Aug. 4, 1959 J. E. HALL, SR., ET AL 2,898,136

CASING STOP COLLAR TO MOUNT A WELL TOOL

Filed June 22, 1954 3 Sheets-Sheet 1

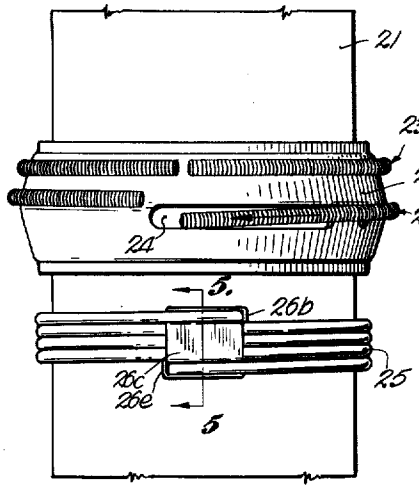

Fig. 1.

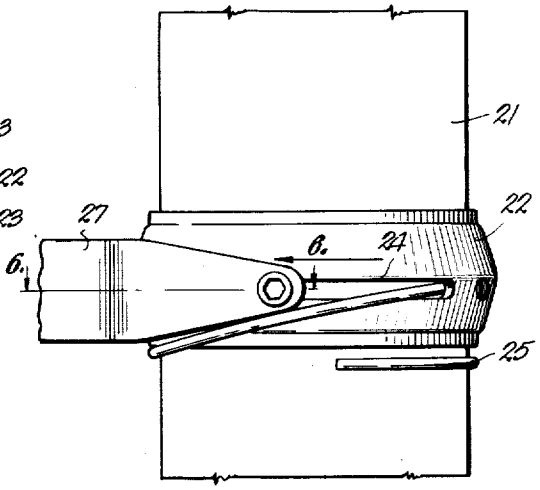

Fig. 3.

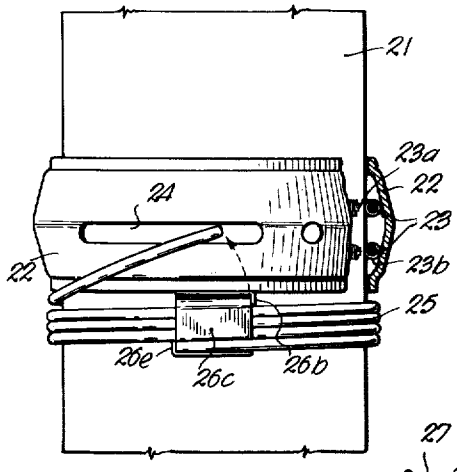

Fig. 2.

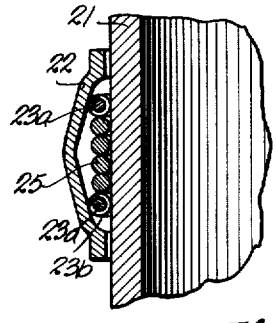

Fig. 4.

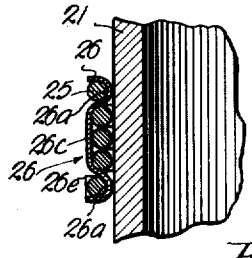

Fig. 5.

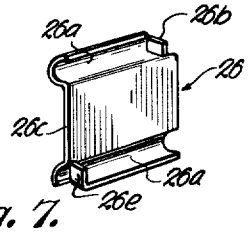

Fig. 7.

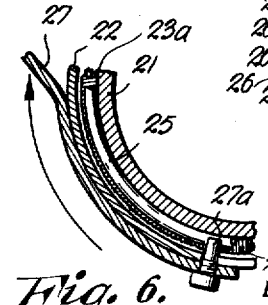

Fig. 6.

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CASING STOP COLLAR TO MOUNT A WELL TOOL

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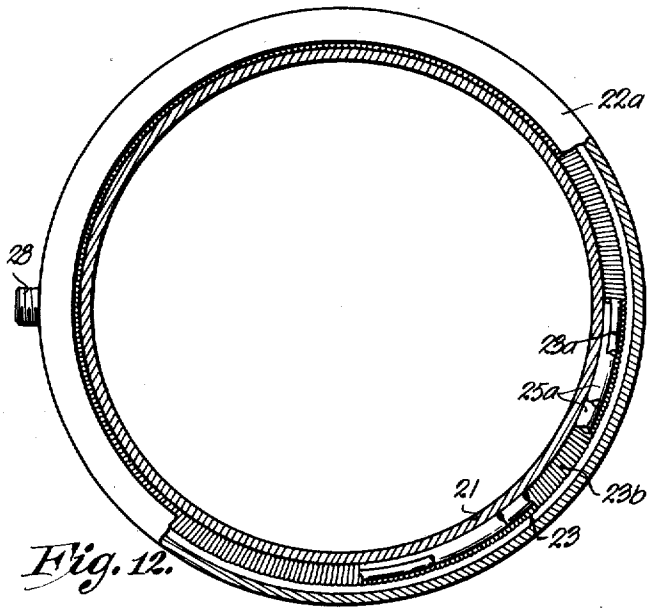

Fig. 12.

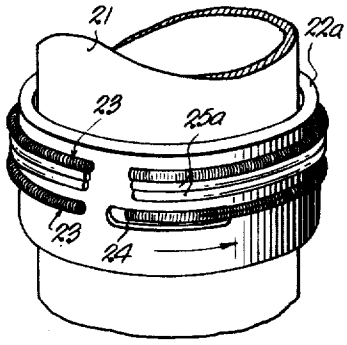

Fig. 8.

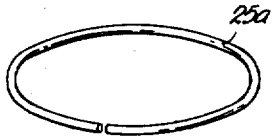

Fig. 9.

Fig. 10.

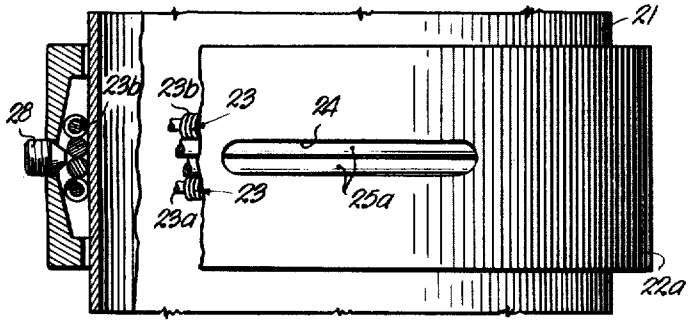

Fig. 13.

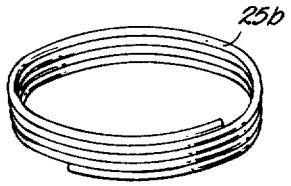

Fig. 11.

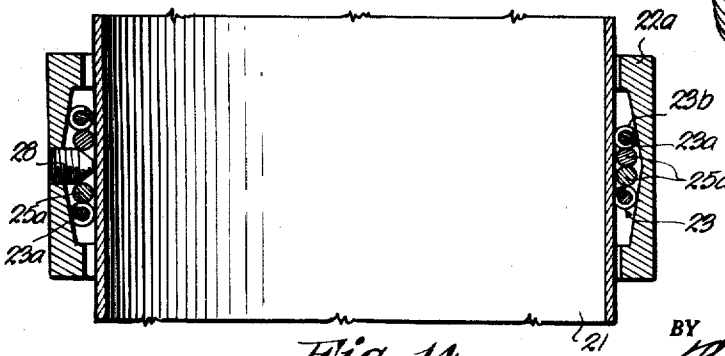

Fig. 14.

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CASING STOP COLLAR TO MOUNT A WELL TOOL

Filed June 22, 1954 3 Sheets-Sheet 3

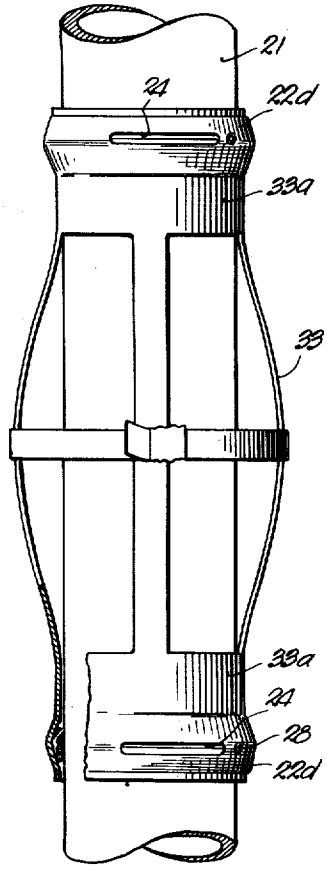

Fig. 20.

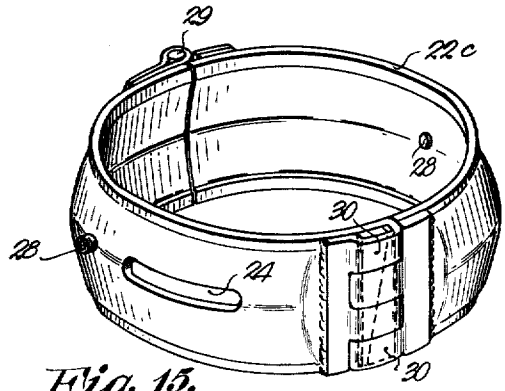

Fig. 15.

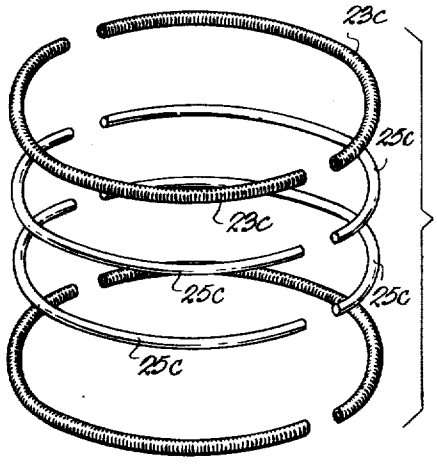

Fig. 16.

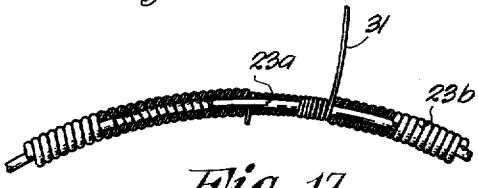

Fig. 17.

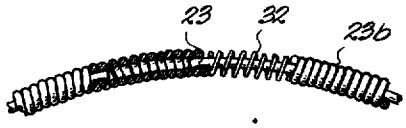

Fig. 18.

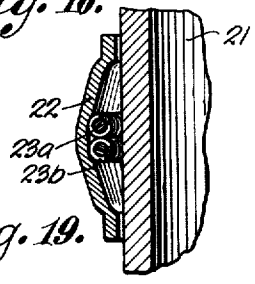

Fig. 19.

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CASING STOP COLLAR TO MOUNT A WELL TOOL

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Application June 22, 1954, Serial No. 438,504

12 Claims. (Cl. 287—52)

This invention relates to improvements in tool mountings and refers more particularly to pipe gripping devices and stop collar construction used on the exterior of pipe or casing to locate and mount well tools thereon.

Heretofore it has been conventional practice to attach well tools such as scratchers, centralizers and cement baskets by welding the collars of the tools to the pipe, or by welding lugs or stops above and below the tools to locate the tools on the pipe and limit their longitudinal movement while permitting their free rotation. The mounting of tools by welding is objectionable not only because of the expense of the labor involved and the necessity of having welding equipment available, but also because it is time-consuming and tends to weaken and deteriorate the pipe at and adjacent the welds.

An object, therefore, of the present invention is to provide a pipe gripping or stop collar construction which is simple, inexpensive to manufacture and easy to install by the operators on the job.

Another object is to provide a construction which is strong, rugged and designed to withstand the abuse to which it is subjected in deep well operations without slipping or failure.

A further object is to provide a construction which eliminates the necessity of welding operations and insures a satisfactory mounting by the use of wire wedge rings which are squeezed between the tapered interior surfaces of a collar and the cylindrical outer surface of the pipe.

Other and further objects and advantages will appear from the description and explanation which follows.

In the accompanying drawings, which form a part of the instant specification and are to be read in conjunction therewith, typical embodiments of the invention are shown, and in the drawings like reference numerals indicate like parts in the various views.

Fig. 1 is a side elevational view of a stop collar encircling a pipe with the wedge rings on the collar ready to be inserted and a pusher wire coil below the collar in position for assembly therewith.

Fig. 2 is a view similar to that shown in Fig. 1 after insertion of the wedge rings and showing entry of the leading end of the pusher wire into the collar.

Fig. 3 is a third view in sequence with Figs. 1 and 2, showing the manner in which the pusher wire coil is fed into the collar between the wedge rings by means of a spanner wrench.

Fig. 4 is a vertical section of a portion of the pipe and collar after insertion of the wedge ring and pusher wire.

Fig. 5 is a sectional view of the coil or pusher wire with its holding clip taken along the line 5—5 in Fig. 1 in the direction of the arrows.

Fig. 6 is a sectional view taken along the line 6—6 in Fig. 3 in the direction of the arrows.

Fig. 7 is a perspective detail of the clip used with the pusher wire coil.

Fig. 8 is a side view of a modified type of stop collar construction employing separate pusher rings instead of a continuous coil.

Fig. 9 is a detail of one of the pusher rings shown in Fig. 8.

Fig. 10 is a detail of one of the coil wrapped wedge rings shown in Fig. 8.

Fig. 11 is a detail of a single coil usable as a substitute for the separate coil wrapped springs and pusher rings shown in Figs. 9 and 10.

Fig. 12 is a plan view showing the pipe in section and with parts of the collar broken away revealing the assembly after insertion of the wedge and pusher rings.

Fig. 13 is an elevational view of the assembly shown in Fig. 12 with parts in section and parts broken away, indicating the location and insertion of the spreader screw.

Fig. 14 is a view corresponding to Fig. 13 after setting of the spreader screw.

Fig. 15 is a perspective view of a hinge type stop collar adapted to utilize the same pipe attachment as the solid collars shown in the previous figures.

Fig. 16 is a detail of a four-ring assembly for collar attachment, the wedge rings comprising two pairs of semicircular coil springs with solid core wire reinforcement and two pusher rings made up of pairs of semicircular wires or rods.

Fig. 17 shows a fragmentary detail, partly in section, of a modified type wedge ring of the coil wrapped wire construction utilizing a removable wrapping of small diameter wire for increasing the diameter of the ring and holding it in place in the collar while the collar is being mounted on the pipe.

Fig. 18 is a view of a portion of a wedge ring similar to that shown in Fig. 17 except that a short length of coil spring has been substituted for the wrapping of smaller wire to increase the diameter of the wedge ring while the collar is being mounted on the pipe.

Fig. 19 is a vertical section of a portion of the pipe and collar with wedge rings such as those shown in Figs. 17 and 18.

Fig. 20 is a side elevation, with parts in section, of a centralizer with stop collars employing the wedge rings and pusher wire construction incorporated as an integral part of its collars.

In the mounting of well tools, and particularly scratchers and centralizers, it is important to locate the tools at a predetermined position on the casing or pipe. Since the tools must operate within a designated and limited area of the well bore in order to accomplish the results for which they were intended, they must be located properly on the pipe. If it is desired to fixedly attach the tools to the pipe, it has been the usual practice to fasten the tools by welding directly to the exterior surface of the pipe. If it is desired to permit the tools to have a limited longitudinal movement and free rotative movement, it is conventional to weld lugs or stops above and below the tools and in some cases in mounting centralizers to place a stop collar within the device between the collars. By the present invention there is provided a gripping device which may form an integral part of the tool itself or constitute a separate collar or abutment for mounting the tool at the desired location on the pipe.

Referring to the structure shown in Figs. 1 to 4, inclusive, there is shown in these figures a stop collar used as an abutment for well tools mounted upon a casing or pipe. At 21 is indicated the pipe or casing. 22 designates a collar arched internally to form a passageway extending circumferentially of the collar and having inner wall surfaces tapered from the midsection of the collar toward the rims. The collar 22 is held fixedly in any preselected location on the pipe by the insertion of wedge

rings and pusher wires into the passageway where the wedge rings are squeezed or wedged between the internal tapered surfaces of the collar and the exterior surface of the pipe. The wedge ring assembly is probably best shown in Figs. 4, 12, 17 and 18. The rings are designated as a whole by the numeral **23**, and consist of an open-ended circular core wire **23***a* surrounded by a helically wrapped coil of smaller diameter wire **23***b*. These wedge rings are inserted into the arched passageway within the collar through a slotted aperture **24**, shown in Figs. 1 to 3, and Figs. 8, 13 and 15. After insertion of the wedge rings into the collar, they are separated and moved into wedging position by the insertion of pusher wires, shown in the form of a single continuous coil, at **25** in Figs. 1 to 4, as open-ended circular wires **25***a*, in Fig. 9 and semicircular sections of wire **25***b*, in Fig. 16.

The collar which serves as the abutment for the tool may be stamped from a band of heavy sheet metal as shown at **22** in Figs. 1 to 4 or machined from a heavy ring of metal as shown at **22***a* in Figs. 8 to 14. To facilitate mounting the collar on the pipe, it may be hinged as shown at **22***c* in Fig. 15.

To assemble the stop collar shown in Figs. 1 to 4, the wedge rings **23** are successively inserted into the passageway between the collar and pipe, after which they are moved apart in order that the pusher wire or rod can be inserted therebetween. In this embodiment the pusher wires are in the form of a continuous coil preferably held at a diameter somewhat greater than the outside diameter of the pipe by means of a clip **26** shown best in Fig. 7. Gripping devices or stop collars applied to oil well casing or pipe require a pusher wire coil of stiff rod or heavy gauge wire which is difficult to handle, particularly in the maintaining of its inside diameter at proper size to fit the pipe and threading of the wire easily into the collar after insertion of the wedge rings. To accomplish this, one end of the pusher wire **25** is held in the groove or trough **26***a* with the extremity of the wire abutting the stop **26***b*. The intermediate loops of the wire fit beneath the web portion **26***c* of the clip, with the opposite end of the coil resting in the lower groove or trough **26***d* and the other end of the wire abutting stop **26***e*. This clip, as previously indicated, maintains the internal diameter of the coiled pusher wire large enough so the coil may be slipped onto the pipe, as shown in Fig. 1. After the wedge rings **23** have been inserted in the collar, the end of the pusher wire adjacent the collar is lifted from the clip and inserted into aperture **24**. A spanner wrench **27**, shown in Figs. 3 and 6, is then fitted to the exterior of the collar, with pin **27***a* of the wrench inserted into the slotted aperture **24**. Rotation of the collar by means of the wrench in a direction opposed to the lead of the wire will easily feed the wire into the passageway of the collar in the manner shown in Fig. 3, until the entire coil lies against the pipe between the wedge rings, as shown in Fig. 4. As the pusher wire is fed into the collar, the clip **26** is removed from the coil and is discarded.

To assure proper functioning of the wedge ring within the collar, a spreader member or tapered setscrew **28** is screwed radially into the collar, as shown in Figs. 13 and 14. The tapered end of the screw **28** separates the loops of the pusher wire, forcing the pusher wires and wedge rings outwardly to cause the wedge rings to wedge tightly between tapered inner surfaces of the collar and the exterior of the pipe.

The modified structure shown in Figs. 8, 12, 13, and 14 has a somewhat heavier type collar **22***a* machined from a heavy metal ring. The wedge rings **23** used with this collar are of similar construction to those shown in Figs. 1 to 5, comprising a solid core wire surrounded by a wrapping or jacket of wire of lesser diameter. In place of a continuous coil of wire **25** used as the pusher or spacer between the wedge rings, there is provided in this modification separate circular solid rings for pusher wires, numbered **25***a* on the drawings. Also, as a substitute for the wedge rings and separate circular pusher rings as shown in Figs. 9 and 10, it is contemplated that there may be used a continuous coil **25***b* of solid wire shown in Fig. 11, without wedge rings. Also, in this modification, as in the previous construction, set-screws **28** are screwed radially through the collar to separate and force the wedge rings and push wires into the narrower portions of the passageway to assure rigid attachment of the collar to the pipe.

In Fig. 15 there is shown a hinge type collar **22***c*. The pintle **29** upon which the halves of the collar swing is bent to conform with the outer contour of the collar. Wedge pins, shown in dotted line at **30**, are inserted from above and below to draw the halves of the collar together after it has been mounted on the pipe. With the hinged construction there may be used the wedge rings as shown at **23** and pusher rings **25***a*, or the continuous pusher coil **25**. Alternatively, there may be used an assembly of semicircular rings shown in Fig. 16 for holding the hinged collar or the solid collars. In this figure the semicircular wedge rings are designated by the numeral **23***c*, the pusher rings by the numeral **25***c*.

To maintain the wedge rings at a predetermined diameter and preferably at a diameter substantially that of the maximum diameter of the passageway within the collar, there is provided the construction shown in Figs. 17 and 18. In these figures the ends of the reinforcement rods **23***a*, the coil wire wrapping **23***b* are spread to enlarge the diameter of the wedge ring, and either a thin separator wire **31** or a short coil spring **32** is interposed between the ends of the coil wire jacket or wrappings **23***b* to hold the wedge ring at the proper diameter. Enlarged in this fashion the wedge rings are inserted into the arched passageway beneath the collar as shown in Fig. 19, and are held in place within the collar due to the expansive force of either the wire wrapping **31** or coil spring **32**, whichever is used. When assembled in this manner the wedge rings can be inserted in the collar at the time they are manufactured and released by removal of the separator wire **31** or coil **32** just prior to applying the collar to the pipe. This assembly of the collar and rings avoids handling the wedge rings as separate items.

In Fig. 20 is shown a centralizer **33** with gripping bands **22***d* made integral with the collars **33***a* of the centralizer. The construction of the collar and wire ring gripping members may be of the type shown in Figs. 1 to 4, or the hinged collar shown in Fig. 15, using any of the combinations of wedge rings and pusher wires desired.

While the application of the stop collar has been shown with but a single tool, it is contemplated that it may be used as well as an integral part of a cement basket or as a separate stop collar mounting with any of the different types of tool which are mounted on the exterior of pipe or casing.

Thus it will be seen that there has been provided a gripping or abutment device adapted to mount well tools without the necessity of welding the tools to the casing or welding lugs or stops to position the tools on the casing. The mounting furnishes a rigid attachment which will not slip or become displaced in use, a mounting that is relatively inexpensive to manufacture and easy to apply and one which materially reduces the labor expense for applying tools to casing or pipe while eliminating the disadvantages of welding operations.

From the foregoing, it will 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 structure.

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 without 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.

Having thus described our invention, we claim:

1. Apparatus of the character described, comprising a well casing or pipe, a collar loosely encircling said casing, the bore of said collar tapering toward both ends thereof from a region of maximum diameter located intermediate said ends whereby said bore forms around the casing an annular chamber which is arched in radial cross section, a pair of axially spaced wedge rings snugly embracing the casing within said chamber, a screw member threaded in said collar and having a tapered portion projecting into said chamber between said rings, thrust transmitting means between the tapered portion of said screw member and each ring for urging that ring outwardly from said member and toward the end of the bore upon rotation of said member, and the outside diameter of each ring being greater than the diameter of the bore at the end toward which that ring is urged whereby each ring is forcibly wedged between the exterior of said casing and the tapered portion of said bore.

2. Apparatus as in claim 1 wherein said thrust transmitting means comprises a helical coil encircling said casing and concentric therewith.

3. Apparatus as in claim 2 wherein said collar has a circumferentially elongated aperture extending through the wall thereof and opening into said bore in said region of maximum diameter to facilitate insertion of said helical coil into said chamber.

4. Apparatus as in claim 1 wherein said thrust means comprises a plurality of coaxial rings embracing said casing in side by side relation.

5. Apparatus as in claim 4 wherein each of said coaxial rings is split and said collar has a circumferentially elongated aperture extending through the wall thereof and opening into said bore in said region of maximum diameter to facilitate insertion of said rings into said chamber.

6. Apparatus of the character described, comprising a spring helix having a predetermined diameter when the helix is in free unrestrained condition, means for maintaining the helix expanded to a greater diameter, said means comprising a clip having portions overlying certain turns of the helix and other portions underlying certain other turns of the helix, and a pair of stops on said clip for abutment with the respective ends of said helix when same is in expanded condition.

7. Apparatus of the character described, comprising a well casing or pipe, a collar loosely encircling said casing, the bore of said collar tapering toward both ends thereof from a region of maximum diameter located intermediate said ends whereby said bore forms around the casing an annular chamber which is arched in radial cross section, a spring helix encircling the casing within said chamber, the inside diameter of said helix in its free unrestrained condition being smaller than the outside diameter of said casing whereby said helix is held in radially expanded condition by the casing and firmly grips the exterior thereof due to its inward contractive tension, wedge elements within said chamber at each end of the helix, each wedge element having an inner surface bearing against the exterior of the casing, an outer surface bearing against the tapered collar bore in a region spaced axially inward from the smallest diameter of the taper, and a side surface bearing against said helix whereby said element is confined against movement either axially of the pipe or radially with respect thereto.

8. Apparatus as in claim 7 having means for spreading at least certain turns of said helix in a direction axially of the casing, thereby to increase the pressure with which each wedge element is confined.

9. Apparatus as in claim 7 wherein the wedge element at each end of said helix comprises a ring embracing the casing, said ring being split to permit contraction thereof into circumferentially continuous bearing engagement with the casing.

10. Apparatus as in claim 9 wherein each ring comprises a stiff core concentric with said casing, said core having a wire coil wrapping thereon.

11. A wedging element of the character described, comprising a metal ring split to permit radial expansion and contraction thereof, a wire coil wrapping on a portion of said ring, and a helical spreader encircling another portion of said ring with its opposite ends bearing against the confronting ends of said wrapping to maintain said ring expanded.

12. A wedge element as in claim 11 wherein said helical spreader is a coiled compression spring.

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