Aug. 5, 1958 J. W. E. HANES 2,846,016

STOP COLLAR FOR WELL CASING

Filed March 19, 1954 3 Sheets-Sheet 1

Fig. 1.

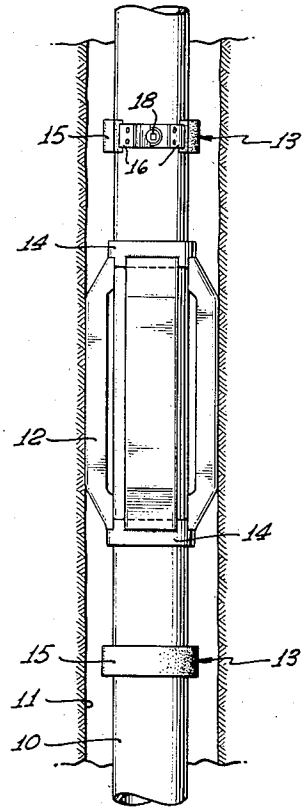


Fig. 2.

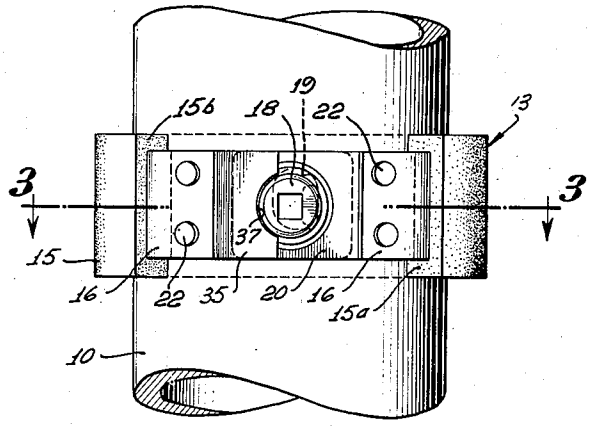


Fig. 3.

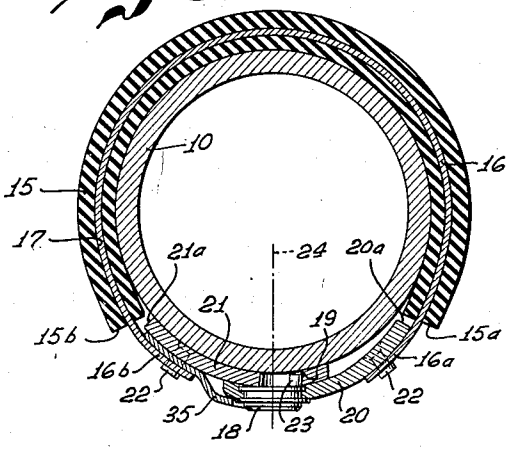


Fig. 6.

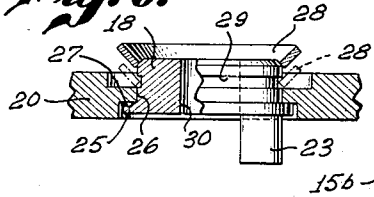


Fig. 4.

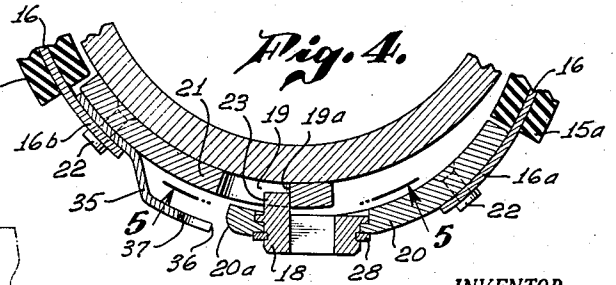
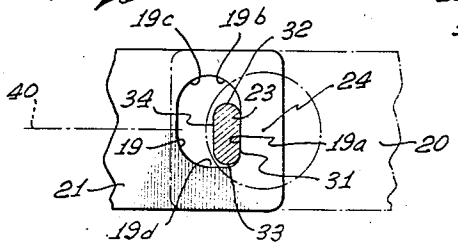


Fig. 5.



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Fig. 7.

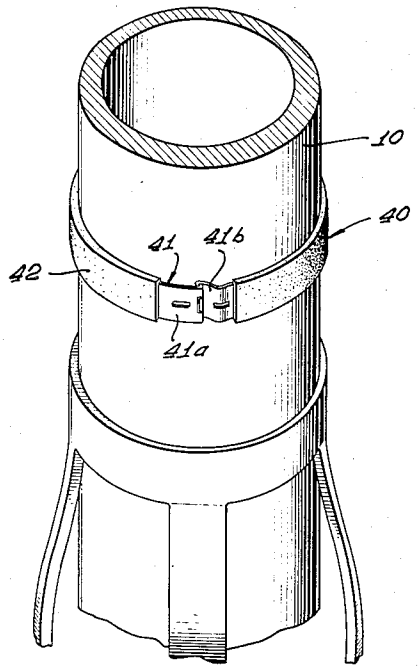


Fig. 9.

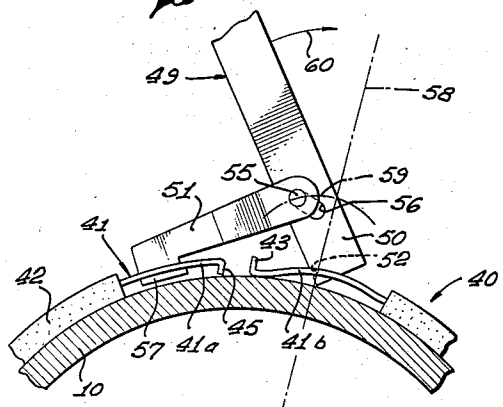


Fig. 10.

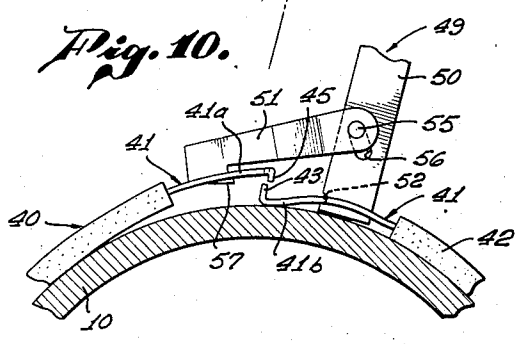


Fig. 12.

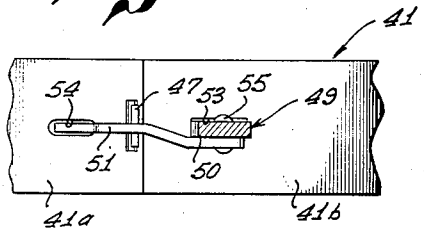


Fig. 11.

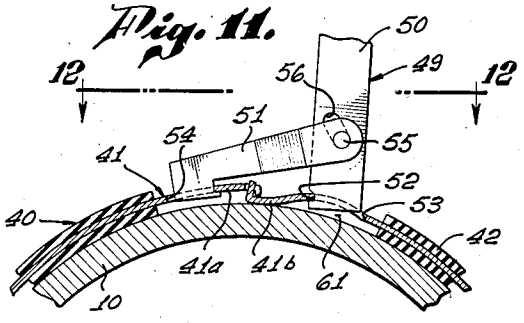
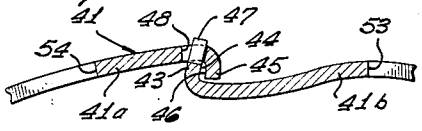


Fig. 13.



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Fig. 8.

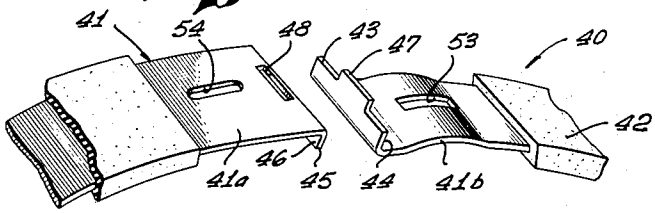


Fig. 16.

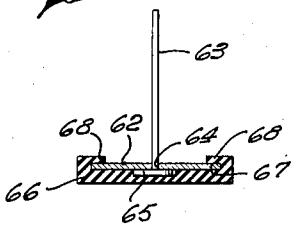


Fig. 14.

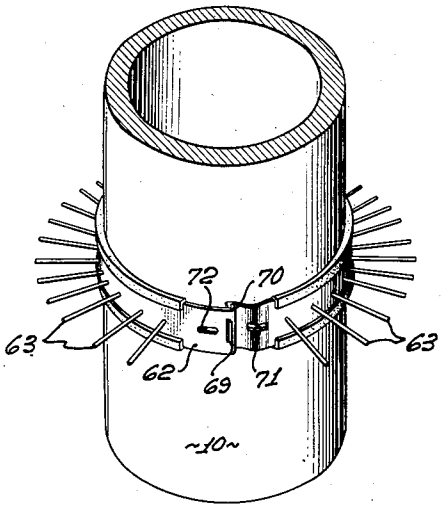


Fig. 17.

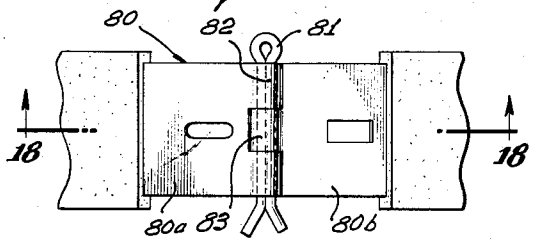


Fig. 18.

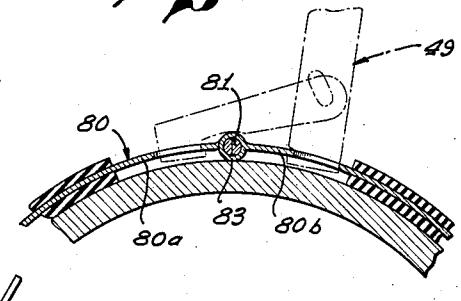
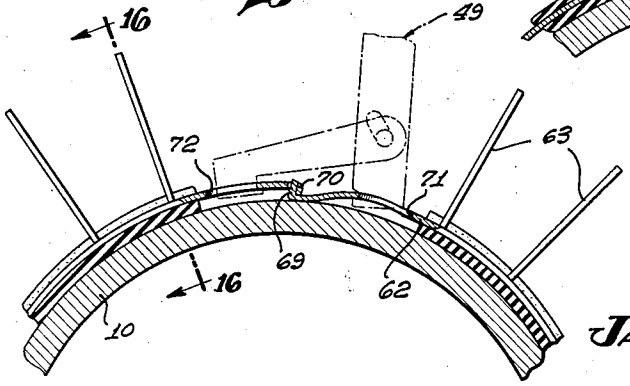


Fig. 15.



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Patented Aug. 5, 1958

2,846,016

STOP COLLAR FOR WELL CASING

James W. E. Hanes, Ventura, Calif., assignor, by mesne assignments, to Huntsinger Associates, a joint venture

Application March 19, 1954, Serial No. 417,290

2 Claims. (Cl. 287—52.04)

This invention relates to equipment for oil well casings, or the like, and particularly to a novel collar construction for limiting movement of casing guiding structures, or the like, or for securing other structures to the exterior of the casing.

In deep well operations, casings of high tensile strength are required. For this purpose, casings made of heat-treated steel are commonly provided. Structures such as casing centralizers are carried for movement on the casing by the aid of stop collars or rings affixed on the casing. It has been common to weld metal collars in place on the casing for this purpose. Unless very carefully performed, the welding process detrimentally alters the grain structure of the steel casing, resulting in a loss of strength. Furthermore, the welding process alters the uniformity of the grain structure, resulting in localized stresses and cracking.

It is an object of this invention to overcome these difficulties and to ensure against any adverse alteration of the metallurgical properties of high quality casing material. For this purpose, a metal strap or band is constricted about the casing for frictional coupling thereto, a yielding member made of rubber or suitable plastic material being interposed between the band and the casing to provide a firm frictional grip. In one form of the invention, novel separable clamp elements mounted on the ends of the band or strip serve to constrict the band or strip as well as to hold the strip or band in constricted condition. In other forms of the invention, the band or strip has elements that may be interconnected to hold the band or strip in constricted condition, a novel tool constricting the band or strip to bring the elements into engagement.

It is another object of this invention to make it possible to locate collars, or the like, on the exterior of substantially cylindrical casing structures without altering the structure of the casing per se. It is still another object of this invention to obviate welding of collars, or the like, to the exterior of the casing.

It is yet another object of this invention to provide a simple collar construction or the like that can be quickly secured to the exterior of a casing by simple operations.

It is another object of this invention to provide an improved clamp structure particularly that makes it possible to maintain the size of the collar small in sustaining the stresses occasioned by the clamping forces.

It is another object of this invention to provide a device of this character that conveniently may be made an integral part of the structure intended to be carried by the casing.

It is another object of this invention to provide a novel tool for constricting a band about a casing and bringing simple elements at the ends of the band into engaging relationship.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several embodiments of the invention. For this purpose, there are shown a few

forms 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 this 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 an elevation of a fragment of an oil well casing in operative position in the well hole, and showing a pair of collars embodying the present invention carried by the casing and cooperating with a casing centralizer;

Fig. 2 is an enlarged elevation, showing a collar incorporating the present invention and in place upon the well casing;

Fig. 3 is a transverse sectional view, taken along the plane indicated by line 3—3 of Fig. 2;

Fig. 4 is a further enlarged fragmentary sectional view similar to Fig. 3, but showing the collar in unclamped position;

Fig. 5 is a sectional view, taken along a plane indicated by line 5—5 of Fig. 4, with some of the parts shown only in phantom lines;

Fig. 6 is a fragmentary broken sectional view, showing the manner in which one of the clamping elements of the collar is rotatably coupled to its supporting member;

Fig. 7 is a fragmentary pictorial view of an oil well casing, showing a collar of modified form carried by the casing and cooperating with a casing centralizer;

Fig. 8 is a fragmentary pictorial view, showing the connecting elements carried at the ends of the band;

Figs. 9, 10 and 11 are plan views, showing the process of constricting the band about the casing and placing elements at opposite ends of the band in interlocking relationship by the aid of a collar;

Fig. 12 is a fragmentary sectional view, taken along the plane indicated by line 12—12 of Fig. 11;

Fig. 13 is an enlarged fragmentary sectional view, showing the elements at opposite ends of the band in engaging relationship;

Fig. 14 is a view similar to Fig. 7, but showing another modified form of the present invention;

Fig. 15 is a fragmentary sectional view, taken on a plane transverse to the wall casing and showing the device of Fig. 14 in operative position;

Fig. 16 is a sectional view, taken along the plane indicated by line 16—16 of Fig. 15;

Fig. 17 is a fragmentary plan view of still another modified form of the present invention; and

Fig. 18 is a fragmentary sectional view, taken along the plane indicated by line 18—18 of Fig. 17.

In the form shown in Figs. 1 to 6, collars 13 are shown that may be used to support a structure, such as a casing centralizer, exteriorly of the casing.

In Fig. 1, there is shown a section of a well casing 10 accommodated in a well bore 11. A centralizer 12 is slidable within limits along the exterior of the casing section 10.

A pair of collars 13 is secured in longitudinally spaced relationship along the exterior of the casing 10. These collars 13 define the limits of relative movement of the centralizer 12 along the casing 10 by appropriate cooperation with end rings 14 of the centralizer 12.

The collars 13 are of special construction whereby they may be affixed to the casing 10 quite readily and without performing any welding operations.

A flexible tubular member 15, made of suitable material such as neoprene or the like, is frictionally held in place on the casing 10 by being tightly constricted thereabout.

A band **16**, made of a thin strip of steel or the like, is accommodated within the tubular member **15**. The band **16** has ends **16***a* and **16***b* extending beyond corresponding opposite ends **15***a* and **15***b* of the tubular member **15**. The tubular member **15** is generally rectangular in cross-section, having a through aperture **17** substantially corresponding in shape to the band **16** accommodated therein.

The tubular member **15** is constricted about the casing **10** by first wrapping the tubular member **15** about the exterior surface of the casing **10**, and then by drawing the ends of the band **16** toward each other. This compresses that portion of the tubular member **15** that is in contact with the casing **10**. For this purpose and for holding the ends together, a clamp structure is provided. The clamp structure comprises a clamp element **18** and an aperture **19** in which the clamp element engages. The clamp element **18** is carried by the support **20** secured to one end **16***a* of the band **16**. The aperture **19** is located in a support **21** secured to the other end **16***b* of the band **16**. These supports are made of relatively thick metal stock.

The supports **20** and **21** are of arcuate configuration, each having a curvature corresponding substantially to that of the casing **10** with which they cooperate. The support **20** is secured on the inner side of the end **16***a* such that its arcuate contour generally forms a continuation of the band **16** when the structure is in operative position on the casing **10**. Similarly, the support **21** is secured on the inner side of the end **16***b*. Rivets **22** secure the supports to the band ends. The supports **20** and **21** limit relative longitudinal movement between the band **16** and the tubular member **15**, the ends **20***a* and **21***a* of the supports forming shoulders for this purpose.

The combined length of the band **16** and the supports **20** and **21** is such with respect to the periphery of the casing **10** that the ends of the supports **20** and **21** overlap each other. The free end of the support **21** is located between the casing **10** and the free end of the other support **20**. The clamp element **18** and the aperture **19** are located at the overlying portions of the supports **20** and **21**.

The clamp element **18** is mounted for angular movement in the outer support **20** about an axis **24** (Fig. 3) transverse to the juxtaposed ends of the supports in a manner to be hereinafter more fully described. An inwardly extending eccentric projection **23** is integrally formed with the element **18**.

The eccentric projection **23** is received in the clamp aperture **19**, and terminates within the confines of the aperture when the parts are in operative position. In order to install the clamp, the ends of the supports **20** and **21** are overlapped and the projection **23** inserted into the aperture **19**, with the projection **23** nearest the end of the support **20**.

The resilience of the band **16** maintains the outwardmost end wall **19***a* of the aperture **19** in engagement with the projection **23**.

The projection **23** moves from one side of the axis **24** to the other upon rotation of the element **18**. Since the end wall **19***a* of the aperture **19** follows the position of the projection **23**, the degree of overlapping of the supports **20** and **21** is increased when the projection is positioned inwardly from the end of the support **20** to cause constriction of the band **16**.

In the position of the clamp element **18** shown in Figs. 2 and 3, the supports **20** and **21** are substantially at their maximum overlapped position in which the tubular member **16** is tightly constricted about the casing **10**.

When the clamp element **18** is moved to the opposite angular position about the axis **24** (Figs. 4 and 5), the supports **20** and **21** are in their minimum overlapped

position. The tubular member **15** is substantially loose upon the casing **10**.

The clamping projection **23** is generally rectangular in configuration, with its edges rounded to facilitate its sliding about the walls of the aperture **19** as the element **18** is rotated. As shown in Fig. 5, the length of the rectangular projection **23** extends perpendicularly to line **40** radial to the axis **24** of rotation of the clamp element **18**.

In the position shown in Figs. 4 and 5, the inner side surface **31** of the projection engages the end wall **19***a* of the aperture **19**. Upon angular rotation of the clamping element **18** in a clockwise direction as viewed in Fig. 5, the upper end **32** of the projection **23** will engage and slide along the upper right-hand rounded corner **19***b* of the clamp aperture **19**. The opposite or lower end **33** of the projection **23** moves generally arcuately away from the wall **19***a*.

At an intermediate position corresponding to a 90° rotation of the element **18** from the position shown in Fig. 5, the projection **23** extends transversely across and near the top of the aperture **19**. Thereafter, the end **32** slides downwardly along the end surface **19***a* of the aperture **19**, and the other end **33** passes about the rounded upper left-hand corner **19***c* and then about the upper right-hand rounded corner **19***b* of the aperture **19**.

Finally, the projection **23** arrives at a position opposite that shown in Fig. 5, and corresponding to Figs. 2 and 3. In this position the outer side surface **34** of the projection engages the end **19***a* of the aperture **19**.

In the clamping position shown in Figs. 2 and 3, the band **16** has passed slightly beyond a condition of maximum stress only slightly exceeding the stress in the band **16** when the parts are in the clamping position shown. Maximum stress in the band **16** occurs when the clockwisemost end **32** of the projection **23** is inwardmost along the length of the outer support **20** immediately before arrival of the parts to clamping position. Stability is thus achieved by virtue of the resistance of the tubular member **15** to increased compression and the resistance of the band **16** to increased strain.

The clamp elements **18** can be operated between clamping and unclamping position by 180° movement. The aperture **19** is of such size and so located as to permit movement only about one 180° path, such as in a clockwise direction as viewed in Fig. 5. For this purpose, the aperture **19** is so located that it extends further above the line **24** than below it; and the aperture is long enough to permit rotation of clamp projection **23** in a clockwise direction through 180°. The length of the aperture **19** below the line **24** precludes full 180° arcuate movement of the projection **23** thereabout in a counterclockwise direction as viewed in Fig. 5. By virtue of this asymmetry, the support **21** has a cross sectional area in a plane passing through the aperture **19** for sustaining the stress in the parts. Low unit stress is thus achieved without increasing the width or thickness of the support **21**.

The gripping member **15** is constricted by the metal band **16** so that its inner periphery is tightly held against the periphery of casing **10**. A circumferential tensile stress is effective on the band **16** to maintain the constricted gripping member **15** securely in place upon the casing **10**. The band **16** being made from a continuous strip of sheet metal, serves to distribute the constricting force over the area of the member **15** which is in contact with casing **10**.

When the parts are in clamping relationship as shown in Figs. 2 and 3, the end **32** of the projection **23** is opposed to the lower side surface **19***d* of the aperture **19**. This surface **19***d* forms a relatively sharp corner with the operative surface **19***a*. Interaction of the end **32** with this side surface **19***d* at the corner resists further movement in a clockwise direction of the clamp element **18**. This resistance apprises the operator that a stable clamping position has been reached. Furthermore, should the op-

erator desire to loosen the collar about the casing **10**, this resistance apprises him that rotation of the element **18** is in the wrong direction. Accordingly unclamping movement of the element **18** is properly accomplished by counterclockwise rotation of the element **18**, as viewed in Figs. 2 and 3.

To ensure against uncoupling movement of the clamping element **18** from aperture **19** when in clamping position, a guiding plate **35** is provided. This guiding plate **35** is secured between the inner support **21** and the end **16***b* of the band **16**. The plate **35** has a free end spaced outwardly of the support **21** in an amount sufficient to accommodate the terminal portion **20***a* of the outer support **20**. When the clamping element **18** is moved to operative position, the terminal portion **20***a* of the outer support **20** enters into the space defined by the plate **35** and the inner support **21**.

The plate **35** clears the terminal portion **20***a* of the outer support **20** when the parts are in the unclamping position shown in Fig. 4, to permit desired coupling of the supports **20** and **21**.

The terminal portion **20***a* of the support **20** has a beveled edge that ensures appropriate entrance of the end of the outer support **20** between the plate **35** and the inner support **21** upon movement of the parts to clamping position.

The free end of the plate **35** has a semi-circular recess **37** (Figs. 2 and 4) conforming to the circular rotatable clamping element **18**.

The construction of the clamp element **18** facilitating rotative placement upon the support **20** is best shown in Figs. 4 and 6. The clamp element **18** has a generally annular periphery, bounded at one end by a peripheral flange **25**. The element **18** is guidingly accommodated in a through annular aperture **26** of the support **20**. The flange **25** engages a shoulder **27** formed by an enlarged portion of the recess **26** at the inner side thereof. The interaction of the flange **25** and the shoulder **27** limits outward movement of the element **18** from the position shown in Fig. 4.

In order to limit inward movement of the element **18**, a stop washer **28** is provided. This stop washer **28** is accommodated in an annular peripheral recess **29** of the element **18** accessible on the outside of the support **20**. Inward movement of the element **18** is limited by engagement of the stop washer **28** with the edges about the support aperture **26**.

For assembling the parts, the stop washer **28** may be made of conical form as shown in Fig. 6, and pressed over the end of the element **18** and into alignment with the groove **29** thereof. The conical stop washer **28** when so in alignment with the groove **29** is flattened by a simple operation. Such flattening is accompanied by a slight radial restriction which appropriately locates the inner portion of the washer inwardly of the groove **29**.

A non-circular socket **30**, extending axially of the element **18**, may accommodate a suitable tool or wrench for appropriate rotation of the clamp element **18**.

The collar can be placed upon the casing **10** in a short space of time properly to locate the casing centralizer **12** or any other structure intended to be carried to the well casing **10**.

In the form shown in Figs. 7 through 12, a collar **40** is shown that may be used in a manner similar to the collar **13** shown in the previous forms.

A band **41**, made of thin strip material such as steel or the like, is accommodated within a tubular member **42**, opposite ends **41***a* and **41***b* of the band projecting beyond the ends of the tubular member **42**.

The band **41** is held in place about the casing **10** by the aid of interengaging locking elements integrally formed at the ends **41***a* and **41***b* of the band **41**. These elements of the band **41** may be brought together for engagement only by constricting the band **41** about the casing. When operative, the locking elements hold the band **41** in constricted condition for firm frictional engagement of the collar with the casing **10**.

The locking elements for the ends **41***b* and **41***a* are formed by outwardly and inwardly bent ends **43** and **45** respectively.

The bent ends **43** and **45** extend transversely of the band **41** respectively outwardly and inwardly of the casing **10**. Inner operative surfaces **44** and **46** of the ends **43** and **45** interengage each other to prevent relative separation between the ends **41***a* and **41***b*. A tongue **47**, formed centrally at the terminal portion of the bent end **43** of the band end **41***b*, enters an aperture **48** provided near the base of the bent end **45** of the other band end **41***a*. Interengagement of the tongue **47** and the aperture **48** prevents relative sidewise movement between the band ends **41***a* and **41***b* when in interlocked relationship.

The locking elements **43** and **45** are brought into operative relationship by first moving the inwardly extending bent end **45** over the outwardly extending bent end **43** of the respective bent ends **41***a* and **41***b*, and then moving the bent ends **43** and **45** toward each other. Such relative movement of the ends **41***a* and **41***b* is accomplished by a tool **49** shown in Figs. 9, 10 and 11.

The tool **49** comprises a lever arm **50**, the end of which is adapted to engage the band end **41***b*. A link arm **51**, pivotally mounted on the lever arm **50**, is adapted to engage the other band end **41***a*.

The end of the arm **50** has a recess or slot **52** in which may be seated the edge at the end of an elongate aperture **53** formed in the band end **41***b*. The end of the link arm **51** has a hook end **57** in which may be seated the edge at the end of an aperture **54** formed in the other band end **41***a*. The seats formed in the lever arm **50** and the link arm **51** oppose each other.

A pin **55**, carried by the link arm **51**, passes through a slot **56** formed in the lever arm **50** and serves as a pivot for the arm **51**.

In Fig. 9, the band **41** has been placed about the casing **10**, the locking elements **43** and **45** being spaced from each other since the band is unstressed. The tool **49** is placed in operative position by causing the hook **57** of the link arm **51** to engage in the slot **54** and the notch or slot **52** of the lever arm **50** to engage in the recess **53**.

When the tool **49** is initially placed in cooperative relationship with the band ends **41***a* and **41***b*, the lever arm **50** cooperating with the band end **41***b* is inclined substantially to a line **58** extending radially of the casing **10** and passing through the seat-forming notch **52**.

Upon angular movement of the lever **50** in a direction corresponding to the arrow **60**, the pin **55** is movable in an arcuate path **59** centered about the seat **52**.

The path of movement of the pin **55** is such as to move the link arm **51** slightly outwardly of the casing as it is pulled to the right by the lever arm **50**. The link arm **51**, acting through its hook end **57**, correspondingly moves the band end **41***a*.

In the position of the parts shown in Fig. 10, the lever **50** has been moved angularly in an amount sufficient to cause the locking element **45** to overlie the locking element **43**. The slot **56** mounting the pin **55** is so located on the lever **50** that it extends in a direction normal to a line joining the pin **55** and the seat formed by the hook end **57** when the parts arrive at the position shown in Fig. 10. Accordingly, upon a slight further movement of the arm **50**, the force produced by the stress in the band **41** acting through the link arm on the pin **55** causes the pin **55** to slide to the opposite end of the slot **56**, thereby moving the link **51** and the end **41***a* inwardly of the casing **10**.

In the position shown in Fig. 11, the pin **55** slides to the opposite end of the slot **56**, and causes corresponding movement of the link **51** so that the locking elements **43** and **45** relatively move into engagement. The lock-

ing elements 43 and 45 supplant the tool 49 in providing forces for maintaining the band 41 in constricted condition, and the tool 49 can be removed from the band simply by reverse angular movement of the lever 50.

In the assembled position of the band 41 shown in Fig. 11, the band end 41*b*, on which is formed the outwardly extending locking element 43, rests against the wall of the casing 10. To permit access of the lower end of the lever 50 beneath the band end 41*b* and to permit removal thereof after the band is in assembled relationship, the band end 41*b* is bowed slightly outwardly. A space 61 is thereby provided in which the lever arm end may be freely accommodated.

As shown in Fig. 12, the operative end of the link arm 51 is offset so that the reactions at the respective seats formed by the tool 49 are aligned, avoiding an undesired turning couple on the tool.

In the form shown in Figs. 14, 15 and 16, a band 62 is shown that is structurally similar to the band 41 shown in the previous form. In this instance, however, the band 62 forms an integral part of a scraper structure intended to be positioned on the casing 10. A series of scraper elements 63 is secured in place upon the band 62. Each scraper element 63 is generally of wire or rod-like configuration, projecting radially outwardly through a transverse aperture 64 in the band 62 (Fig. 16). An integrally formed head 65 on each scraper element 63 abuts the edges about the band aperture 64 on the inner side of the band properly to orient the scraper element 63.

A resilient member 66, generally similar to the member 15, is provided for ensuring proper frictional engagement of the scraper with the casing 10. Opposite lateral edges of the band 62 are accommodated in recesses 67 located on the inner sides of outwardly extending flanges 68 of the resilient member 66. The outer surface of the band 62 is thus exposed.

In Fig. 15, the band 62 is placed in operative position by the tool 49. The tool 49 operates in the same manner as in the previous form. The band 62 has locking elements 69 and 70, as in the previous form. Recesses 71 and 72 near the ends of the band 62 cooperate with the tool 49 for constricting the band 62 about the casing 10.

In the form shown in Figs. 17 and 18, the ends 80*a* and 80*b* of a metal band 80 are held together in a slightly different manner. The band ends 80*a* and 80*b* have integrally formed rounded ends 82 and 83 forming eyes capable of being aligned to receive a cotter pin 81. The eyes 82 and 83 are brought into alignment by the tool 49, as shown in Fig. 18.

By virtue of the structures being capable of attachment to the casing 10 without a welding operation, the desirable metallurgical properties of the casing 10 are retained.

The inventor claims:

1. In a stop collar adapted to be mounted on a well casing: a split band adapted to be disposed about the exterior of the well casing; a pliant elastic gripping member extending at least within the band and adapted to be compressed in gripping engagement with the casing upon constriction of the band; the end portions of the band on opposite sides of its split providing projections extending in opposite lateral directions and adapted to be placed in overlapping engagement with each other to prevent circumferential separation between the band ends and to maintain the gripping member in gripping engagement with the casing; said band having apertures in its end portions adapted to receive a means for shifting said end portions toward each other to grip the gripping member with the casing and to place said projections in overlapping engagement with each other.

2. In a stop collar adapted to be mounted on a well casing: a split band adapted to be disposed about the exterior of the well casing; a pliant elastic gripping member extending at least within the band and adapted to be compressed in gripping engagement with the casing upon constriction of the band; the end portions of the band on opposite sides of its split providing projections extending in opposite lateral directions and adapted to be placed in overlapping engagement with each other to prevent circumferential separation between the band ends and to maintain the gripping member in gripping engagement with the casing; said band having apertures in its end portions adapted to receive a means for shifting said end portions toward each other to grip the gripping member with the casing and to place said projections in overlapping engagement with each other; one of said end portions having a terminal opening adjacent its projection; and a tongue on the terminal portion of the projection of the other end portion disposed in said opening to prevent relative axial movement between said end portions.

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