tool and unevenly distributes the pressure of the slips against the interior of the casing, which frequently results in distortion and damage to the casing, as well as malfunctioning of the tool.

It is a general object of this invention to provide a casing hanger that evenly distributes the pressure and gripping engagement of the tool so that the casing is not distorted and so that better, more reliable gripping action is obtained.

A feature of this invention is to provide a casing hanger of the character referred to wherein the entire circumference of the tool is effective to have gripping action with the interior of the casing. In the tool that I have provided, gaps or spaces between the slips are closed by secondary slips that are under control of the first-mentioned slips.

Another feature of my invention is to provide a tool of the character referred to wherein one slip controls action of another. In practice, one slip may control a number of other slips as circumstances require.

Still another feature of this invention is to provide a hanger construction wherein each slip carries its load independently of the other slips, and wherein the plurality of slips delivers the load uniformly around the casing.

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

Figs. 1 and 2 are vertical sectional views taken through a well bore, Fig. 1 showing the structure that I have provided being lowered into the well bore, and Fig. 2 showing the structure after it has been set or positioned therein. Figs. 3 and 4 are enlarged transverse sectional views taken as indicated by lines 3—3 and 4—4 on Fig. 2. Fig. 5 is an enlarged detailed sectional view taken as indicated by line 5—5 on Fig. 1. Fig. 6 is an enlarged detailed sectional view of a portion of the structure taken as indicated by line 6—6 on Fig. 3. Fig. 7 is a view similar to Fig. 6 being a view taken as indicated by line 7—7 on

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Fig. 4. Fig. 8 is a view illustrating a modified form of the present invention, and Fig. 9 is an enlarged detailed sectional view of a portion of the structure illustrating a modified form of the invention.

The casing hanger of the present invention is referred to as a multiple slip hanger and is characterized by a plurality of slips that are substantially evenly distributed around the circumference of the tool. It is a feature of the invention that a controlling slip is adapted to govern action of other or secondary slips related thereto. The tool that I have provided involves, generally, a body portion A, control slips B, secondary slips C, slip retaining means D, slip actuating means E and an operating tool F. The body portion A carries the other elements of the structure including the control slips B and the secondary slips C. The slip retaining means D acts to secure the slips B and C so that they are secured to the body A to be shiftable axially thereof, the slip actuating means E provides for individual operation of each of the slips, and the operating tool is adapted to release the control slips B which also results in release of the secondary slips C and engagement of the slips with the casing surrounding the tool.

The several connections that may be made in a well are essentially alike and will vary only as to size and detail of construction as circumstances require. Therefore, I will refer to and illustrate only one typical unit of construction throughout the specification, it being understood, for example, that the number and arrangement of slips may vary.

In Figs. 1 and 2 of the drawings, I have illustrated a typical well construction wherein a tubular casing 10 has been set in a well 11, there being a casing shoe 12 at the lower end thereof. It will be observed that the well bore 11 continues downwardly from the lower end of the casing 10, and in accordance with the present invention, a multiple slip casing hanger X is provided that is adapted to be lowered into the casing 10 at the lower end of a string of drill pipe 13, or the like, and which is adapted to be operated into uniform gripping engagement with the lower end portion of the casing 10 to suspend an additional string of casing Y, or the like, downwardly into said well bore 11.

The body portion A is an elongate vertically disposed cylindrical element with a smooth outer wall 15 and a bore 16 that extends therethrough. The lower end portion of the body A is provided with a coupling portion 17 having screw threads such as are commonly employed in tools of the type under consideration. The suspended casing Y is threadedly engaged with said coupling portion 17 and depends therefrom into the lower portion of the well bore 11. The upper end portion of the body A is made to cooperate with the operating tool F and is provided with an upwardly disposed conical end face 18 and with internal threads 19 that enter the upper portion of the bore 16. The threads 19 are left-handed for purposes hereinafter set forth.

In accordance with the present invention, a multiplicity of slips is carried by the body A, there being upper control slips B and lower secondary slips C. As shown, the control slips B are at an upper level and the secondary slips C are at the next lower level to be controlled by movement or operation of the slips B. Control of the slips C by the slips B is gained by reason of an overlapping relationship between the ends of the two slips. That is, the lower ends of the control slips B overlie the upper ends of the secondary slips C thereby preventing movement of the secondary slips until the control slips are allowed to move or operate. It will be readily understood that additional secondary slips C may be carried by the body A at lower levels and engaged by and con-

trolled by the secondary slips at the next higher level by reason of an overlapping engagement of parts in the same manner as above described.

The several control slips B are circumferentially spaced, and, in the preferred form of the invention, each slip B has lapping engagement with a pair of circumferentially spaced secondary slips C. However, as clearly illustrated in Fig. 8 of the drawings, there may be overlapping engagement with only a single secondary slip C'. That is, the control slip B' may only overlap one secondary slip.

The slips B and C are essentially alike and involve a substantially rectangular vertically disposed element, wedge-shaped in cross section and tapered toward the upper end. The slips B and C are characterized by cylindrical inner and outer faces 20 and 21, respectively. The inner face 20 is plain and smooth, while the outer face 21 is provided with teeth or wickers 22 adapted to have gripping engagement with the interior of the previously set casing.

In practice, there may be two or three or more slips B or C at one level, as shown in the drawings, and each slip is carried in a recess 25 in the outer wall 15 of the body A. The recesses 25 are preferably formed in the body A in an equally spaced series that extends circumferentially of the body A, there being several series of recesses, one series for the control slips B and one series for each of the secondary slips C. Each recess 25 is angularly related to the axis of the body A and is characterized by a cylindrical bottom wall 26 formed about an axis that intersects the axis of the body A at an acute angle. The recess 25 has side walls 27 and enters the body A to extend downwardly and inwardly where it terminates at a lower end wall 28. The cylindrical bottom wall 26 extends upwardly and outwardly from the end wall 28 and intersects and terminates at the outer wall 15 of the body A. The angular relationship of the inner cylindrical face 20 of the slips B and C is the same as the angular relationship of the wall 26 so that the outer face 21 of the slips is parallel with the axis of the body A. It will be apparent from the foregoing that the entire area or inner face of the slips B and C engage with the bottom walls 26 of the recesses 25.

The slips B and C are shiftable axially of the body A so that they move outwardly into engagement with the interior of the casing 10. Therefore, I have provided slip retaining means D that allow for free axial movement of the slips B and C. The retaining means D secure the slips onto the body A so that they are not displaced therefrom and involve lips 30 at the sides of each slip. The lips 30 are carried in channels 31 formed in the sides 27 of the recesses 25 carrying the slips. The channels 31 are adjacent the bottom wall 26 and allow the slips to move freely along the bottom 26. A stop 32 may be provided in order to limit upward movement of the control slips B.

The slip actuating means E that I have provided is employed in connection with each individual slip B and C and involves, generally, a spring means adapted to yieldingly urge the slip upwardly and outwardly into pressure engagement with the casing 10. As shown, there is a substantially vertically disposed socket 35 formed in the body A and entering the recess 25 through the lower end wall 28 thereof. In practice, there may be one or more of said spring means. A guide 36 depends from the lower end of the slip in alignment with, and adapted to enter into the socket 35 and a spring 37 is carried on the guide 36 and extends into the socket 35. The spring 37 is operable between the socket 35 and slip and acts to yieldingly urge the slip upwardly when the control slip or slips B are allowed to move axially. It is to be observed that each slip is individually actuated by the springs 37 of the means E.

The operating tool F that I provide is adapted to carry the hanger X and lower casing Y into position in the well and to release the hanger so that the slips B and C are actuated into individual pressure engagement with the

interior of the casing already set in the well. The tool F involves, generally, a nut 40 threadedly engageable with the threads 19 at the upper end of the body A, a polygonal mandril 41 shiftable carrying the nut 40 and having driving engagement therewith, and an anti-friction collar 42 rotatably carried on the nut 40 and adapted to lock with the upper end of the body A.

The nut 40 has outer left-hand threads 43 for coupling to the body A, and is provided with a polygonal bore 44 slidably receiving the mandril 41. The mandril 41 has a stop 45 in the form of an enlargement at its lower end and is provided with a threaded coupling 46 at its upper end for receiving the lower end of a drill pipe, or the like. The anti-friction collar 42 is rotatably carried on the exterior of the nut 40 above the threads 43 and is held in working position by means of a stop ring 47 threaded onto the nut. A row of ball bearings 48, or the like, is carried by a suitable retainer 49 to occur between the stop ring 47, and the collar 42. The collar 42 has a downwardly disposed conical face 50 engageable with the face 18 above referred to, to have locking engagement when the parts are tightly threaded together.

The collar 42 shifts longitudinally of the tool and acts to hold the slips B and C in a down or retracted position, and when the tool F is operated, acts to release the slips so that they are actuated to an up or extended position. Extensions 57 may be provided to project upwardly from the slips B to be directly engaged by the collar 42. As shown in Figs. 1, 2, 5, and 7, of the drawings, fingers 55 depend from the collar 42, there being one finger for each control slip B. The fingers 55 are received in channels 56 in the upper end of the body A and engage the upper ends of the control slips B to hold them depressed and in a down or retracted position. As shown in Fig. 9 of the drawings, each slip B' may be engaged by an extension 55' that depends from the collar 42' and engages a pin 56' that projects laterally from the slip. As shown, the pin 56' may project inwardly through a longitudinal slot 57' in the wall of the body A'.

In order to operate the multiple slip casing hanger of the present invention with the operating tool F that I have provided, the hanger X is applied to the upper end of the casing Y to be set in the lower portion of the well bore 11, and the operating tool F is threadedly engaged with the hanger X. With the parts thus related, the casing Y and tool X are lowered into the well to the proper working position by the use of a string of drill pipe, or the like, and when it is desired to release the hanger X, the drill pipe is rotated in a right-hand direction, whereupon the threaded connection between the operating tool F and the hanger X is released allowing the tool F to be withdrawn from the hanger X. As the tool is withdrawn from the hanger X the control slips B are operated by the actuating means E and so that the secondary slips are also operated by the actuating means E. Thus, it will be apparent that a multiplicity of slips is brought into engagement with the interior of the casing previously set in the well with each slip independently engaging the casing and so that the new casing Y is reliably suspended in the well.

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

Having described my invention, I claim:

1. A multiple slip hanger of the character described, including, an elongate cylindrical body, upper and lower circumferentially offset recesses in the wall of said body, said recesses having inclined walls, and a wedge-shaped slip slidably retained in each recess, the slips in the upper recesses as overlying and engaging adjacent slips in the lower recesses.

2. A multiple slip hanger of the character described,

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including, an elongate cylindrical body, upper and lower circumferentially offset rows of recesses in the wall of said body, said recesses having inclined walls, a wedge-shaped slip slidably retained in each recess, the slips in the upper recesses overlying and engaging the slips in the lower recesses, and individual actuating means at each slip yieldingly urging the slip upwardly in the recess in which it is retained.

3. A multiple slip hanger of the character described, including, an elongate cylindrical body, a plurality of circumferentially spaced upwardly and radially outwardly inclined upper recesses in the wall of said body, a plurality of circumferentially spaced upwardly and radially outwardly inclined lower recesses in the wall of said body, the lower recesses being circumferentially offset from the upper recesses to extend between adjacent upper recesses, a slip slidably retained in each recess, the slip in each of said upper recesses overlying and engaging the slips in the adjacent lower recesses, actuating means carried by the body adjacent each slip to urge said slips upwardly, and an operating tool fixed to the lower end of a drill pipe and threadedly engaged with the hanger body and releasable therefrom, said tool having a depending portion overlying and engaging each of the upper slips to normally hold the slips down and inactive.

4. A multiple slip hanger of the character described, including, an elongate cylindrical body, a plurality of circumferentially spaced upper recesses in the wall of said body, a plurality of circumferentially spaced lower recesses in the wall of said body, the lower recesses being circumferentially offset from the upper recesses to extend between and communicate with adjacent upper recesses, said recesses having upwardly and radially outwardly inclined bottom walls, a slip slidably retained in each recess, each of said upper slips overlying and engaging the two adjacent lower slips, spring loaded actuating means carried by the body adjacent each slip to normally yieldingly urge the slips upwardly relative to the body and into

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active position, and an operating tool fixed to the lower end of a drill pipe and threadedly engaged with the hanger body and releasable therefrom, said tool having portions overlying and engaging the upper slips to normally hold the slips down against the resistance of the actuating means and in position.

5. A multiple slip hanger of the character described, including, an elongate cylindrical body, a plurality of elongate, longitudinally disposed, circumferentially spaced, upwardly and radially outwardly inclined upper recesses in the wall of said body, a plurality of elongate, longitudinally disposed, circumferentially spaced upwardly and radially outwardly inclined lower recesses in the wall of said body, the lower recesses being circumferentially offset from the upper recesses to extend between and communicate with adjacent upper recesses, a slip slidably retained in each recess, the slip in each of said upper recesses overlying and engaging slips in the two adjacent lower recesses, individual actuating means related to each slip and including a compression spring at the lower end of the slip and acting against the body to urge the slip upwardly, and an operating tool fixed to the lower end of a drill pipe and threadedly engaged with the upper end of the hanger body and releasable therefrom upon rotation of the drill pipe, said tool having circumferentially spaced, depending fingers engaging the tops of the upper slips to hold the slips down and against the resistance of the compression springs and inactive.

References Cited in the file of this patent

UNITED STATES PATENTS

1,667,733	Leonard	May 1, 1928
1,815,376	Jones	July 21, 1931
1,839,652	Crippen	Jan. 5, 1932
2,228,503	Boyd et al.	Jan. 14, 1941
2,241,561	Spencer	May 13, 1941