This invention is a releasing tubing anchor adapted for use in pumping tubing; though it is not limited alone to such utility.

Deep well reciprocating foot-installed pumps are known to have a loss of efficiency because of the upward creep of the pump bodily due to contraction of the long tubing string as the liquid load is taken by the piston and its working rod on the up stroke. On the down stroke of the piston the load is again taken by the tubing and it sags again, since it is free at the lower end of the string but is rigidly landed at the head gear of the pump.

It is an object of the invention to provide a device which can be installed in the lower portion of the tubing string at a level suitably above the foot pump and when lowered with and by the tubing to the intended level in a well hole can be positively set solidly in the well casing and operate to rigidly anchor the foot of the tubing, carrying the pump, in the casing; especially to anchor the foot tubing and its pump from creeping upwardly incident to up stroke of the pump piston.

A further object of the invention is to provide an anchor, for the tubing, which incorporates features which will allow the foot end of the tubing to depend to the limit of its elasticity following the original setting of the anchor in the surrounding casing; that is— to automatically take up slack as load accumulates on the descending stroke of the piston of the pump.

Another object of the invention is to provide an anchor suitable on the casing to hold the pump tubing from constant vertical vibration in and destructive chafing on the surrounding casing—which is frequently irreplaceable. And by so holding the tubing, to prevent opening of the screw joints of the string and materially reduce fluid loss at loosened joints.

An additional object of the invention is to provide a pump tubing anchor which can be readily assembled into the hook-up of the pump string and can be set against casing either while the tubing is rotatably suspended by the head gear, that is is landed, or can be set on the casing at the desired level in the well hole and anchor the foot section whilst the head end of the tubing is put under a desired tension and then set on landing means.

And an object is to provide a tubing anchor which can be casing set at will and can be released at any time for pulling of the tubing and its pump.

The invention consists in certain advancements in this art as will be set forth in the ensuing dis-
closure and having, with the above, additional objects and advantages as hereafter developed, and whose constructions, combinations and sub-combinations and details of means will be made manifest in the following description of the herewith illustrative embodiment; it being understood that modifications, variations and adaptations may be resorted to within the scope, spirit and principles of the invention as it is more directly claimed hereinafter.

Figure 1 is an axial section of the anchor, some parts being in longitudinal section.

Figure 2 is a cross-section on line 2—2 of Fig. 1.

The anchor is shown in Fig. 1 as positioned in contractile state of its parts in a well casing C, into which is introduced a conventional pump tubing including a lower or foot pump carrying section T and an upper suspended section T'. Both of these tubing sections are rigidly attached to the present anchor.

The anchor assembly includes a substantial core or mandrel comprising a top end box 2 for reception of the complementary threaded tubing T, and a pipe threaded bottom end 3 to receive the near end of the foot section T'. Slidably fitted and packed on the box 2 is a collar 4 bushing into the upper end of a windowed cage 5 surrounding the mandrel and entrapping an annular system of casing engaging slips 6 whose top ends are radially movable toward and are stopped by an annular guard ring 7 embracing the top end of the cage which, with the ring 7, is rigidly fixed to the mandrel box in any suitable manner, as by one or more set-screws 8. The lower ends of the slips straddle and are mounted on cage lugs 9 for a limited degree of outward movement; the slips, when entirely free for longitudinal movement in the cage, resting on the top ends of the lugs.

The backs of the slips have, each, a series of longitudinal wedge parts, all integral, which are engageable with and are thrust outward by respective, coaxial conical cams 10 forming a body part of the mandrel and intermediate its threaded ends.

Attached to the cage 5 are external resilient brake shoes 11 which frictionally engage the wall face of the surrounding casing and serve to hold the cage from undesired rotation whilst the mandrel is being rotated by the tubing T to set the slips against the casing.

Means are provided to forcibly shift the sleeve up or down on the mandrel so that the conic cams 10 will either release or will press outward on the slips, and said means is here shown as
including a right-hand pitch, coarse thread 12 constantly but loosely meshing with mutual threads 13 cut in the lower end of the cage; the threads 12 being cut on the mandrel at a position just below the lowest cam 10.

The cage is stopped at its uppermost position on the mandrel by abutment of a stop shoulder 14 on the inner wall of the cage against an interposed shoulder 15 on the cage abuts an interposed shoulder 17 forming a part of a fall guard collar 18. This collar is adjustable along mandrel threads 19 to regulate the proper setting of the casing slips. The guard collar 18 has an outside diameter such that should the tubing T break the collar will lodge on the top rim edge of the usual casing liner L and thereby protect the cage from a possibly injurious shock, and damage to the respective threads of the cage and mandrel.

When the slips have been set by the screwing down of the cage (under left hand rotation of the tubing and the mandrel) to engage the casing, the basal shoulders 16a of the cams are well above opposed top end shoulders of the slip wedges 6a. Therefore the mandrel has capacity for some downward shift in the set slips should a heavy load build up on the pump string and increase its stretch. At the same moment the slips would gravitate and instantly grab on the casing—particularly if the tubing and the mandrel should tend to ascend, under string tension, or falling tubing load, or up stroke friction of the pump piston.

From the above it will be clear that the pump tubing can be lowered by the head works elevator to locate the anchor at an estimated desired level in the well and the anchor can be expanded there by rotation of the tubing and then the tubing can be put under tension by the elevator and at that time landed on the casing head. Or, the tubing can be lowered and landed without applied stretch and the anchor can be then set while the tubing is at estimated full load factor, by rotation of the tubing.

By right hand rotation of the tubing the cage 5 can be shifted up to release the slips at any time.

What is claimed is:

1. A releasing tubing anchor including a mandrel having attached at its ends upper and lower sections of a string of tubing, and means including a cage having slips and operated by and threaded on the mandrel for anchoring the mandrel to and in a surrounding casing whereby to prevent the lower section of the tubing from creeping up in the casing during fall of load in the lower section of the tubing, and cages on the mandrel for setting the slips.

2. The anchor of claim 1; said means operative to automatically shift down to and set at lower positions following initial set of said means by the mandrel.

3. A tubing anchor including casing grabbing slips, and a mandrel having upper and lower tubing sections and having means for actuating the slips to bind in the casing and hold the mandrel against upward shift in the casing when the upper tubing section is put under tension, and a cage for the slips threaded on the mandrel.

4. A releasing tubing anchor including a mandrel having at its ends attached tubing sections and which is rotative by the upper section, a cage threaded on the mandrel and casing engaging slips mounted on the cage, and means on the mandrel to set the slips as the mandrel is rotated; the cage having means to engage the casing and prevent rotation of the cage.

5. The anchor of claim 4; said mandrel being adapted to work down in the slips under increase of load in the tubing.

6. The anchor of claim 4; said mandrel being capable of descent in the slips, and the slips automatically following down and resetting on the casing.

7. The anchor of claim 4; the threads connecting the cage and the mandrel being of loose fit to prevent arithmetical chafing.

8. A tubing anchor including a mandrel adapted for attachment at its ends to tubing sections and having external, heavy threads, a cage about the mandrel and constantly meshing with the said threads to be raised or lowered by rotation of the mandrel, means to fix the cage against rotation in casing in which the tubing is disposed, and casing slips in the cage and adapted to be set by the mandrel as the latter is rotated.

9. The anchor of claim 8; said mandrel having a stop to limit downward motion of the cage on the threads.

10. The anchor of claim 8; said mandrel having a guiding collar below the cage shielding it in event of fall.

11. The anchor of claim 8; the anchor mandrel having stops to limit both up and down shift of the cage on the mandrel.

12. A tubing anchor including a rotative mandrel having an external threaded portion and a plurality of coaxial cams above the said portion, a cage having casing shoes and constantly meshing with the threads to be shifted up or down on the mandrel, and a set of annularly disposed slips mounted in the casing adjacent to the cams for both axial shift and radial adjustment; the cams out-thrusting the slips as the cage is moved down by the mandrel threads and the mandrel cams having capacity for down shift in the set slips.

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