

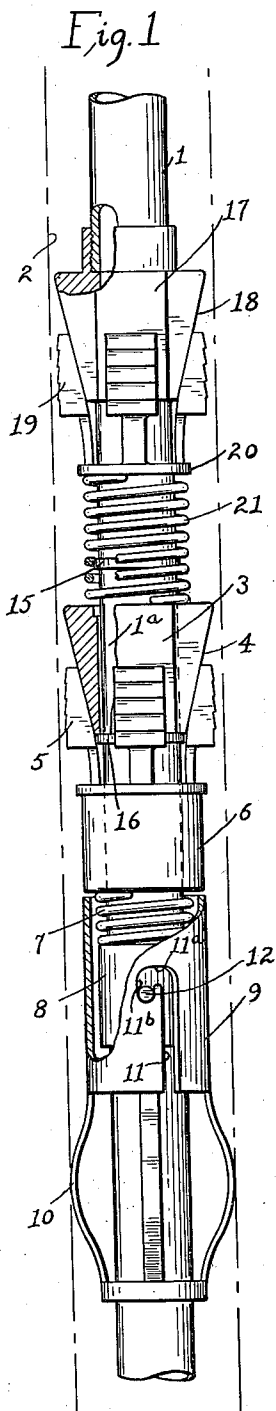
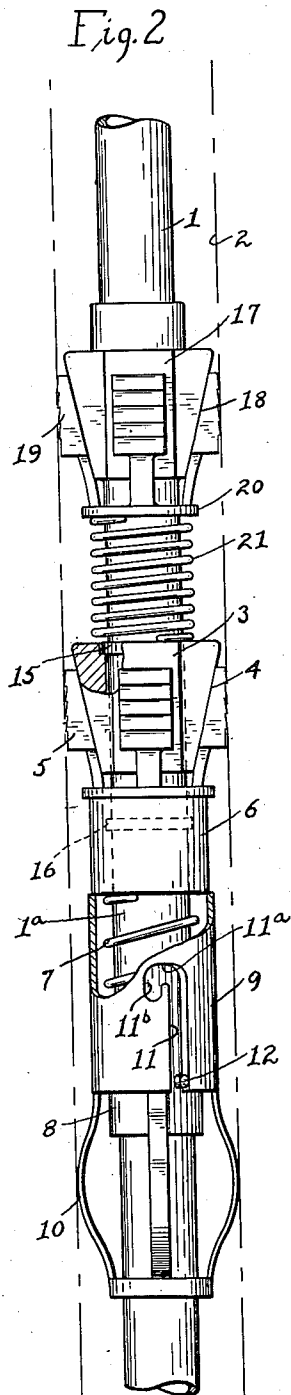
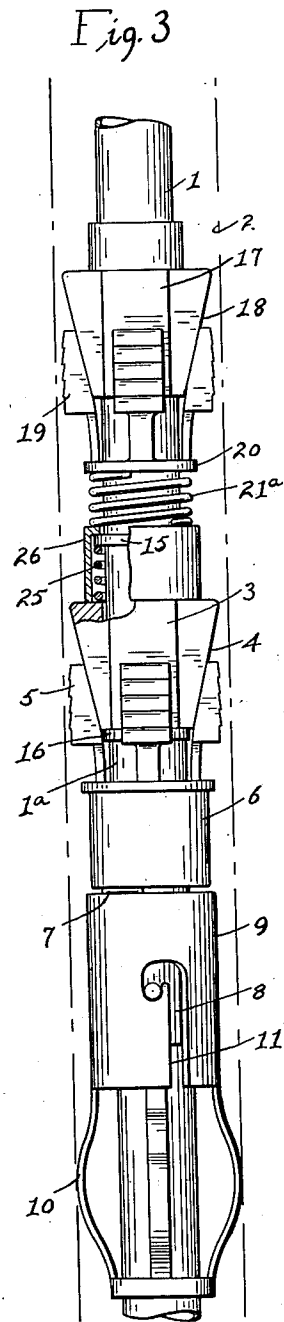
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E. V. CROWELL

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TUBING ANCHOR

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INVENTOR.

ERD V. CROWELL

BY

R. W. Smith
ATTORNEY.

UNITED STATES PATENT OFFICE

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TUBING ANCHOR

Erd V. Crowell, Glendale, Calif.

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This invention is a tubing catcher of the type disclosed in my U. S. Letters Patent No. 1,866,087 of July 5, 1932, wherein a plurality of longitudinally spaced anchoring means are adapted for successive actuation to anchor a section of tubing at a plurality of vertically spaced points; and it is the object of the present invention to simplify the construction by mounting the plurality of anchoring means on a section of tubing which is of fixed length and which is adapted for assembly in a tubing string so that the entire string may be raised and lowered in a well as a unit.

More particularly it is an object of the invention to actuate the primary anchoring means by relative longitudinal movement between its gripping elements and a cooperating operating head, with said actuation of the primary anchoring means causing relative longitudinal movement between its operating head and the tubing section on which the anchor is mounted, and this relative movement of the operating head actuating a secondary anchoring means.

It is a further object of the invention to support gripping elements of the secondary anchoring means on the operating head of the primary anchoring means, with an operating head for the secondary anchoring means adapted for longitudinal movement with the tubing section on which the anchor is mounted, so that relative longitudinal movement between the operating head of the primary anchoring means and said tubing section, causes relative longitudinal movement between the gripping elements and the operating head of the secondary anchoring means for actuating the latter.

It is a still further object of the invention to provide a resiliently yieldable support between the gripping elements of the secondary anchoring means and the operating head of the primary anchoring means, whereby actuation of the secondary anchoring means is cushioned so as to avoid such abrupt or tight setting of the secondary anchoring means as might split the well casing or prevent subsequent release of the anchor.

It is a still further object of the invention to normally hold the operating head of the primary anchoring means against longitudinal movement relative to the tubing section on which the anchor is mounted, thereby avoiding premature actuation of the secondary anchoring means, and thus insuring successive actuation of the primary and secondary anchoring means.

Further objects of the invention will be readily understood from the following description of the accompanying drawing, in which:

Fig. 1 is a side elevation of the anchor, partly in axial section, and showing it in inoperative position.

Fig. 2 is a similar view showing the anchor in operative position.

Fig. 3 is a view similar to Fig. 1, showing a modified construction.

A tubing string 1 is adapted for reception in the bore of well casing which is indicated at 2; and the anchor is mounted on a tubing section 1a which is of fixed length, i. e. it does not consist of relatively telescopic sections, and which is connected by threaded coupling collars to upper and lower portions of the tubing string 1 so that the complete assembly may be raised and lowered as a unit in casing 2. The anchor includes a primary anchoring means and a secondary anchoring means, with each of these anchoring means adapted for actuation while the tubing section 1a forms a part of the complete, unitary, tubing string assembly. The primary anchoring means is preferably below the secondary anchoring means and may comprise a usual anchor adapted for either manual actuation at any desired level or automatic operation in the event of the tubing breaking.

This primary anchoring means includes an operating head 3 on the tubing section 1a, having wedging elements 4 which cooperate with normally inoperative slips 5 so that relative longitudinal movement between the head and the slips operatively expands the latter for anchoring engagement in the casing 2. The slips are mounted on a sleeve 6 which is slidable on tubing section 1a, and a spring 7 which is mounted on the tubing section between the sleeve and a coupling collar 8, is normally compressed by the weight of the slips so that the slips are inoperatively contracted below head 3 as shown at Fig. 1; but if the string of tubing drops suddenly the inertia of sleeve 6 and the tension of spring 7 tends to retard the sleeve so that the slips carried thereby are operatively expanded by relative downward movement of the head 3.

Manual operation of the primary anchoring means may be controlled by a sleeve 9 which is slidable on tubing section 1a below the sleeve 6, but which is yieldably held against rotation or axial displacement in casing 2 by means of bowed springs 10. The sleeve 9 has a slot 11 opening through its lower end, with the upper end of the slot forming a transverse slot 11a terminating in a depending slot 11b; and a pin 12 which projects radially from the tubing string, preferably at the coupling collar 8, is slidable in

the slots. When the pin engages slot 11b it locks the sleeve 9 on the tubing string as shown at Fig. 1, but by slightly elevating and then turning the tubing string relative to the sleeve, the pin 12 is adapted to be aligned with slot 11 so that the tubing string may then be lowered relative to sleeve 9, thereby impinging the sleeve 9 against the sleeve 6 for elevating the slips 5 relative to head 3 so as to operatively expand the slips as shown at Fig. 2.

A secondary anchoring means is provided so as to insure adequate anchoring engagement for a tubing string of such length and weight that a usual anchor such as has been described, might not afford the desired safety factor; and the secondary anchoring means is actuated by anchoring engagement of the primary anchoring means. For this purpose the head 3 of the primary anchoring means is slidable on tubing section 1a between spaced abutments 15—16, so that when the primary anchoring means has been actuated the tubing string will have been lowered relative to head 3 until the abutment 15 has engaged the head as shown at Fig. 2. A head 17 having wedging elements 18 is fixed on tubing section 1a above the abutment 15, and cooperating slips 19 are mounted on the tubing section and are supported by head 3, so that the slips are normally in inoperative position below their cooperating wedging elements as shown at Fig. 1, but relative longitudinal movement of the tubing section and the head 3 when the primary anchor is actuated, is adapted to elevate the slips 19 relative to their wedging elements 18 so as to operatively expand the slips as shown at Fig. 2.

A cushioned support is preferably provided between the slips 19 and the head 3, so as to avoid setting the slips so tightly as to split the casing or prevent subsequent release of the anchor, and for this purpose the slips may be mounted on a collar 20 which is slidable on tubing section 1a, with a coil spring 21 resting upon head 3 and supporting the collar 20. The spring 21 is thus adapted to yield slightly when the secondary anchoring means is actuated, so as to cushion its anchoring engagement.

As shown in the modified construction illustrated at Fig. 3, means may be provided for preventing elevation of head 3 on tubing section 1a until such time as the primary anchoring means has been actuated, thereby avoiding premature or accidental actuation of the secondary anchoring means. As an instance of this arrangement the construction may be the same as that previously described, except that a coil spring 25 is interposed between the abutment 15 and the head 3, tending to retain the head in inoperative position supported on the abutment 16, and the spring 21a which supports the slips 19, instead of being supported directly on head 3 may be supported on a sleeve 26 which rests on head 3.

If an obstruction is met while lowering the tubing string into the well casing, the spring 25 thus counteracts any tendency of the head 3 to slide upwardly on the tubing string such as would prematurely actuate the secondary anchor, but when the primary anchor is actuated the weight of the tubing string lowers the same relative to head 3 against the tension of spring 25, until the spring 25 is fully compressed so that the compressed spring and the abutment 15 arrest downward movement of the tubing string relative to the head 3. The secondary anchoring means is then actuated by the sleeve 26 acting through

the cushioning spring 21a to elevate the slips 19 relative to their cooperating head 17.

The invention thus provides a plurality of anchoring means adapted for actuation consecutively upwardly so as to afford an adequate safety factor, with the plurality of anchoring means mounted on a tubular support which is of fixed length and which is connected to upper and lower portions of a tubing string so that the complete assembly forms a unitary tubing string, and the primary anchoring means adapted for either manual or automatic actuation, and the secondary anchoring means adapted for cushioned actuation responsive to initial actuation of the primary anchoring means, with both of said anchoring means adapted for actuation while their tubular support is connected to the tubing string as a part of the complete assembly which is adapted to be raised and lowered in a well as a unit.

I claim:

1. In a tubing catcher, a tubular support of fixed length adapted to connect proximate sections of a tubing string in fixed spaced relation, wedging elements on the support at different elevations, slips for the respective wedging elements adapted for actuation by relative telescoping of the slips on their wedging elements, and means for actuating the slips for said wedging elements consecutively upwardly, the tubular support being positively fixed against downward displacement relative to each of the wedging elements entirely independently of the other of said wedging elements when the slips have been actuated, whereby the actuated slips for each wedging element support a part of the weight of the tubing string.

2. In a tubing catcher, a single tubular stock adapted to connect proximate sections of a tubing string in fixed spaced relation, anchoring means on the stock each comprising a wedging element and cooperating slips adapted for actuation by relative telescoping of the slips on their wedging elements, the anchoring means being spaced longitudinally on the tubular stock with the lower anchoring means slidable on the stock while being actuated, and means for automatically actuating the anchoring means consecutively upwardly when the catcher is dropped, the tubular stock being positively fixed against downward displacement relative to each of the wedging elements entirely independently of the other of said wedging elements when the anchoring means have been actuated, whereby each of the actuated anchoring means supports a part of the weight of the tubing string.

3. In combination, a tubular support of fixed length adapted to connect proximate sections of a tubing string in fixed spaced relation, wedging elements on the support, slips for the respective wedging elements adapted for actuation by relative telescoping of the slips on their wedging elements, the slips when actuated being expanded for engagement with the wall of a well bore, and means for actuating the slips for said wedging elements consecutively upwardly, the tubular support being positively fixed against downward displacement relative to each of the wedging elements entirely independently of the other of said wedging elements when the slips have been actuated, whereby the actuated slips for each wedging element support a part of the weight of the tubing string.

4. In a tubing catcher, a support of fixed length adapted for incorporation in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the as-

sembled string may be raised and lowered in a well bore as a unit of fixed length, a plurality of anchoring means on the support, each adapted for actuation while the support forms a part of the unitary tubing string assembly, each anchoring means including a gripping element and a wedging element, said elements being adapted for cooperation so that as a result of actuation of each anchoring means its gripping element is operatively wedged between its wedging element and the wall of the well bore, the wedging element of each anchoring means being mounted on the support so that when its cooperating gripping element has been operatively wedged the support is positively fixed against downward movement relative to said wedging element entirely independently of the other of the anchoring means, and means operable by actuation of one of the anchoring means for automatically actuating another of the anchoring means.

5. In a tubing catcher, a support of fixed length adapted for incorporation in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the assembled string may be raised and lowered in a well bore as a unit of fixed length, a plurality of anchoring means on the support, each adapted for actuation while the support forms a part of the unitary tubing string assembly, each anchoring means including a gripping element and a wedging element, said elements being adapted for cooperation so that as a result of actuation of each anchoring means its gripping element is operatively wedged between its wedging element and the wall of the well bore, the wedging element of each anchoring means being mounted on the support so that when its cooperating gripping element has been operatively wedged the support is positively fixed against downward movement relative to said wedging element entirely independently of the other of the anchoring means, and means adapting the anchoring means for actuation consecutively upwardly.

6. In a tubing catcher, a support of fixed length adapted for incorporation in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the assembled string may be raised and lowered in a well bore as a unit of fixed length, a plurality of anchoring means on the support, each adapted for actuation while the support forms a part of the unitary tubing string assembly, each anchoring means including a gripping element and a wedging element, said elements being adapted for cooperation so that as a result of actuation of each anchoring means its gripping element is operatively wedged between its wedging element and the wall of the well bore, the wedging element of each anchoring means being mounted on the support so that when its cooperating gripping element has been operatively wedged the support is positively fixed against downward movement relative to said wedging element entirely independently of the other of the anchoring means, means adapting one of the anchoring means for actuation responsive to inertia in the event of the tubing string dropping, and means operable by actuation of said one of the anchoring means for automatically actuating another of the anchoring means.

7. In a tubing catcher, a support of fixed length adapted for incorporation in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the assembled string may be raised and lowered in a well bore

as a unit of fixed length, a plurality of anchoring means on the support, each adapted for actuation while the support forms a part of the unitary tubing string assembly, each anchoring means including a gripping element and a wedging element, said elements being adapted for cooperation so that as a result of actuation of each anchoring means its gripping element is operatively wedged between its wedging element and the wall of the well bore, the wedging element of each anchoring means being mounted on the support so that when its cooperating gripping element has been operatively wedged the support is positively fixed against downward movement relative to said wedging element entirely independently of the other of the anchoring means, means for manually actuating one of the anchoring means when the unitary tubing string assembly is at any desired level in the well, and means operable by actuation of said one of the anchoring means for automatically actuating another of the anchoring means.

8. In a tubing catcher, a support of fixed length adapted for incorporation in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the assembled string may be raised and lowered in a well bore as a unit of fixed length, a plurality of anchoring means on the support, each adapted for actuation while the support forms a part of the unitary tubing string assembly, each anchoring means including a gripping element and a wedging element, said elements being adapted for cooperation so that as a result of actuation of each anchoring means its gripping element is operatively wedged between its wedging element and the wall of the well bore, the wedging element of each anchoring means being mounted on the support so that when its cooperating gripping element has been operatively wedged the support is positively fixed against downward movement relative to said wedging element entirely independently of the other of the anchoring means, means adapting one of the anchoring means for actuation responsive to inertia in the event of the tubing string dropping, means for manually actuating said one of the anchoring means when the unitary tubing string assembly is at any desired level in the well, and means operable by actuation of said one of the anchoring means for automatically actuating another of the anchoring means.

9. In a tubing catcher, a support of fixed length adapted for incorporation in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the assembled string may be raised and lowered in a well bore as a unit of fixed length, a plurality of anchoring means on the support, each adapted for actuation while the support forms a part of the unitary tubing string assembly, each anchoring means including a gripping element and a wedging element, said elements being adapted for cooperation so that as a result of actuation of each anchoring means its gripping element is operatively wedged between its wedging element and the wall of the well bore, the wedging element of each anchoring means being mounted on the support so that when its cooperating gripping element has been operatively wedged the support is positively fixed against downward movement relative to said wedging element entirely independent of the other of the anchoring means, and means adapting the anchoring means for actuation consecutively upwardly by longi-

tudinal movement of the support relative to the gripping elements of the anchoring means.

10. In a tubing catcher, a support of fixed length adapted for incorporation in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the assembled string may be raised and lowered in a well bore as a unit of fixed length, a plurality of anchoring means on the support, each adapted for actuation while the support forms a part of the unitary tubing string assembly, each anchoring means including a gripping element and a wedging element, said elements being adapted for cooperation so that as a result of actuation of each anchoring means its gripping element is operatively wedged between its wedging element and the wall of the well bore, the wedging element of each anchoring means being mounted on the support so that when its cooperating gripping element has been operatively wedged the support is positively fixed against downward movement relative to said wedging element entirely independently of the other of the anchoring means, and means adapting the anchoring means for actuation consecutively upwardly by longitudinal movement of the wedging elements of the anchoring means relatively toward each other.

11. In a tubing catcher, a support of fixed length adapted for incorporation in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the assembled string may be raised and lowered in a well bore as a unit of fixed length, a plurality of anchoring means on the support, each adapted for actuation while the support forms a part of the unitary tubing string assembly, each anchoring means including a gripping element and a wedging element, said elements being adapted for cooperation so that as a result of actuation of each anchoring means its gripping element is operatively wedged between its wedging element and the wall of the well bore, the wedging element of each anchoring means being mounted on the support so that when its cooperating gripping element has been operatively wedged the support is positively fixed against downward movement relative to said wedging element entirely independently of the other of the anchoring means, the wedging element of a first anchoring means being adapted for sliding movement on the support while said anchoring means is being actuated, and means operable by said sliding movement for actuating another of the anchoring means.

12. In a tubing catcher, a support of fixed length adapted for incorporation in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the assembled string may be raised and lowered in a well bore as a unit of fixed length, a plurality of anchoring means on the support, each adapted for actuation while the support forms a part of the unitary tubing string assembly, each anchoring means including a gripping element and a wedging element, said elements being adapted for cooperation so that as a result of actuation of each anchoring means its gripping element is operatively wedged between its wedging element and the wall of the well bore, the wedging element of each anchoring means being mounted on the support so that when its cooperating gripping element has been operatively wedged the support is positively fixed against downward movement relative to said wedging element en-

tirely independently of the other of the anchoring means, the wedging element of a first anchoring means being adapted for sliding movement on the support while said anchoring means is being actuated, and means supporting the gripping element of a second anchoring means on the wedging element of said first anchoring means for actuating the second anchoring means by said sliding movement of the wedging element of said first anchoring means.

13. In a tubing catcher, a support of fixed length adapted for incorporation in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the assembled string may be raised and lowered in a well bore as a unit of fixed length, an anchoring means including a slip and a cooperating wedging element slidable on the support, a second anchoring means including a slip and a cooperating wedging element, the last mentioned wedging element being fixed against longitudinal movement relative to the support, and a spring supporting the last mentioned slip, said spring being mounted on the wedging element of the first mentioned anchoring means, each of the anchoring means being adapted for actuation by relative longitudinal movement of its slip and its wedging element while the support forms a part of the unitary tubing string assembly, and the tubular support being positively fixed against downward movement relative to the wedging element of each of the actuated anchoring means entirely independently of the other of the actuated anchoring means, whereby each of the actuated anchoring means supports a part of the weight of the tubing string.

14. In a tubing catcher, a support of fixed length adapted for incorporation in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the assembled string may be raised and lowered in a well bore as a unit of fixed length, a plurality of anchoring means on the support, each adapted for actuation while the support forms a part of the unitary tubing string assembly, each anchoring means including a gripping element and a wedging element, said elements being adapted for cooperation so that as a result of actuation of each anchoring means its gripping element is operatively wedged between its wedging element and the wall of the well bore, the wedging element of each anchoring means being mounted on the support so that when its cooperating gripping element has been operatively wedged the support is positively fixed against downward movement relative to said wedging element entirely independently of the other of the anchoring means, the wedging element of a first anchoring means being adapted for sliding movement on the support while said anchoring means is being actuated, and a spring supporting the gripping element of a second anchoring means, said spring being mounted on the wedging element of said first anchoring means.

15. In a tubing catcher, a support of fixed length adapted for assembly in a tubing string so that the complete assembly may be raised and lowered in a well as a unit, automatic anchoring means slidable on the support while said anchoring means is being actuated, and a second anchoring means including a wedging element for operating the same, said wedging element being fixed against longitudinal displacement relative to the support, the second anchoring means being actuated by sliding movement

of the first anchoring means on the support, and each of the anchoring means when actuated gripping the wall of the well and having the support positively fixed against downward displacement relative to said actuated anchoring means entirely independently of the other of the actuated anchoring means, whereby each of the actuated anchoring means supports a part of the weight of the tubing string.

16. In a tubing catcher, a support of fixed length adapted for assembly in a tubing string so that the complete assembly may be raised and lowered in a well as a unit, anchoring means comprising superimposed heads mounted on the support and having inclined faces, gripper slips mounted to slide on said faces whereby the slips are displaced radially of the heads, and means for automatically actuating the anchoring means by radial displacement of the slips of said anchoring means consecutively upwardly when the catcher is dropped, the support being positively fixed against downward displacement relative to the head of each of the actuated anchoring means entirely independently of the other of the actuated anchoring means, whereby each of the actuated anchoring means supports a part of the weight of the tubing string.

17. In a tubing catcher, a support of fixed length adapted for assembly in a tubing string so that the complete assembly may be raised and lowered in a well as a unit, a plurality of superimposed anchoring means mounted on the support in normal spaced relation, and means operated responsive to inertia of the tubing catcher when it is dropped for automatically and consecutively actuating each of the superimposed anchoring means, each of the anchoring means when actuated gripping the wall of the well and having the support positively fixed against downward displacement relative to each of said actuated anchoring means entirely independently of the other of the actuated anchoring means, whereby each of the actuated anchoring means supports a part of the weight of the tubing string.

18. An apparatus of the character described comprising a section of tubing of fixed length adapted for assembly in a tubing string so that the complete assembly may be raised and lowered in a well as a unit, a plurality of superimposed anchoring means on said tubing section in normal spaced relation, and means for consecutively actuating each of the anchoring means by moving the anchoring means toward one another, each of the anchoring means when actuated gripping the wall of the well and having the said tubing section positively fixed against downward displacement relative to each of said actuated anchoring means entirely independently of the other of the actuated anchoring means, whereby each of the actuated anchoring means supports a part of the weight of the tubing string.

placement relative to each of said actuated anchoring means entirely independently of the other of the actuated anchoring means, whereby each of the actuated anchoring means supports a part of the weight of the tubing string.

19. In a tubing catcher, a support of fixed length adapted for assembly in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the complete assembly may be raised and lowered in a well as a unit of fixed length, anchoring means including a wedging element for actuating said anchoring means, said wedging element being fixed against longitudinal displacement relative to the support, and a second anchoring means slidable on the support responsive to inertia when the catcher is dropped, said sliding movement of the second anchoring means actuating the second anchoring means and then actuating the first anchoring means, each of the anchoring means when actuated gripping the wall of the well and having the support positively fixed against downward displacement relative to said actuated anchoring means entirely independently of the other of the actuated anchoring means, whereby each of the actuated anchoring means supports a part of the weight of the tubing string, and the actuated first and second anchoring means gripping the wall of the well at consecutively higher levels.

20. In a tubing catcher, a support of fixed length adapted for incorporation in a tubing string so as to connect proximate sections of the string in fixed spaced relation whereby the assembled string may be raised and lowered in a well bore as a unit of fixed length, an anchoring means including a slip and a cooperating wedging element slidable on the support, a second anchoring means including a slip and a cooperating wedging element, the last mentioned wedging element being fixed against longitudinal movement relative to the support, each of the anchoring means being adapted for actuation by relative longitudinal movement of its slip and its wedging element while the support forms a part of the unitary tubing string assembly, and an abutment fixed against longitudinal movement relative to the support, the wedging element of the first anchoring means being fixed by said abutment against longitudinal movement relative to the support when said first anchoring means has been actuated, and the slip and the wedging element of each anchoring means being of non-yielding material whereby when each anchoring means is actuated it provides a non-yielding support for a part of the weight of the tubing string.

ERD V. CROWELL.