

Aug 5, 1941.

L. O. REICHELT

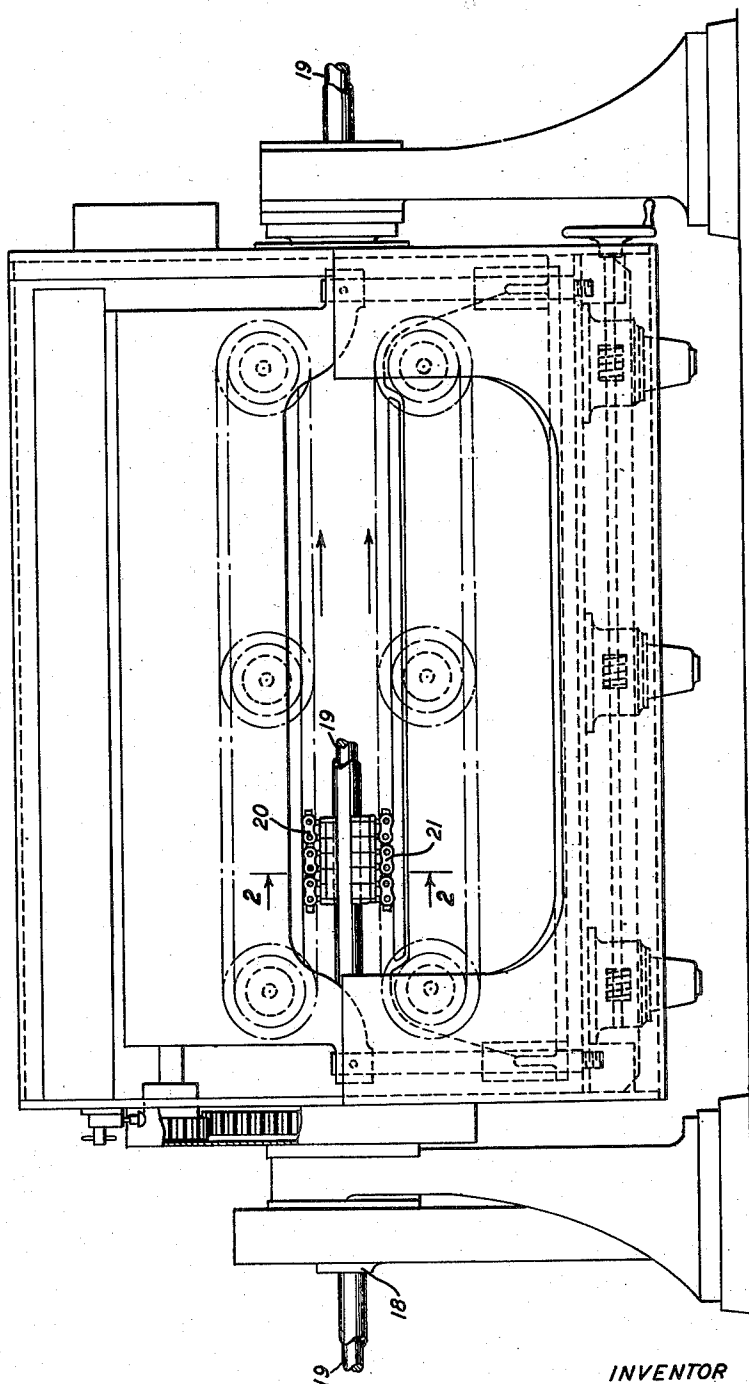
2,251,291

STRAND HANDLING APPARATUS

Filed Aug. 10, 1940

2 Sheets-Sheet 1

FIG. 1



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FIG. 3

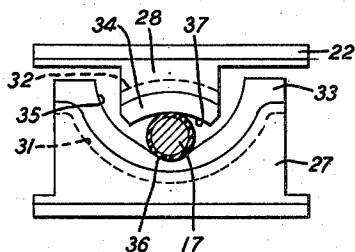


FIG. 2

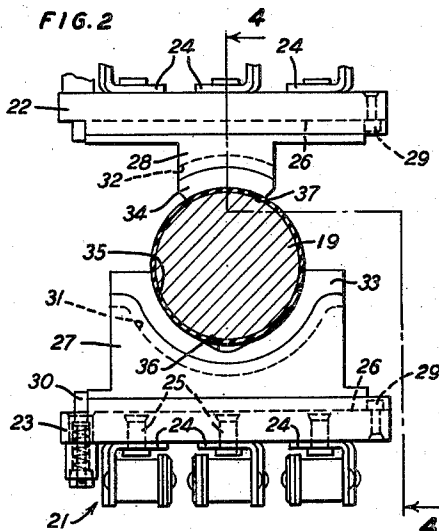


FIG. 4

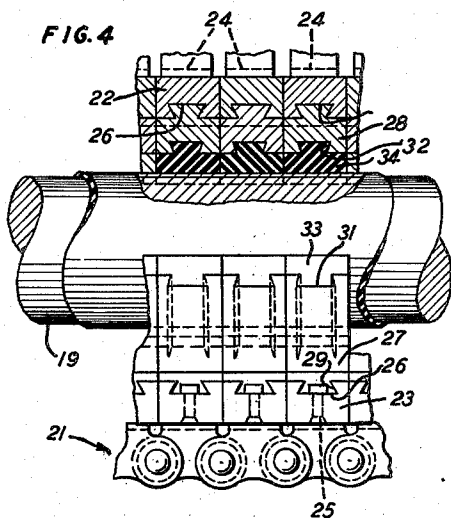


FIG. 5

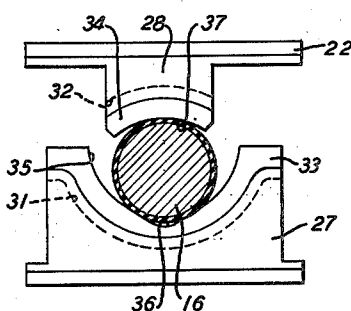
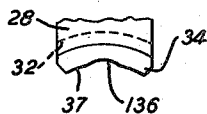


FIG. 6



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2,251,291

STRAND HANDLING APPARATUS

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Application August 10, 1940, Serial No. 352,054

10 Claims. (Cl. 254—135)

This invention relates to strand handling apparatus, and more particularly to apparatus for advancing strands longitudinally of themselves.

In the arts which pertain to the manufacture of strands, especially of the many kinds of compound strands, cords, ropes, cables, etc., employed for both mechanical and electrical purposes, there is need for apparatus to pull the strands from or through the various devices and machines used to make or variously treat them. Generally speaking such devices fall into two principal classes, rotary capstans and tractor capstans, each with its peculiar and inherent defects and advantages. A principal advantage of the rotary capstan, which is essentially a driven drum around which the strand to be advanced is wrapped in a sufficient number of turns to effect the required frictional grip, is that a given capstan may be used without alteration or adjustment of any kind for strands having a large range of diameters. A principal inherent defect of the rotary capstan is that a strand of relatively large diameter bent around the drum of the capstan under the normal pulling tension has a differential tension superimposed by the difference of curvature between the radially inner and outer parts of the curved or bent portions of the strand. This excessive superadded tension in the outer side of the strand may cause troublesome displacements or even rupture of elements of such strands as, for instance, multi-conductor telephone cables or cable cores which must be corrected. A tractor capstan is essentially a pair of endless belts portions of which run parallel to each other on each side of a straight segment of the strand to be moved, and which are provided with suitable tractor blocks or other means on the belts to grip, carry along and release the strands, and with means such as suitable cam tracks to press the blocks into gripping engagement with the strand passing between them. Such tractor capstans have the inherent advantage of operating on a straight portion of strand. There is no bending of the strand under tension, and hence no differential tension imposed within the strand because of bending. On the other hand, such tractor capstans have the inherent disadvantage of being capable of handling strands of practically only one diameter without a difficult and tedious removal and interchange of belts.

An object of the present invention is to provide a strand advancing apparatus generally of the tractor capstan type provided with simple, durable, inexpensive and reliable means whereby the apparatus may be employed to advance strands having a relatively large range of diameter without interchange of parts.

With the above and other objects in view, the invention may be embodied in a tractor capstan

in which the strand gripping elements are provided with strand gripping surfaces generally cylindrical in cross-section and having portions of two separate degrees of curvature, which elements may further be composed of resilient material.

Other objects and features of the invention will appear from the following detailed description of one embodiment thereof taken in connection with the accompanying drawings, in which the same reference numerals are applied to identical parts in the several figures, and in which

Fig. 1 is a generally diagrammatic, broken view in side elevation of a tractor capstan constructed in accordance with the invention;

Fig. 2 is an enlarged section on the line 2—2 of Fig. 1;

Fig. 3 is a partial view similar to Fig. 2, showing application to a strand of minimum diameter;

Fig. 4 is a section on the line 4—4 of Fig. 2;

Fig. 5 is a view similar to Fig. 3, showing a strand of intermediate diameter; and

Fig. 6 is a partial view of a modified form of gripping member.

In the embodiment herein disclosed, a tractor capstan generally shown in Fig. 1 is provided with two tractor belts 20 and 21 of any suitable material and construction, here indicated as sprocket chains. The portions of the two belts which face each other are always parallel to each other. The belts are drivable so that the mutually facing parallel portions run at the same speed and in the same direction. The general structure and mode of operation of the capstan are no part of the present invention and so are not disclosed or described here. A suitable structure is disclosed and described in U. S. Patent No. 1,882,902 of October 18, 1932, to the present inventor, to which reference may be had, if desired, for such information.

For present purposes all that is necessary as to the machine generally is that the mutually facing portions of the belts 20 and 21 are drivable to run in strict parallelism, from left to right in Fig. 1; at the same speed; that means be provided as in the patent above cited for adjusting the distance apart of the belts; and that means are present such as a hollow shaft 18 to lead a strand 19 to be advanced, propelled or drawn along from left to right, to enter between the belts.

As herein disclosed, each of the belts 20 and 21 consists of three distinct parallel sprocket chains, bound together at each link by transverse crossbars 22 and 23, respectively, of metal, each secured to three laterally aligned links of the three chains by being secured with rivets 25 to supporting arms 24 formed integral with the links. Each of the crossbars 22 and 23 is formed

with a dovetail slot 26 running longitudinally of the bar and transversely to the belts and located in the face of the bar away from its supporting belt.

A mounting member 27 or 28 respectively, of metal, has a base portion corresponding in width to the slotted face of the cross bar and is formed on the under side of its base with a dovetail to match the dovetail slot 26 and assembled therein. The base dovetail is locked into exact position in the slot 26 by a permanent stop 29 at one end and a spring lock 30 at the other. Thus each of the mounting members 27 or 28 may be removed individually at will for exchange or repair.

The upstanding body of each mounting member 27 is relatively wide, as herein shown spanning all three chains of the belt 21. The depending body of each member 28 is relatively narrow, spanning, in the structure disclosed, substantially only the middle chain of the belt 20. The top surface of the member 27 and the bottom surface of the member 28 are each curved to a radius somewhat greater than that of the largest strand to be handled by the particular assembly, and each of these faces is formed with a correspondingly arcuate dovetail slot 31 or 32 respectively.

A gripping member 33 or 34, preferably of rubber or the like material, is formed, pressed and vulcanized into each slot 31 or 32 respectively to be securely gripped therein. Each of the members 33 has in its upper face a semi-cylindrical slot or groove 35 whose radius is that of the largest strand to be handled, except at the bottom. Here there is a further groove 36 cut into the bottom of the groove 35 with a radius equal to that of the smallest strand in view, and preferably with a width of about 90°, the sharp intersection of the two curved surfaces being smoothly faired away. The bottom face of each gripping member 34 is curved to the radius of the largest strand in view, as at 37. In the preferred form, as noted above, the members 33 or 34 are of some relatively softly resilient material such as rubber. They may then be molded in place as described to be substantially homogeneous. Or they may, in some instances preferably, be partially preformed of laminations of fabric impregnated with uncured rubber material and cured after being put in place in the members 27 or 28. Or in other instances the members 27 and 33 or 28 and 34 or both may be made integral and of metal, while preserving the particular contours of the gripping surfaces 35 and 36 or 37 as described.

The operation of the members 33 and 34 in gripping a strand to be advanced is thought to be self-evident from the above description of the apparatus. It may be noted that in any given case the distance apart of the belts 20 and 21 will be adjusted to an optimum value which will be related to the diameter of the particular strand in question in a manner dependent upon the structure and nature of the particular strand, the severity of the grip upon the strand in turn depending upon the difference between the un-gripped diameter of the strand and the empty distance between the opposed faces of the gripping members. Generally, both the members 33 and 34 on the one hand and the strand gripped by them on the other, will be more or less deformed by the gripping pressure. At one extreme is the case where the members 33 and 34 are of relatively soft rubber and the strand a solid rod of metal or a closely laid cable of hard metal

strands, in which case there is no deformation of the strand. At the other extreme the members 33 and 34 may be of metal and the strand of relatively soft and deformable material. In such case, there will be no deformation of the gripping members.

In the particular case of the handling of compound strands such as telephone cable cores, composed of a plurality of wires intertwined together as a whole or in pre-twisted groups, the invention has its principal practical value. Such cores, in practice, at various stages of manufacture, may be simply such compound strands of intertwined wire, or they may have a binder strand wound about them at relatively short pitch, or they may, as illustrated in the case of the strand 19, have a wrapping of paper tape completely covering them. Such cores will endure a certain amount of deformation under transverse squeezing without material injury but obviously not a great deal.

When a maximum diameter core, such as 19, is gripped as in Figs. 2 and 4, the gripping pressure is applied over something like two thirds of the circumference of the core, the relatively soft, resilient surfaces 35 and 37 accommodate themselves not only to the general contour of the core but also to the minor irregularities, and a relatively heavy tractive effort may be harmlessly applied to the core.

In the case of a minimum diameter core 17, as illustrated in Fig. 3, the surface 36 makes close contact with the core over a quarter of the circumference without any deformation of either; and only a slight and negligible deformation at the upper contact of the core is needed to make the surface 37 and the core conform together over another quarter of the circumference. In cases where extreme tenderness of action is required, the upper member 34 may even be formed with a secondary groove 36 like the groove 36 in the member 33, as illustrated in Fig. 6. Generally, however, this is not found to be necessary.

The most common intermediate case is illustrated in Fig. 5, where the core 16 has a diameter intermediate between the least and greatest. The figure illustrates, as do the others also, an impossible state in which there is no deformation of any of the elements involved. In actuality there will be both a flattening of the core 16 at the top and a deepening of the surface 37 under the gripping pressure. But a moment's study will show that only a practically negligible deformation of the strand is required, in view of the concomitant deformation of the surface 37, to spread the tangency of the core and upper gripping members from the ideal line contact illustrated over a very considerable angular portion of the circumference of the core. The case at the bottom is similar. Ideally the core makes contact with the member 33 only along two lines where the surface 36 is faired off into the surface 35. In actuality only negligible mutual deformations are required to flatten down the faired ridges and correspondingly shallowly indent the core so that contact between the gripping member and the core is established over the whole surface 36, the faired ridges and considerable angular fractions of the surface 35 on both sides.

Thus by the employment of gripping members preferably of resilient material, which are mutually approximable for coaction, and whose strand gripping surfaces are primarily curved to fit the largest strand in view and of which either or both may have a portion secondarily curved to fit the

smallest strand contemplated, it is possible satisfactorily to grip and exert tractive effort on a strand of any of a large range of diameters without material injury to either the strand or the apparatus and without need for interchangeable gripping members.

The embodiment of the invention disclosed is illustrative and may be variously modified and departed from without departing from the spirit and scope of the invention as pointed out in and limited only by the appended claims.

What is claimed is:

1. In apparatus of the general character described, a pair of opposed and mutually approx-
imable gripping members for gripping there-
between a strand of any diameter between and
including predetermined maximum and minimum
values, each such gripping member having a
strand gripping surface primarily cylindrically
curved to fit a strand of maximum diameter.

2. In apparatus of the general character described, a pair of opposed and mutually approx-
imable gripping members for gripping there-
between a strand of any diameter between and
including predetermined maximum and minimum
values, each such gripping member having a
strand gripping surface primarily cylindrically
curved to fit a strand of maximum diameter,
and each such gripping member being composed
of elastically resilient material.

3. In apparatus of the general character described, a pair of opposed and mutually approx-
imable gripping members for gripping there-
between a strand of any diameter between and
including predetermined maximum and minimum
values, each such gripping member having a
strand gripping surface primarily cylindrically
curved to fit a strand of maximum diameter, one
of the gripping members also having its said
strand gripping surface further formed over a
portion thereof with a cylindrical curvature to
fit a strand of minimum diameter.

4. In apparatus of the general character described, a pair of opposed and mutually approx-
imable gripping members for gripping therebe-
tween a strand of any diameter between and in-
cluding predetermined maximum and minimum
values, each such gripping member having a
strand gripping surface primarily cylindrically
curved to fit a strand of maximum diameter, one
of the gripping members also having its said
strand gripping surface further formed over a
portion thereof with a cylindrical curvature to
fit a strand of minimum diameter and having the
junctures of the two portions of different curva-
ture faired away.

5. In apparatus of the general character described, a pair of opposed and mutually approx-
imable gripping members for gripping therebe-
tween a strand of any diameter between and in-
cluding predetermined maximum and minimum
values, each such gripping member having a
strand gripping surface primarily cylindrically
curved to fit a strand of maximum diameter, each
of the gripping members also having its said
strand gripping surface further formed over a
portion thereof with a cylindrical curvature to
fit a strand of minimum diameter.

6. In apparatus of the general character described, a pair of opposed and mutually approx-
imable gripping members for gripping therebe-

tween a strand of any diameter between and in-
cluding predetermined maximum and minimum
values, each such gripping member having a
strand gripping surface primarily cylindrically
curved to fit a strand of maximum diameter,
each of the gripping members also having its
said strand gripping surface further formed over
a portion thereof with a cylindrical curvature
to fit a strand of minimum diameter and having
the junctures of the two portions of different
curvature faired away.

7. In apparatus of the general character de-
scribed, a pair of opposed and mutually approx-
imable gripping members for gripping therebe-
tween a strand of any diameter between and in-
cluding predetermined maximum and minimum
values, each such gripping member having a
strand gripping surface primarily cylindrically
curved to fit a strand of maximum diameter, one
of the gripping members also having its said
strand gripping surface further formed over a
portion thereof with a cylindrical curvature to
fit a strand of minimum diameter and each such
gripping member being composed of elastically
resilient material.

8. In apparatus of the general character de-
scribed, a pair of opposed and mutually approx-
imable gripping members for gripping therebe-
tween a strand of any diameter between and in-
cluding predetermined maximum and minimum
values, each such gripping member having a
strand gripping surface primarily cylindrically
curved to fit a strand of maximum diameter, one
of the gripping members also having its said
strand gripping surface further formed over a
portion thereof with a cylindrical curvature to
fit a strand of minimum diameter and having the
junctures of the two portions of different curva-
ture faired away and each such gripping member
being composed of elastically resilient material.

9. In apparatus of the general character de-
scribed, a pair of opposed and mutually approx-
imable gripping members for gripping therebe-
tween a strand of any diameter between and in-
cluding predetermined maximum and minimum
values, each such gripping member having a
strand gripping surface primarily cylindrically
curved to fit a strand of maximum diameter,
each of the gripping members also having its said
strand gripping surface further formed over a
portion thereof with a cylindrical curvature to
fit a strand of minimum diameter and each such
gripping member being composed of elastically
resilient material.

10. In apparatus of the general character de-
scribed, a pair of opposed and mutually approx-
imable gripping members for gripping therebe-
tween a strand of any diameter between and in-
cluding predetermined maximum and minimum
values, each such gripping member having a
strand gripping surface primarily cylindrically
curved to fit a strand of maximum diameter, each
of the gripping members also having its said
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portion thereof with a cylindrical curvature to
fit a strand of minimum diameter and having the
junctures of the two portions of different curva-
ture faired away and each such gripping member
being composed of elastically resilient material.

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