

Oct. 14, 1941.

A. M. GRAHAM

2,258,889

CABLE SPOOLING DEVICE

Filed July 31, 1939

Fig. 1.

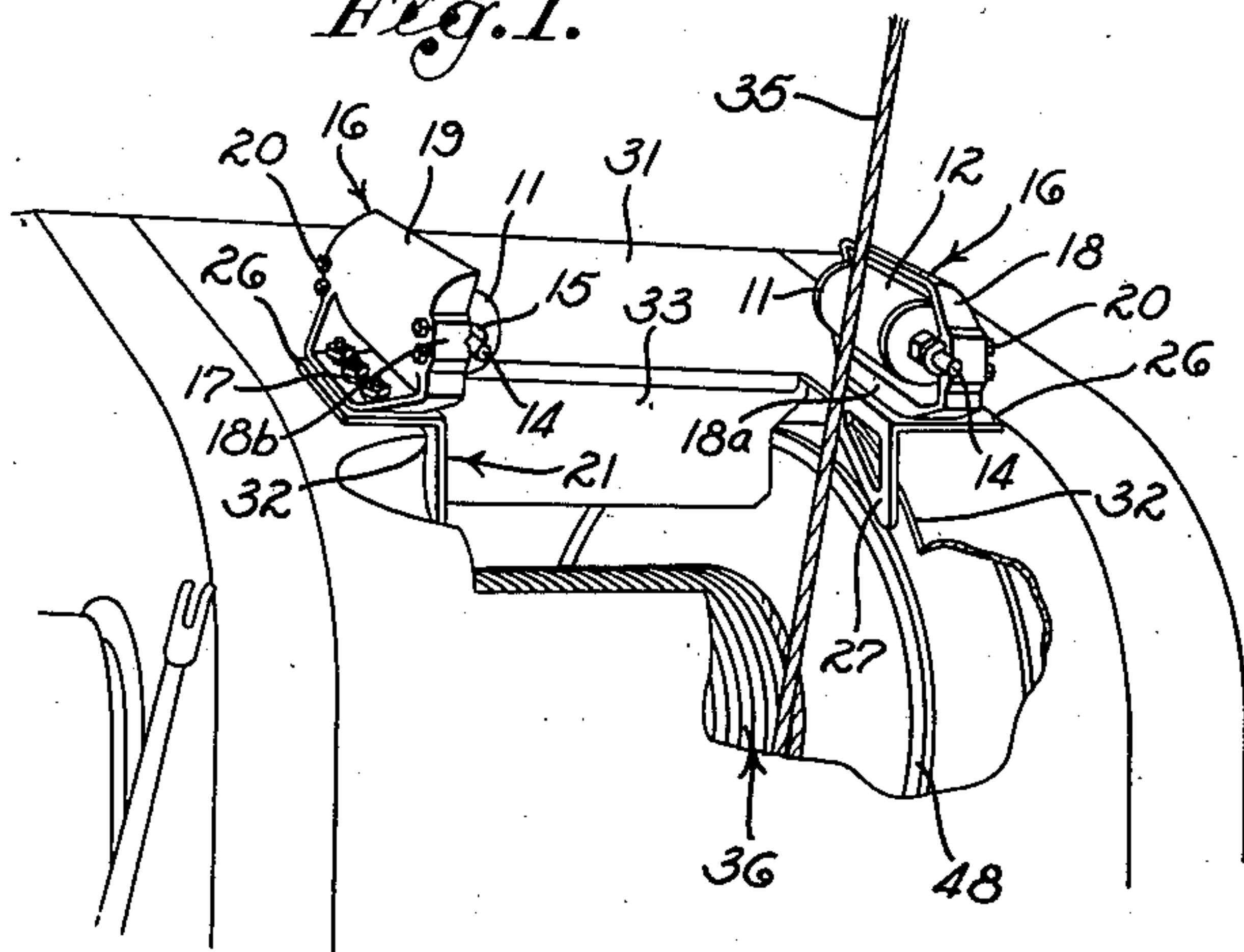


Fig. 2.

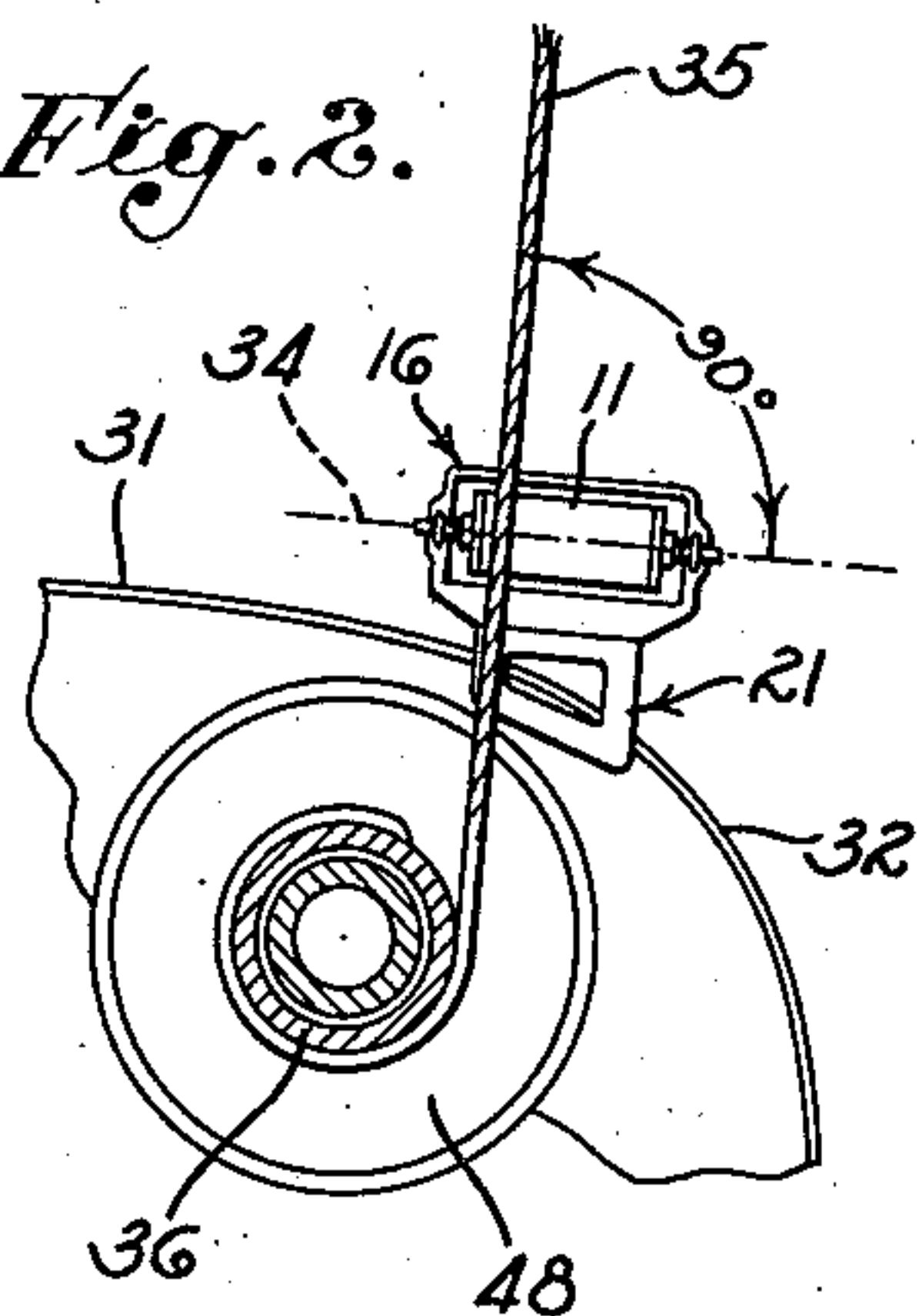


Fig. 4.

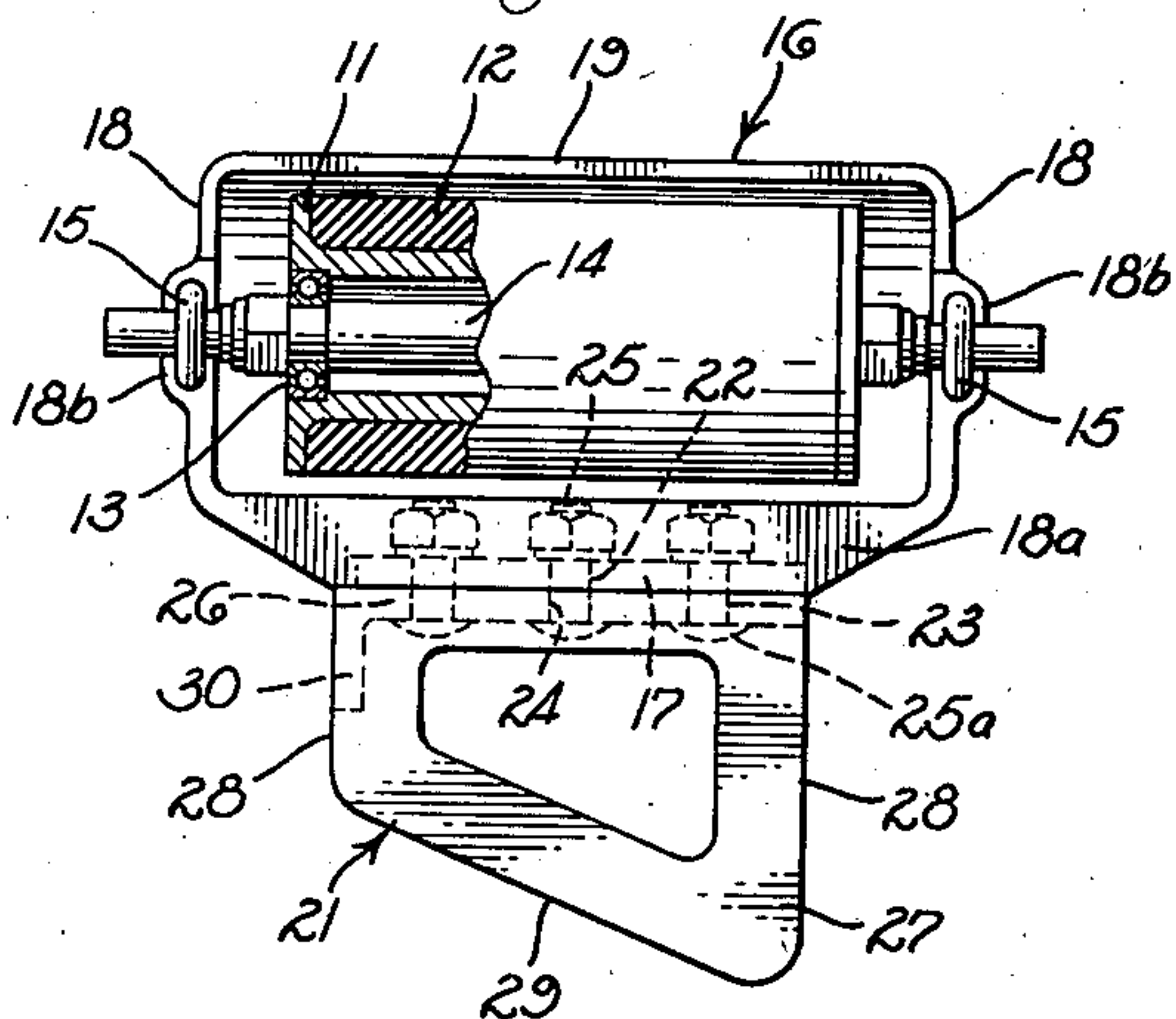


Fig. 5.

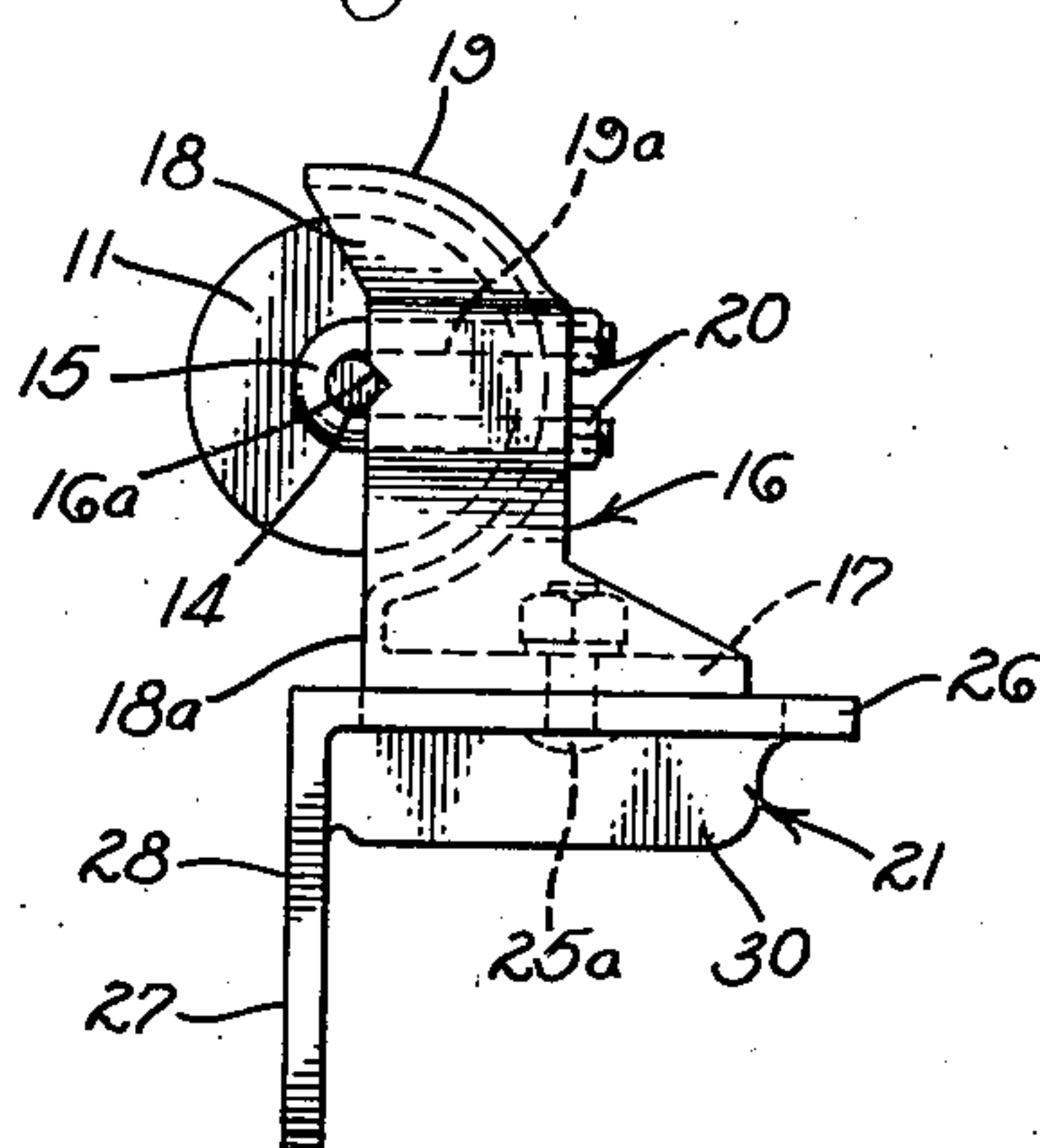


Fig. 3.

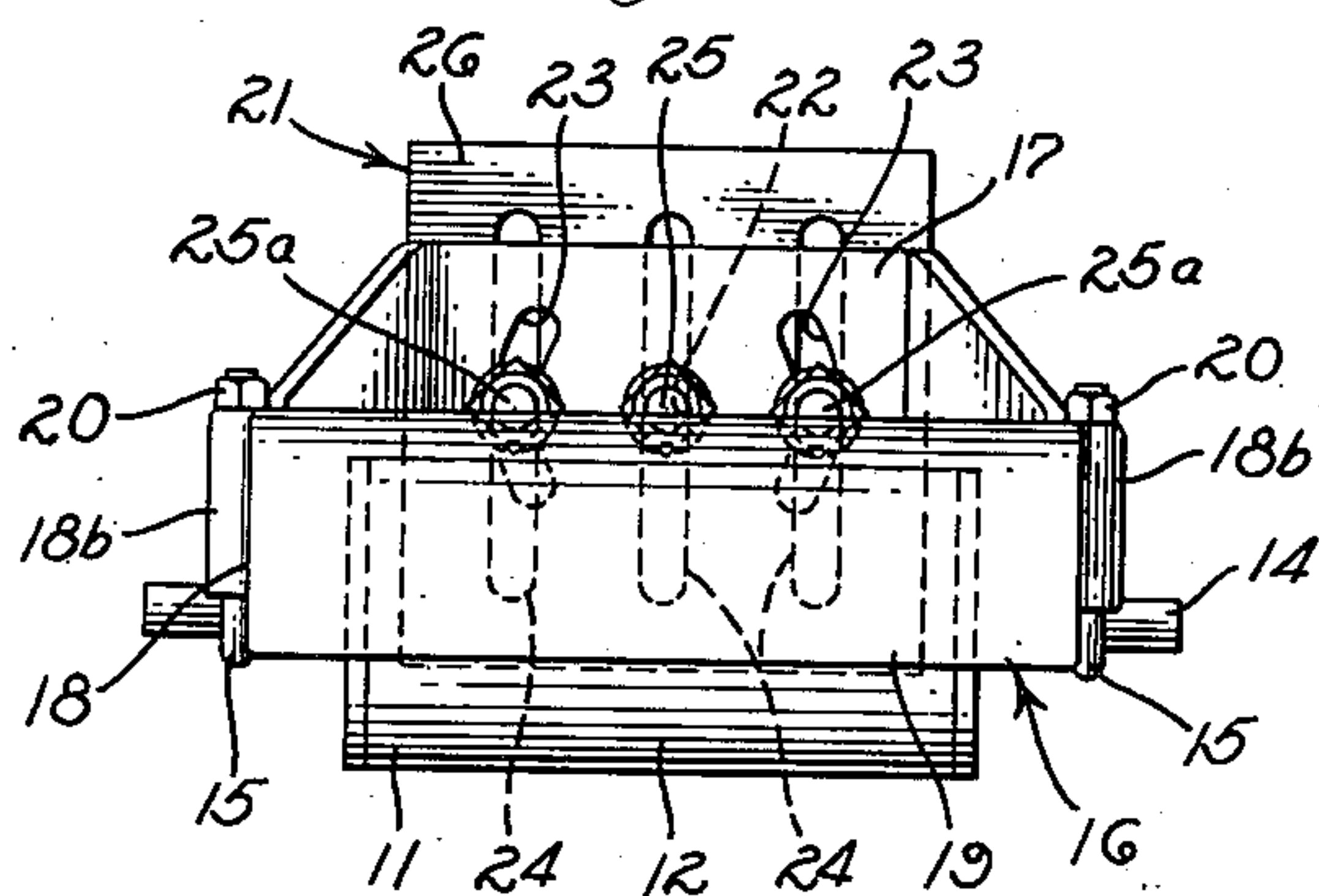
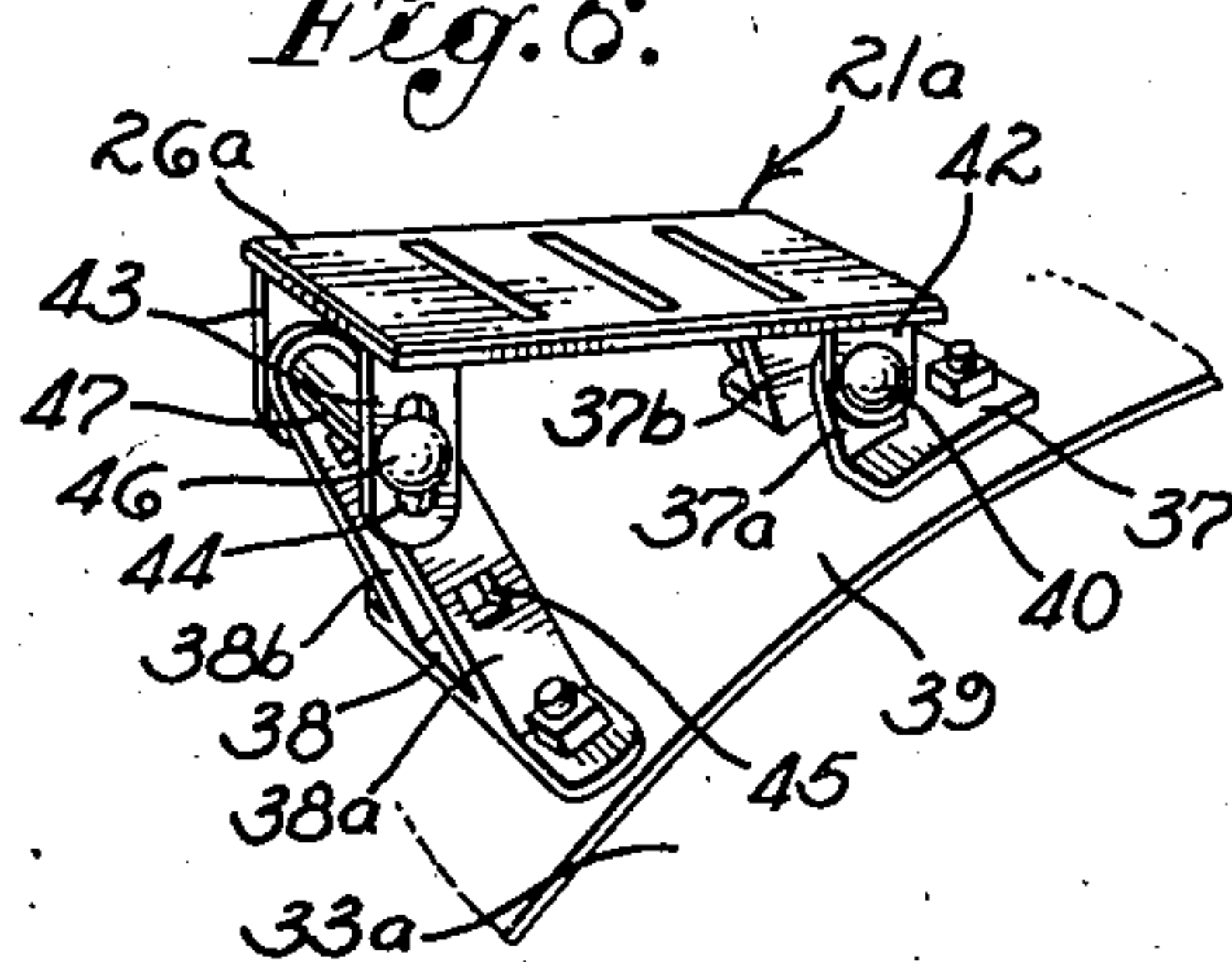


Fig. 6.



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UNITED STATES PATENT OFFICE

2,258,889

CABLE SPOOLING DEVICE

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Application July 31, 1939, Serial No. 287,600

11 Claims. (Cl. 254—190)

This invention relates to a cable spooling device, and particularly to a cable contacting roller for reversing the direction along the axis of a drum of the progression of spiral cable windings on the drum. It is particularly adapted for use with cable winding drums which are not equipped with a level winder, such as the cable drum of the draw-works of a well drilling apparatus and of other heavy duty hoisting apparatus.

The heavy cables used in well rigs are wound on a drum which is power driven for rotation in the winding direction and which is rotated in the unwinding direction by the weight of the drilling apparatus or well casing or other object sustained by the cable.

Because of the long span of the cable from the drum to the crown block at the top of the derrick, the angle between the cable and the longitudinal lines of the drum, which is substantially a right angle, does not appreciably vary as the tangential winding point travels back and forth from one drum flange to the other during the spooling of the cable. As a result, there is no appreciable horizontal component of the tensile stress in the cable tending to turn the cable back at the drum flanges when the cable is being wound on the drum. The cable thus tends to pile up one coil on top of another at the end of the drum instead of starting back with the beginning of the first coil made after the cable contacts the flange. When several coils of the cable thus pile up at the end of the drum, they are apt to become suddenly disengaged by the stress of the cable and slip sideways, creating a slack which, when abruptly taken up by the stress of the cable, subjects the machinery to a heavy shock.

It is an object of this invention to provide a device for turning back the cable at the ends of the drum as it is being wound upon the drum so as to cause it to start back smoothly and evenly without piling up or slipping laterally.

It is a further object of this invention to provide such a turn-back device which will be adjustable to apply in exactly the right direction just enough force to start the cable coiling toward the other end of the drum, and not enough force to prevent the cable from completing one wrap of coils upon the drum all the way to the drum flange.

It is a further object of this invention to provide a mounting for the roller which will be adjustable to position the roller so as to reduce to a minimum the wear to which the roller is subjected.

It is a further object of this invention to provide a mounting for the roller which will permit the roller to be adjusted to such a position that the turn-back force exerted upon the cable is varied to compensate for the variation in frictional resistance to the turn-back force which is a variant of the changing diameter of the wrap of cable upon the drum.

Further objects and advantages of the invention will be made evident throughout the following part of the specification.

Referring to the drawing, which is for illustrative purposes only,

Fig. 1 is a perspective view showing the top portion of a housing of a draw-works with a turn-back spooling roller and roller mounting constructed in accordance with this invention secured in position at each end of the cable opening in the housing directly beneath which the drum is mounted.

Fig. 2 is a vertical section of a drum and adjacent portions of the housing.

Fig. 3 is a top plan view of the roller and roller housing.

Fig. 4 is a side elevation thereof with one end of the roller shown in vertical section.

Fig. 5 is an end elevation of the roller and housing.

Fig. 6 is a perspective view of a modified form of the bracket of the roller mounting.

A roller 11 preferably, but not necessarily, provided with a hard rubber facing 12 is rotatably mounted by means of ball bearings 13 upon a spindle 14. The spindle 14 is secured by means of U-bolts 15 to a roller housing 16 and is prevented from vertical displacement in the housing by its engagement with the sides of notches 16a.

The roller housing 16 comprises a base plate 17, end walls 18, a vertical web 18a, and a semi-cylindrical guard hood 19. Each of the end walls 18 is formed with an outwardly bowed pocket 18b. The U-bolts 15 are seated within these pockets, their threaded ends projecting through apertures 19a in the hood 19. Nuts 20 on the threaded ends of the U-bolts clamp the spindle 14 in position. The base plate 17 is formed with a central aperture 22 and two arcuate apertures 23 arranged on opposite sides of the aperture 22 as a center with the median point of each aperture 23 disposed between the aperture 22 and the adjacent end of the roller housing 16. A table 26 is formed with three parallel slotted apertures 24 spaced to register with the aperture 22 and the arcuate apertures 23 of the base plate

17. A bolt 25 and two flanking bolts 25a fasten the base plate 17 to the table 26. The bolt 25 is seated in the central circular aperture 22 and the central slot 24. Each of the bolts 25a is seated in one of the arcuate slots 23 and the corresponding outer one of the three slots 24.

This arrangement of apertures, slots, and bolts permits the housing 16, and with it the roller 11, to have a translatory adjustment in a horizontal plane from front to rear, or vice versa, of the horizontal table 26. Since, because of the manner of mounting the table 26, the direction of this translatory movement of the roller housing is parallel to the axis of the cable drum, the vertical plane of the working face of the roller may be offset any desired distance from the vertical plane of the flange at the end of the drum.

The character and relationship of the apertures and slots 22, 23, and 24, are also such as to permit an angular adjustment of the base plate 17 of the roller housing 16, and consequently an angular adjustment of the roller 11, in a horizontal plane with respect to the table 26. By means of this angular adjustment, the vertical plane of the working face of the roller may be inclined somewhat from an angle of 90° with the axis of the drum.

The table 26 is a part of a bracket 21, which is formed with a vertical plate 27 integrally connected to the forward edge of the table 26. This vertical plate is preferably formed to present parallel vertical end edges 28 and a bottom edge 29 inclined at a substantial angle to the horizontal. A vertical strengthening web 30 is provided extending from front to rear of the table 26 and connecting with the plate 27 along its shorter end edge 28.

As shown in Fig. 1, the plate 27 is welded or otherwise rigidly attached to a draw-works housing 31 at an end 32 of a cable aperture 33. It is preferably attached to the draw-works housing in such a relative position thereto that, as shown in Fig. 2, the axis 34 of the roller makes an angle of 90° with a cable 35 as it travels to and from a drum 36. While the cable 35 usually occupies an approximately vertical position, its position may vary slightly from the true vertical, and it is desirable that the bracket 21 be attached to the draw-works housing in such position that the roller axis 34 is set at an angle to the direction of the cable 35 which is as nearly 90° as it may be possible to establish. It is apparent that if this perpendicular relationship is not present, end thrust develops upon one or the other of the bearings 13, and the rubber face of the roller is subjected to an abrasive force longitudinally of the working face of the roller at the point of contact with the cable 35.

An alternative form of bracket for mounting the roller housing is shown in Fig. 6 of the drawing. This bracket 21a comprises a short standard 37, a long standard 38, and a table 26a. The standards 37 and 38 are arranged to be rigidly bolted to a curvilinear portion 39 of the draw-works housing at the end of a cable aperture 33a. The difference in height of the two standards 37 and 38 is a feature by which the bracket 21a is adapted to be attached to a support of the sloping character of this portion of a draw-works housing and provides in the table 26a a substantially horizontal support for the roller housing.

The table 26a is secured to the standards 37 and 38 by means of bolts 40 and 46 which engage bolt holes or bolt slots in the upper ends of the

two standards, and registering bolt holes or bolt slots in depending ears of the table. As shown in the drawing, the standard 37 has two legs 37a and 37b each formed with a bolt hole at its upper end, and the table 26a has two depending ears 42 provided with registering bolt holes. The bolt 40 snugly fitting within the bolt holes in the legs 37a and 37b and the ears 42 provides a hinged joint between the table 26a and the standard 37 which may be made a rigid connection by tightening the nut on the threaded outer end of the bolt 40. The table 26a is provided at its other end with two depending ears 43 which lie outside of the two legs 38a and 38b of the standard 38. Each of the ears 43 is formed with a short vertical slot 44, and each of the standards 38a and 38b is formed with a plurality of bolt holes 45. A bolt 46, preferably encircled with a ferrule 47 to give rigidity to the assembled structure when drawn together by the nut on the threaded end of the bolt 46, passes through the slots 44 and any selected one of the pairs of bolt holes 45, the selection depending upon the degree of inclination to the horizontal of the draw-work housing 39. The slots 44 provide for an accurate adjustment of the table 26a with respect to the horizontal by which the axis 34 of the roller (see Fig. 2) may be placed at an angle of exactly 90° with the cable 35.

The translatory adjustability of the base plate 17 on the table 26 makes it possible to regulate the displacement between the vertical plane of the working face of the roller and the vertical plane of the flange 48 of the drum 36. By regulating this displacement, the angle with the vertical formed by the length of cable from the working face of the roller to the drum, at the moment when the cable reaches the drum flange, may be adjusted to exactly the correct magnitude to give a horizontal component of the longitudinal stress in the cable just sufficient to cause the cable to start back across the drum at exactly the right juncture, i. e., neither prematurely, causing a short wrap, nor belatedly, causing a piling up of the cable at the end of the drum, resulting in an even, smooth wrap of convolutions.

The turn-back force must be sufficient to overcome the frictional resistance between the first portion of the second coil of a new wrap and the first coil of that new wrap beneath it, for it is this resistance which opposes lateral movement of the second coil into place beside the first coil. This frictional resistance is proportional to the inward pressure of a coil upon the wrap beneath it. This inward pressure is a function of the tensile stress in the cable line.

Another kind of adjustability of the roller is desirable. The above-mentioned inward pressure of a coil upon the wrap beneath it varies per unit length of cable inversely as the diameter of the wrap. The turn-back force should correspondingly decrease in magnitude as the wraps increase in diameter during the winding operation.

To accomplish this, the axis of the roller should be disposed at a slight angle to a vertical plane perpendicular to the axis of the drum so that as the diameter of the wrap increases and the point of contact of the cable with the working face of the roller travels lengthwise of the roller, this point of contact may approach the vertical plane of the flange of the drum, giving rise to a decrease in the angle of inclination of the cable to the vertical. The angular adjustability of the roller housing 16 with respect to the mounting bracket

21 renders it possible to so position the axis of the roller at such a slight angle to the vertical plane of the drum flange that the horizontal turn-back force exerted upon the cable will at all times be of exactly the right amount to reverse the direction of the wrap at exactly the right juncture, i. e., neither prematurely, causing a short wrap, nor belatedly, causing a piling up of the cable at the end of the drum.

While this invention has been disclosed and described in connection with the draw-works of a well drilling rig, it is applicable to many other similar installations of winding equipment, and the invention is not to be construed as limited to the particular field of application in connection with which it has been shown and described.

I claim as my invention:

1. A cable spooling turn-back roller assembly, comprising: a frame having a plane supporting face formed with at least two parallel slots intersecting said face and adapted to be rigidly secured in a position stationary with respect to the axis of a cable drum, with said face substantially perpendicular to the cable line; a roller; and a bearing support for said roller having a plane face cooperating with said plane supporting face and having clamping means associated with said plane face and cooperating with said slots, said clamping means being arranged on a center line parallel to the axis of said roller.

2. A cable spooling turn-back roller assembly, comprising: a roller; a bearing support for said roller having a wall formed with a plane face parallel to the axis of said roller, and formed, intersecting said face, with a central aperture and two diametrically opposite isocentric arcuate slots centered about said aperture and bisected by a line parallel to the axis of said roller; a bracket for attachment to a drum housing, formed with a plane face and formed, intersecting said plane face, with three parallel straight slots centered to register with said aperture and arcuate slots; and bolt means cooperating with said aperture and said slots to adjustably secure together said support and said bracket.

3. A cable spooling turn-back roller assembly, comprising: a roller; a bearing support for said roller formed with a plane face parallel to the axis of said roller, and formed, intersecting said face, with a central aperture and two diametrically opposite isocentric arcuate slots centered about said aperture and bisected by a line parallel to the axis of said roller; a bracket for attachment to a drum housing, formed with a plane face, and formed, intersecting said face, with three parallel straight slots centered to register with said aperture and arcuate slots, said bracket having two elements, one of which is formed with said plane face, and the other of which is attachable to said drum housing, said elements being adjustably secured together to vary the ratio between the distances from the two ends of the roller respectively to a point of attachment of said bracket to said drum housing; and bolt means cooperating with said aperture and said slots to adjustably secure together said support and said bracket.

4. A cable spooling turn-back attachment for use with a power driven cable drum to cooperate with a cable on the drum extending from the drum to a point relatively remote therefrom and located so as to cause said cable, when being power-wound on said drum, to move toward said drum in a direction approximately perpendicular to the direction of the axis of said drum, comprising in combination:

a cable spooling turn-back roller; a first support having bearings in which said roller is revolvably mounted; a second support; coaxing engaging means on said two supports establishing relatively rectilinear movability therebetween in a path having a direction substantially perpendicular to the direction of the axis of said roller, said means having means for holding said supports in any desired relative position along said path against stresses acting in the direction of said path; and means on said second support adapted for securing it to the housing of a cable drum with the direction of said path substantially parallel to the drum axis, whereby said roller may be adjusted to finely regulate the ratio to the tensile stress in said cable of the turn-back reactive force component of that tensile stress at the point of rolling contact of said cable with said roller at times during the winding operation when such contact occurs.

5. A cable spooling turn-back attachment for use with a power-driven cable drum to cooperate with a cable on the drum extending from the drum to a point relatively remote therefrom and located so as to cause said cable, when being power-wound on said drum, to move toward said drum in a direction approximately perpendicular to the direction of the axis of said drum, comprising in combination: a cable spooling turn-back roller; a first support having bearings in which said roller is revolvably mounted; a second support; coaxing engaging means on said two supports establishing relative angular movability therebetween about an axis having a direction substantially perpendicular to the direction of the axis of said roller; means for fixing said supports together in selected relative angular positions permitted by said engaging means; and means on said second support adapted for securing it to the housing of a cable drum with the direction of said axis of relative angular movement perpendicular to the direction of the drum axis, whereby said roller may be adjusted to provide during a winding operation a varying turn-back reactive force component of the tensile stress in said cable at the point of rolling contact of said cable with said roller at times during the winding operation when such contact occurs, said variation being in accordance with the varying diameter of the cable wrap on the drum during said winding operation.

6. A cable spooling turn-back attachment for use with a power-driven cable drum to cooperate with a cable on the drum extending from the drum to a point relatively remote therefrom and located so as to cause said cable, when being power-wound on said drum, to move toward said drum in a direction approximately perpendicular to the direction of the axis of said drum, comprising in combination: a cable spooling turn-back roller; a first support having bearings in which said roller is revolvably mounted; a second support; coaxing engaging means on said two supports establishing relative angular movability therebetween on an axis having a direction substantially perpendicular to the direction of the axis of said roller; means for fixing said supports together in selected relative angular positions about said axis permitted by said engaging means; and means on said second support adapted for securing it to the housing of a cable drum with said axis substantially parallel to the drum axis, whereby the component of the tensile stress in the cable which is parallel to the axis of the roller and applied to the roller at the

point of contact of said cable with said roller at times during the winding operation when such contact occurs may be adjusted to approximately zero value.

7. A cable spooling turn-back attachment for use with a power-driven cable drum to cooperate with a cable on the drum extending from the drum to a point relatively remote therefrom and located so as to cause said cable, when being power-wound on said drum, to move toward said drum in a direction approximately perpendicular to the direction of the axis of said drum, comprising in combination: a cable spooling turn-back roller; a first support having bearings in which said roller is revolvably mounted; a second support; means for rectilinearly, translationally movably mounting said first support on said second support to be movable thereon in a direction of translatory movement at an angle to the axis of said roller having a normal value of 90° , and for oscillatably movably mounting said first support on said second support on an axis having a direction perpendicular to the direction of said roller axis and to said direction of translatory movement to permit variation in said angle; means for fixing said supports together in selected relative positions with respect to each other translationally and oscillatively; and means on said second support adapted for securing it to the housing of a cable drum with said direction of translatory movement substantially parallel to the drum axis and with the direction of said axis of relative oscillatory movement substantially perpendicular to the direction of said drum axis, whereby said roller may be adjusted to finely regulate, both in relation to the tensile stress in said cable and to the varying diameter of the cable wrap on said drum incident to a winding operation, the turn-back reactive force component of said tensile stress at the point of rolling contact of said cable with said roller at times during the winding operation when such contact occurs.

8. A cable spooling turn-back attachment for use with a power-driven cable drum to cooperate with a cable on the drum extending from the drum to a point relatively remote therefrom and located so as to cause said cable, when being power-wound on the drum, to move toward said drum in a direction approximately perpendicular to the direction of the axis of said drum, comprising in combination: a cable spooling turn-back roller; a first support having bearings in which said roller is revolvably mounted; a second support; plane surfaces on said two supports, respectively, substantially parallel to the axis of said roller and adapted for mutual sliding engagement; means on said supports limiting relative translatory sliding movement of said supports at said plane surfaces to a rectilinear path and permitting relative angular sliding movement of said supports at said surfaces about an axis at any point along said path; means for fixing said supports together in any relative position of said plane surfaces; and means on said second support adapted for securing it to the housing of a cable drum with the direction of said path substantially parallel to the drum axis and the direction of said axis of angular movement substantially perpendicular to the direction of said drum axis, whereby said roller may be adjusted to finely regulate, in relation both to

the degree of tensile stress in said cable and to the varying diameter of the cable wrap on the drum during a winding operation, the turn-back reactive force component of said tensile stress at the point of rolling contact of said cable with said roller at times during the winding operation when such contact occurs.

9. In a cable winding structure, the combination of: a power-driven cable drum; cable-retaining flanges at each end of the drum; a cable traverse limiting means mounted adjacent and spaced inwardly in a direction parallel to the direction of the drum axis from each of said flanges; and means for adjusting the position of said cable traverse limiting means at selected spaced intervals from the drum flanges, whereby said cable traverse limiting means may be adjusted to finely regulate the ratio to the tensile stress in said cable of the turn-back reactive force component of that tensile stress at the point of contact of said cable with said cable traverse limiting means at times during the winding operation when such contact occurs, in correspondence to the coefficient of friction of the material of the cable, the diameter of the cable, and other physical qualities of the cable.

10. In a cable winding structure, the combination of: a power-driven cable drum; cable-retaining flanges at each end of the drum; a cable traverse limiting means for each end of said drum having an elongated cable-contacting surface, said limiting means being mounted adjacent and spaced inwardly along the drum axis from a corresponding flange with the direction of elongation of its cable-contacting surface transverse the direction of the drum axis and facing toward the other flange; and means for adjusting the position of said cable-contacting surface to provide selected angular relationships between the direction of elongation of said cable-contacting surface and the direction of said drum axis.

11. In a cable winding structure for winding a cable extending therefrom to a relatively remote point located so as to cause said cable to move toward said structure in a direction approximately perpendicular to the direction of the axis of the cable windings, the combination of: a power-driven cable drum; end flanges on the drum; and a cable-contacting roller mounted adjacent each end of said drum with the direction of its axis at an angle slightly less than 90° to the direction of the axis of said drum and with the cable-contacting face of said roller overhanging the drum and the two ends of the cable-contacting face of said roller disposed at substantially different distances from said drum axis, that end of the cable-contacting face of said roller which is nearer to the drum axis overhanging the drum to a slightly greater extent than the other end of said cable-contacting face of said roller, said angle being of that particular magnitude required to vary the turn-back reactive force component of the winding tensile stress of a cable being power-wound on said drum in correspondence to the variation, as the diameter of the wrap increases during a winding operation, of the frictional resistance to lateral movement of the first portion of a second coil of a new wrap over the first coil of a new wrap beneath it.

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