Feb. 25, 1958 R. C. BAKER ET AL 2,824,613

STOP DEVICES FOR WELL CONDUITS

Filed March 24, 1952 2 Sheets-Sheet 1

Fig. 1.

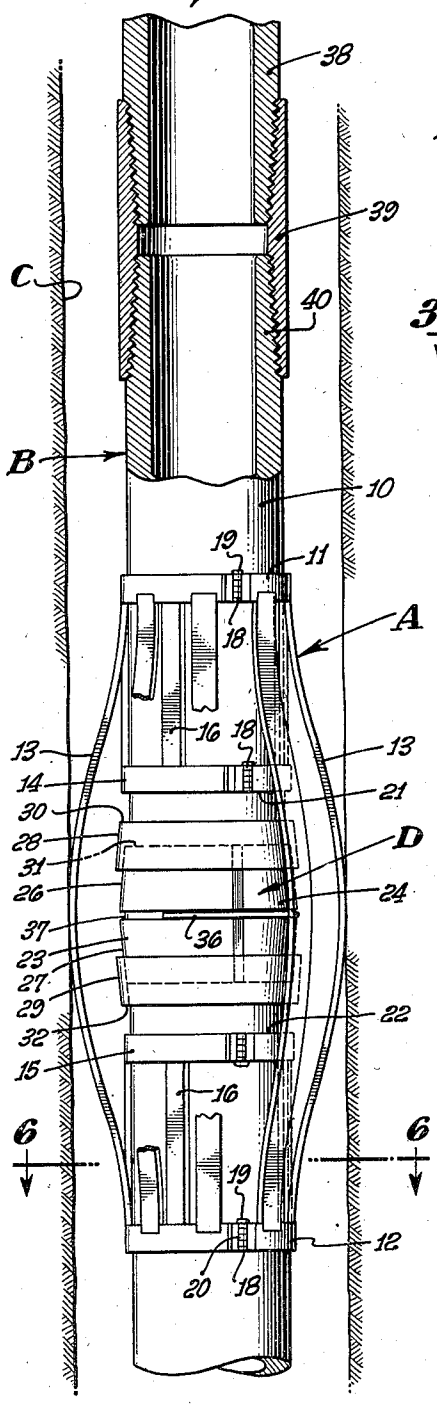

Fig. 2.

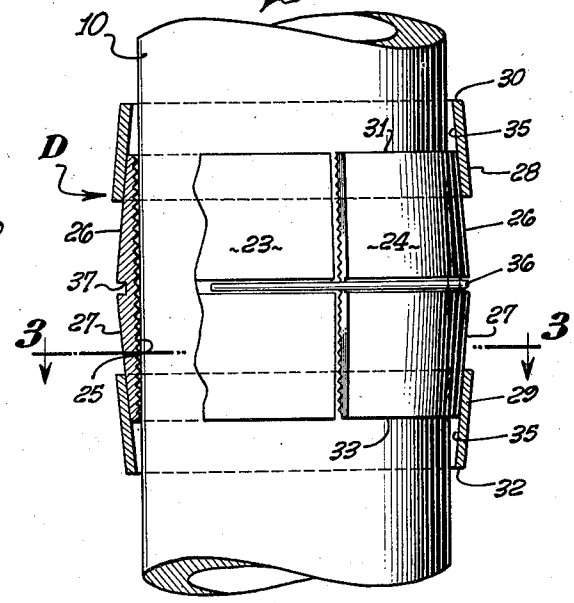

Fig. 3.

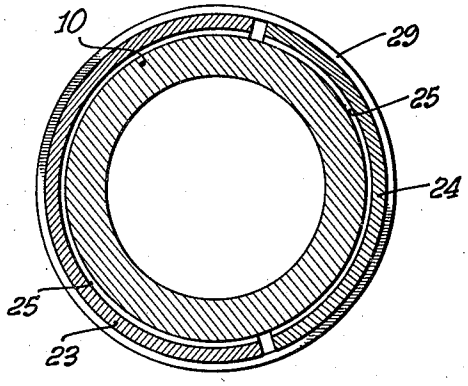

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Fig. 4.

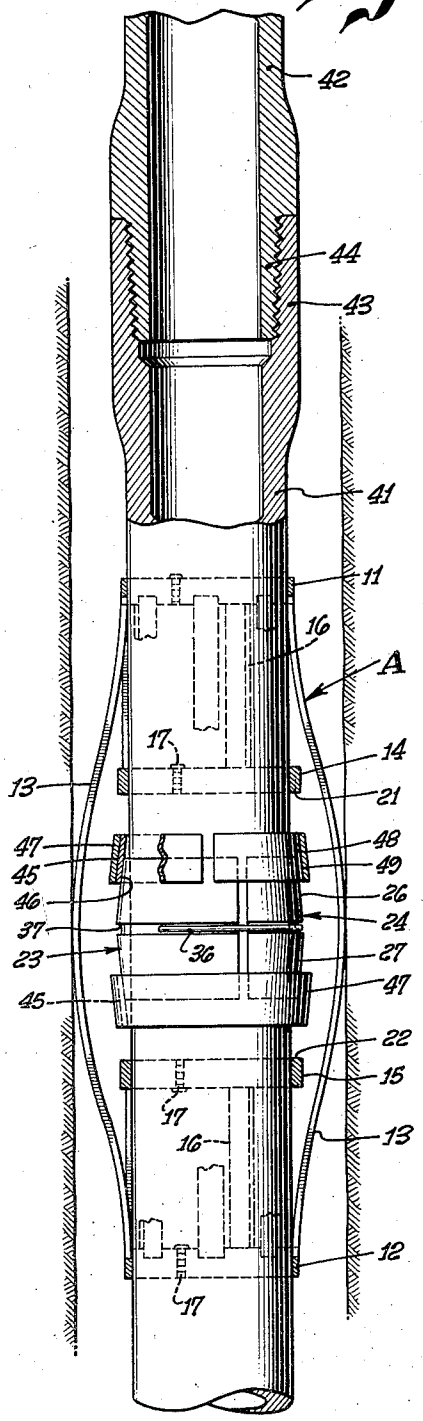


Fig. 5.

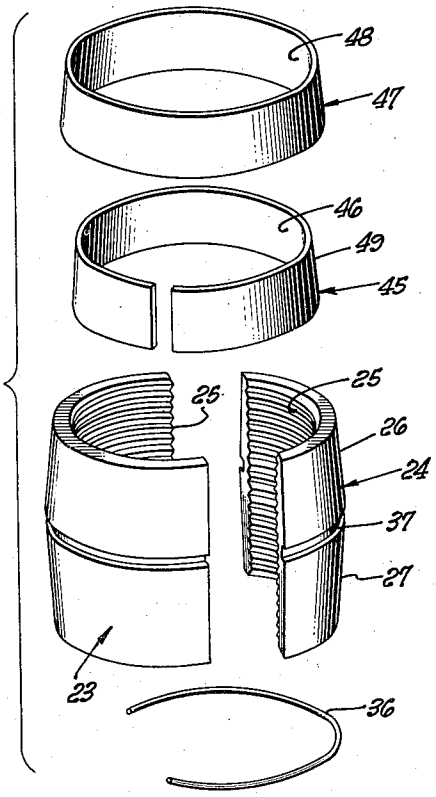
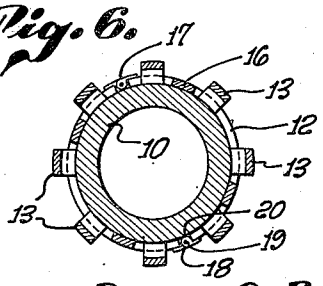


Fig. 6.



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2,824,613

STOP DEVICES FOR WELL CONDUITS

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Application March 24, 1952, Serial No. 278,182

9 Claims. (Cl. 166—241)

The present invention relates to subsurface well equipment, and more particularly to devices capable of being mounted on well casing, liner, tubing, and similar conduit, strings for moving apparatus on said strings longitudinally through the well bore.

Apparatus, such as casing centralizers, wall scratchers, and cement baskets are mounted on casing, or similar conduit, strings, being moved longitudinally through the well bore with the casing string because of their engagement with one or more stop devices secured to the casing string. Heretofore, the stop device or devices have been secured to the casing string in a rigid manner by use of welding material, which is a time consuming operation, and which also requires the availability of welding equipment at the well location.

An object of the present invention is to provide a stop device of the character mentioned above which can be easily and securely mounted on the conduit string without resort to welding operations and the like.

Another object of the invention is to provide a stop device of simple construction and small number of parts, which tends to tighten itself on the well conduit string when in use, thereby precluding its inadvertent disconnection from the conduit string.

A further object of the invention is to provide a stop device of the type indicated which can be secured to externally upset casing, as well as other types of casing, such as threaded and coupled casing.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several forms in which it may be embodied. Such forms are shown in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a side elevation of apparatus mounted on a string of well casing disposed in a well bore, the parts being broken away for purposes of clarity;

Fig. 2 is an enlarged longitudinal section, parts being shown in elevation, of one form of stop device used in the combination shown in Fig. 1;

Fig. 3 is a cross-section taken along the line 3—3 on Fig. 2;

Fig. 4 is a view similar to Fig. 1 of a modified form of the apparatus embodying the invention;

Fig. 5 is an exploded view of part of the stop device forming a portion of the apparatus illustrated in Fig. 4;

Fig. 6 is a cross-section taken along the line 6—6 on Fig. 1.

The specific devices illustrative of the invention, and shown in the drawings, are particularly designed for use with a casing centralizer A mounted on a string of well casing B, or other running-in string, positionable in a well bore. It is to be understood, however, that such devices are also useful in other relationships, being adapted for engagement with wall scratchers, cementing baskets, and other apparatus, mounted on a casing or similar conduit string, to be moved longitudinally through

the well bore with such conduit string, as well as being supported on the latter.

As shown in the drawings, the casing centralizer A is mounted on a casing section 10 disposed in the well bore C. The centralizer can take any desired form, the one particularly shown including upper and lower longitudinally spaced collars 11, 12 slidable on the casing section 10, which are interconnected by circumferentially spaced, outwardly bowed leaf spring members 13 welded, or otherwise suitably attached, to the upper and lower collars. The springs 13 engage the wall of the well bore C and tend to center the well casing therewithin.

Upper and lower stop rings 14, 15 are secured in longitudinally spaced relation to the upper and lower collars 11, 12, respectively, as by use of circumferentially spaced and longitudinally extending rigid bars 16 that are attached to both the collars 11, 12 and the rings 14, 15 in any suitable manner, as by a welding operation.

The particular centralizer disclosed is of the hinge type, in which the collars 11, 12 and the rings 14, 15 are each formed of two parts that are secured to one another by hinges 17, 18 (see Fig. 6, particularly). The hinges 18 on one side of the device may be disconnected as by removing the hinge pins 19, which then allow the casing centralizer to be swung to open position and placed laterally around the casing section 10, whereupon the centralizer can be closed and the pins 19 reinserted through the hinge knuckles 20, all in a known manner.

The centralizer or centering apparatus A is movable longitudinally through the well bore upon longitudinal movement of the casing B. A stop device D is secured to the casing section 10 between the upper and lower stop rings or collars 14, 15, such device being engageable with the inner edges 21, 22 of the rings to force the centralizer apparatus through the well bore. For example, the stop device is engageable with the upper edge 22 of the lower stop ring 15 when the casing B is moved downwardly in the well bore, to pull the apparatus A and its outwardly bowed springs 13 through the well bore and past any restrictions that might be encountered therein. Conversely, movement of the casing string in an upward direction will cause the stop device D to engage the lower edge 21 of the upper stop ring 14 and pull the centering device A in an upward direction with the casing string B within the well bore.

As disclosed in Figs. 1, 2 and 3, the stop device D includes a split or segmental collar 23, 24 having internal wickers or teeth 25 that are adapted to dig in or grip the periphery of the casing section 10. The periphery of the stop collar is provided with upper and lower tapered surfaces 26, 27, the upper surfaces 26 converging in an upward direction and the lower surface 27 converging in a downward direction. Disposed around the upper surface 26 of the segmental collar 23, 24 is a circumferentially continuous ring or sleeve 28, which snugly embraces such tapered surface of the collar. A similar lower lock ring or sleeve 29 is disposed in snug engagement with the lower tapered surface 27, although this lower ring is oppositely arranged with respect to the upper ring. The upper end 30 of the upper ring 28 extends in an upward direction beyond the upper end 31 of the stop collar 23, 24, whereas the lower end 32 of the lower ring 29 extends downwardly below the lower end 33 of the stop collar. Such ends 30, 32 of the rings are disposed adjacent the periphery of the casing section 10; so as to be engageable with the upper and lower ends 21, 22 of the stop rings 14, 15 of the centralizer A when the entire stop device D is disposed between the centralizer stop rings 14, 15.

When a longitudinal force is exerted on each lock ring 28, 29, tending to drive it toward the larger portion of the tapered collar 23, 24, the segments 23, 24 are

thereby driven laterally inwardly, to dig the wickers or teeth 25 firmly into the casing, thereby holding the entire stop device assembly D firmly anchored to the casing B. It is evident that the downward driving of the upper lock ring 28 on the tapered collar will wedge the segments 23, 24 of the latter inwardly against the casing, whereas the upward driving of the lower lock ring 29 upon the collar will drive the segments 23, 24 of the latter inwardly against the periphery of the well casing.

It is preferred that the lock rings 28, 29 be of a frusto-conical or tapered construction, their inner tapered surfaces 35 conforming to the external tapers 26, 27 on the collar 23, 24. By virtue of this arrangement, a surface engagement is obtained between the rings 28, 29 and the collar 23, 24 that has a large load transmitting capacity. In addition, the outer ends 30, 32 of these rings are thereby disposed closely adjacent the periphery of the well casing B; so as to be capable of engaging the stop rings or collars 14, 15 of the centralizer device A.

The wickers or teeth 25 of the tapered collar 23, 24 are designed to grip the casing firmly and prevent longitudinal movement of the collar on the casing in both directions. These teeth may be constituted by a V thread formed in the collar, and they may have relatively sharp inner edges; to dig into the well casing.

The collar itself may be formed of a plurality of sections 23, 24. As disclosed in the drawings, it is preferred to use two sections, one section 23 extending arcuately greater than 180 degrees, the other section 24 constituting the remainder of the collar. The collar section 23 of larger arcuate extent tends to contract with its wickers or teeth 25 gripping the periphery of the casing B. When this larger collar segment is to be mounted on the casing, it can be sprung outwardly, passing laterally over the casing beyond the casing diameter and then released, snapping into place with its wickers 25 engaging the well casing. The other smaller collar section 24 can then be inserted laterally into a position in transverse alignment with the other collar segment, and this smaller segment held in place by use of an inherently constractile snap ring 36 fitting into a peripheral groove 37 formed collectively in both sections 23, 24.

The embodiment of the invention illustrated in Figs. 1 to 3 can be used readily in connection with threaded and coupled casing, such as illustrated in Fig. 1. An upper casing section 38 is secured to a lower casing section 10 by an intervening coupling collar 39. Prior to attachment of the coupling collar 39 to the lower casing section, the lower lock ring 29 can be placed over the upper end of the lower section 10 and moved downwardly to its desired location, which will ordinarily be an adequate distance below the pin end 40 of the lower casing section. Thereafter, the larger collar segment 23 is expanded and moved laterally onto the casing section 10, being released to grip this section. The smaller collar segment 24 can be moved laterally into its proper position in transverse alignment with the larger segment and the snap ring 36 then disposed in the peripheral groove 37 formed in both segments. The lower ring 29 may then be moved upwardly and wedged over the aligned collar segments 23, 24. The upper lock ring 28 is then moved over the upper pin end 40 of the lower casing section 10 and moved downwardly until it is located over the upper tapered surface 26 of the collar segments. This ring 28 can then also be wedged downwardly over the tapered surface 26. It is evident that the wedging actions of the upper and lower lock rings 28, 29 firmly anchor the collar segments 23, 24 to the casing section 10.

The hinged centralizer device A can then be opened and moved laterally over the casing section 10, with its upper and lower stop rings 14, 15 disposed on opposite sides of the stop device D. The hinge pins 19 can then be reinserted through the hinge knuckles 20. After this occurs, the coupling collar 39 can be mounted on the lower casing section 10 and the casing sections 38 thereabove secured to one another in the usual manner, to constitute the casing string, as the latter is lowered in the well bore. During such lowering of the casing string, the lower lock ring 29 will engage the lower stop ring 15 and pull the casing centralizer through the well bore. The force exerted in a longitudinal direction by the lower lock ring 29 on the lower centralizer lock ring 15 tends to wedge the former more firmly over the collar segments 23, 24 and forces the wickers or teeth 25 of the latter more securely into the well casing, insuring against slippage between the two. Similarly, in the event the casing string is elevated, the upper lock ring 28 will engage the upper stop ring 14 on the centralizer, causing the former to be wedged more firmly down over the collar segments 23, 24, urging them laterally inward into firmer gripping engagement with the periphery of the well casing.

In the form of the invention disclosed in Figs. 4 and 5, the same segmental collar 23, 24 and snap ring 36 device can be used. However, in place of a single lock ring at each end of the collar segments, a pair of nested lock rings is used to enable the device to be assembled on externally upset casing 41, 42.

As shown in Fig. 4, the box and pin ends 43, 44 of the externally upset casing have substantially greater diameter than the normal diameter of the main portion of each casing section. Accordingly, a single lock ring, such as shown in the other form of the invention, would have to be too large in inside diameter, for the purpose of slipping it over the externally upset pipe end 43, to be capable of engaging the stop ring 14 or 15 of the casing centralizer. For that reason, the nested arrangement shown in Figs. 4 and 5 is used.

As disclosed, the stop ring on each end of the segmental collar 23, 24 includes an inner split ring 45 of frusto-conical shape having an inner tapered surface 46 conforming to the tapered surface 26 or 27 of the collar segments. An outer circumferentially continuous lock ring 47 is also formed of frusto-conical shape, its inner tapered surface 48 conforming to the outer tapered surface 49 of the inner split ring member 45.

In assembling the stop device on the well casing, the lower outer continuous ring 47 is first moved over the enlarged externally upset portion 43 of the casing section 41. This ring has a minimum inside diameter sufficient to permit it to be passed longitudinally over such enlarged casing end 43. The smaller diameter split ring 45 can then be spread apart sufficiently, to also enable it to be passed longitudinally over the enlarged end 43 of the casing 41, and then moved downwardly to be nested inside the lower outer continuous ring 47. The collar segments 23, 24 and snap ring 36 for coupling them to one another are then placed over the casing section in the same manner as described in connection with the other form of the invention. The lower split ring 45 is then moved upwardly with its inner surface 46 in engagement with the lower tapered surface 27 of the collar segments 23, 24. The lower continuous ring 47 is then moved upwardly, to place its inner tapered surface 48 in snug engagement with the external tapered surface 49 of the inner split ring.

The upper split ring 45 and upper outer continuous ring 47 are then moved in sequence over the enlarged end 43 of the casing section and moved downwardly to place the inner surface of the split ring 46 in engagement with the upper tapered surface 26 of the collar segments 23, 24, the continuous ring 47 then being disposed snugly over the split ring 45, with its inner tapered surface 48 engaging the outer tapered surface 49 of the latter.

The two rings 45, 47 at each end of the segmental collar 23, 24 may then be driven onto the companion tapered surface of the segments, to wedge the rings firmly on such segments 23, 24 and to wedge the latter inwardly to cause their wickers or teeth 25 to be embedded securely in the casing section 41. The casing centralizer A is then mounted on the casing section 41, in the same

manner as described in connection with the other form of the invention, with the centralizer stop rings **14**, **15** disposed on opposite sides of the upper and lower nested lock rings **48**, **49** of the stop device.

During lowering of the casing string in the well casing, the lower split and continuous rings **45**, **47** engage the lower centralizer stop ring **15**, the longitudinal force being transmitted between the two, urging the lock rings **45** upwardly along the externally tapered surface **27** of the segments **23**, **24** and forcing the latter inwardly against the casing. Any longitudinal force exerted on the inner split ring **45** tends to spread it apart, in view of its being a split member. However, such spreading tendency is prevented by the outer continuous ring **47**. Any longitudinal force imposed on the outer ring **47** by the stop collar **15** of the casing centralizer tends to move it longitudinally relative to the split ring **45**, and, in view of their coengaging tapered urfaces **48**, **49**, urges the split ring inwardly, contracting it slightly and also causing such contraction to force the segments **23**, **24** of the collar more firmly against the well casing.

In the event the casing string is moved upwardly, then the upper split ring **45** and outer continuous ring **47** are engageable with the upper stop collar **14** of the casing centralizer A, being wedged more firmly with respect to one another and upon the collar segments **23**, **24**, in the same manner as described in connection with the lower ring.

Although the embodiments of the invention have been described in connection with both upper and lower lock rings, the apparatus will function if only one half of it is used. As an example, if only the upper tapered lock ring **28** shown in Fig. 2 is used in conjunction with the upper portion of the collar segments **23**, **24**, then the engagement of the collar segments with the lower stop collar **15** of the casing centralizer would urge such segments longitudinally into the tapered lock ring **28**, and cause the segments **23**, **24** to be disposed more firmly against the well casing. Similarly, during upward movement of the casing section **10**, the end of the lock ring **28** would engage the upper stop collar **14** of the centralizer and be urged down over the collar segments **23**, **24**, forcing them inwardly to a greater extent into gripping engagement with the periphery of the well casing.

It is, accordingly, apparent that stop devices for casing centralizers and similar apparatus have been provided, which are easily mounted on the well casing, and which will remain in assembled position, despite the imposition of comparatively heavy loads thereon. No welding is necessary, the rings **28**, **29** or **45**, **47** merely being associated with the segmental collar **23**, **24** by hand, and driven thereon through use of a suitable tool, such as a hammer, mallet, wrench, etc.

The inventors claim:

1. In a stop device adapted to be mounted on a tubular running-in string to be lowered in a well bore to engage an apparatus mounted on the tubular running-in string: a split collar having an inner surface adapted to grip the running-in string and an external tapered smooth surface; a longitudinally split inner ring encompassing and engaging said external tapered surface, said ring having an external tapered smooth surface; and a circumferentially continuous outer ring encompassing and engaging the smooth tapered surface of said inner ring, said outer ring being movable longitudinally and without rotation along said inner ring to wedge itself upon said inner ring, the smaller end of said split inner ring extending axially at least as far as said outer ring, whereby said inner ring is engageable with the apparatus mounted on the tubular running-in string to grip said collar with the running-in string.

2. In a stop device adapted to be mounted on a tubular running-in string to be lowered in a well bore to engage an apparatus mounted on the tubular running-in string. a split collar having an inner surface adapted to grip the running-in string and upper and lower external smooth surfaces tapering in opposite directions; longitudinally split upper and lower inner rings disconnected from each other and disposed over and in wedging engagement with said upper and lower external surfaces, respectively, said split rings having external smooth surfaces tapering in opposite directions; and upper and lower circumferentially continuous outer rings disconnected from each other and disposed over and in wedging engagement with said upper and lower external surfaces, respectively, of said inner rings the smaller end of each split ring extending axially at least as far as the adjacent end of an associated outer ring, whereby each split ring is engageable with the apparatus mounted on the running-in string to grip said collar with the running-in string.

3. In a stop device adapted to be mounted on a tubular running-in string to be lowered in a well bore to engage an apparatus mounted on the tubular running-in string: a split collar having an inner surface adapted to grip the running-in string, said collar having an upper external smooth surface converging in an upward direction and a lower external smooth surface converging in a downward direction; a split upper annular member disposed around said upper surface and having a tapered internal smooth surface companion to and engaging said upper surface, said split upper ring having an outer smooth surface converging in an upward direction; a circumferentially continuous outer annular member disposed around said inner member and having a tapered internal smooth surface companion to and engaging said surface of said inner member; an inner split lower annular member disposed around said lower surface of said collar and having a tapered internal smooth surface companion to and engaging said lower surface of said collar, said lower inner member having an external smooth surface converging in a downward direction; a lower circumferentially continuous annular member disconnected from said other circumferentially continuous annular member and disposed around said outer surface of said lower split member and having a tapered internal smooth surface companion to and engaging said lower surface of said lower split member; said upper and lower split members and circumferentially continuous members extending longitudinally outward beyond the upper and lower ends of said split collar the upper end of said upper split member and the lower end of said lower split member extending longitudinally at least as far as the adjacent upper end of said upper continuous member and the adjacent lower end of said lower continuous member, respectively, whereby each split ring is engageable with the apparatus mounted on the tubular running-in string to grip said collar with the tubular running-in string.

4. In a stop device adapted to be mounted on a tubular running-in string to be lowered in a well bore to engage an apparatus mounted on the tubular running-in string: a segmental collar composed of separate segments and having an upper external smooth surface converging in an upward direction and a lower external smooth surface converging in a downward direction; a split upper annular member disposed around said upper surface and having a tapered internal smooth surface companion to and engaging said upper surface, said split upper ring having an outer smooth surface converging in an upward direction; a circumferentially continuous outer annular member disposed around said inner member and having a tapered internal smooth surface companion to and engaging said surface of said inner member; an inner split lower annular member disposed around said lower surface of said collar and having a tapered internal smooth surface companion to and engaging said lower surface of said collar, said lower inner member having an external smooth surface converging in a downward direction; a lower circumferentially continuous annular member disposed around said outer surface of said lower split member and having a tapered internal smooth surface

companion to and engaging said lower surface of said lower split member; said upper and lower split members and circumferentially continuous members extending longitudinally outward beyond the upper and lower ends of said segmental collar the upper end of said upper split member and the lower end of said lower split member extending longitudinally at least as far as the adjacent upper end of said upper continuous member and the adjacent lower end of said lower continuous member, respectively, whereby each split ring is engageable with the apparatus mounted on the tubular running-in string to grip said collar with the tubular running-in string; one of said segments having an arcuate extent of over one hundred and eighty degrees.

5. In combination: a tubular running-in string to be lowered in a well bore; a stop device mounted on said running-in string to be lowered therewith in the well bore; another device on the running-in string; said stop device including a split collar member having an inner surface adapted to grip the running-in string and upper and lower external smooth surfaces tapering in opposite directions; upper and lower annular members disconnected from each other and disposed over and in wedging engagement with said upper and lower external surfaces, respectively, to urge and hold said inner surface in gripping engagement with the running-in string; one of said members being engageable with said another device to move said another device in the well bore in response to longitudinal movement of said running-in string in the well bore; the engaging force between said one of said members and said another device tending to shift said collar member and one of said annular members longitudinally relative to each other to maintain said collar member and said one of said annular members in wedging engagement with each other.

6. In combination: a tubular running-in string to be lowered in a well bore; a stop device mounted on said running-in string to be lowered therewith in the well bore; another device on the running-in string; said stop device including a split collar having an inner surface adapted to grip the running-in string, said collar having an upper external smooth surface converging in an upward direction and a lower external smooth surface converging in a downward direction, an upper annular member disposed around an upper surface and having a tapered internal smooth surface companion to and engaging said upper surface, a lower annular member disposed around said lower surface and having a tapered internal smooth surface companion to and engaging said lower surface, said upper and lower members being disconnected from each other and extending longitudinally outward beyond the upper and lower ends of said split collar to engage and move said another device in the well bore in response to longitudinal movement of said running-in string in the well bore; the engaging force between said upper and lower members and said another device tending to shift said annular members and collar longitudinally relative to each other to maintain said annular members and collar in wedging engagement with each other.

7. In combination: a tubular running-in string to be lowered in a well bore; a stop device mounted on said running-in string to be lowered therewith in the well bore; another device on the running-in string; said stop device including a segmental collar member composed of separate segments and having an inner surface adapted to grip the running-in string and upper and lower external smooth surfaces tapering in opposite directions; upper and lower annular members disconnected from each other and disposed over and in wedging engagement with said upper and lower external surfaces, respectively, to urge and hold said inner surface in gripping engagement with the running-in string, one of said segments having an arcuate extent of over one hundred and eighty degrees; one of said members being engageable with said another device to move said another device in the well bore in response to longitudinal movement of said running-in string in the well bore; the engaging force between said one of said members and said another device tending to shift said annular members and collar member longitudinally relative to each other to maintain said annular members and collar member in wedging engagement with each other.

8. In combination: a tubular running-in string to be lowered in a well bore; a stop device mounted on said running-in string to be lowered therewith in the well bore; another device on the running-in string; said stop device including a segmental collar composed of separate segments and having an inner surface adapted to grip the running-in string, said collar having an upper external smooth surface converging in an upward direction and a lower external smooth surface converging in a downward direction, an upper annular member disposed around said upper surface and having a tapered internal smooth surface companion to and engaging said upper surface, a lower annular member disposed around said lower surface and having a tapered internal smooth surface companion to and engaging said lower surface, said upper and lower members being disconnected from each other and extending longitudinally outward beyond the upper and lower ends of said segmental collar, one of said segments having an arcuate extent of over one hundred and eighty degrees, said annular members being engageable with said another device to move said another device in the well bore in response to longitudinal movement of said running-in string in the well bore; the engaging force between said annular members and said another device tending to shift said annular members and collar longitudinally relative to each other to maintain said annular members and collar in wedging engagement with each other.

9. In combination: a tubular running-in string to be lowered in a well bore; a stop device mounted on said running-in string to be lowered therewith in the well bore; another device on the running-in string; said stop device including a split collar having an inner surface adapted to grip the running-in string, said collar having an upper external smooth surface converging in an upward direction and a lower external smooth surface converging in a downward direction, a circumferentially continuous upper annular member disposed around said upper surface and having a tapered internal smooth surface companion to and engaging said upper surface, a circumferentially continuous lower annular member disposed around said lower surface and having a tapered internal smooth surface companion to and engaging said lower surface, said upper and lower members being disconnected from each other and extending longitudinally outward beyond the upper and lower ends of said split collar to engage and move said another device in the well bore in response to longitudinal movement of said running-in string in the well bore; the engaging force between said members and said another device tending to shift said members and collar longitudinally relative to each other to maintain said members and collar in wedging engagement with each other.

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