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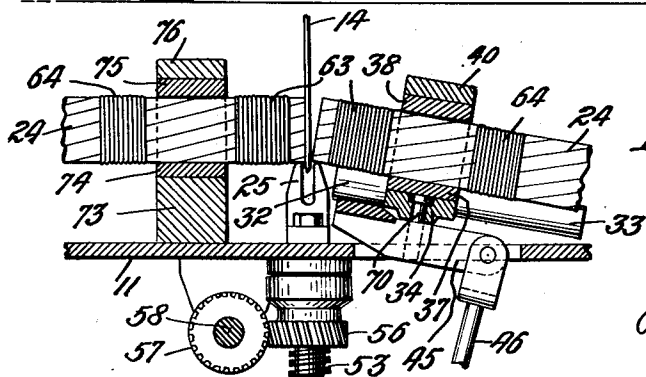
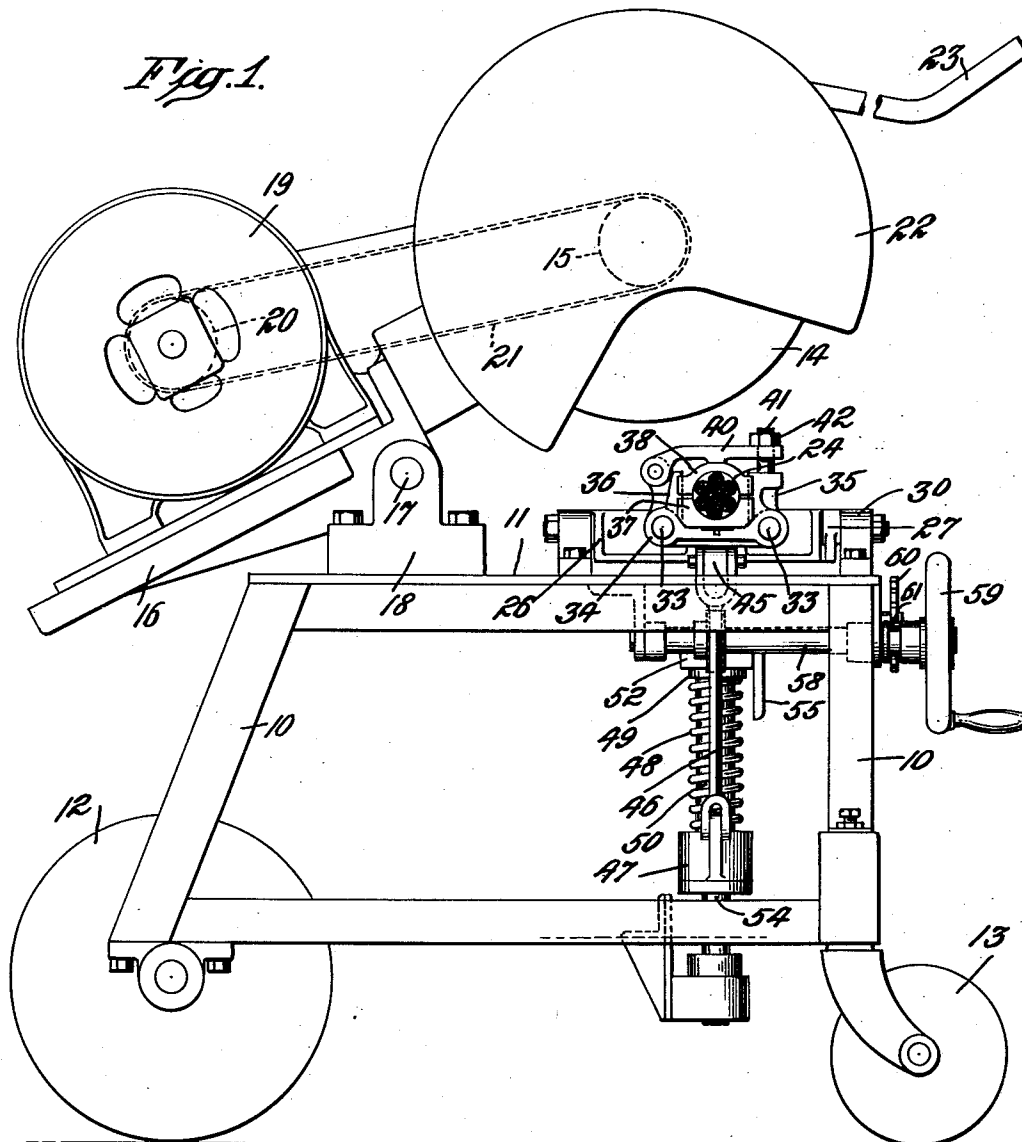
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2,064,017

APPARATUS FOR CUTTING WIRE ROPE, CABLE AND THE LIKE

Filed Sept. 18, 1936

3 Sheets-Sheet 1



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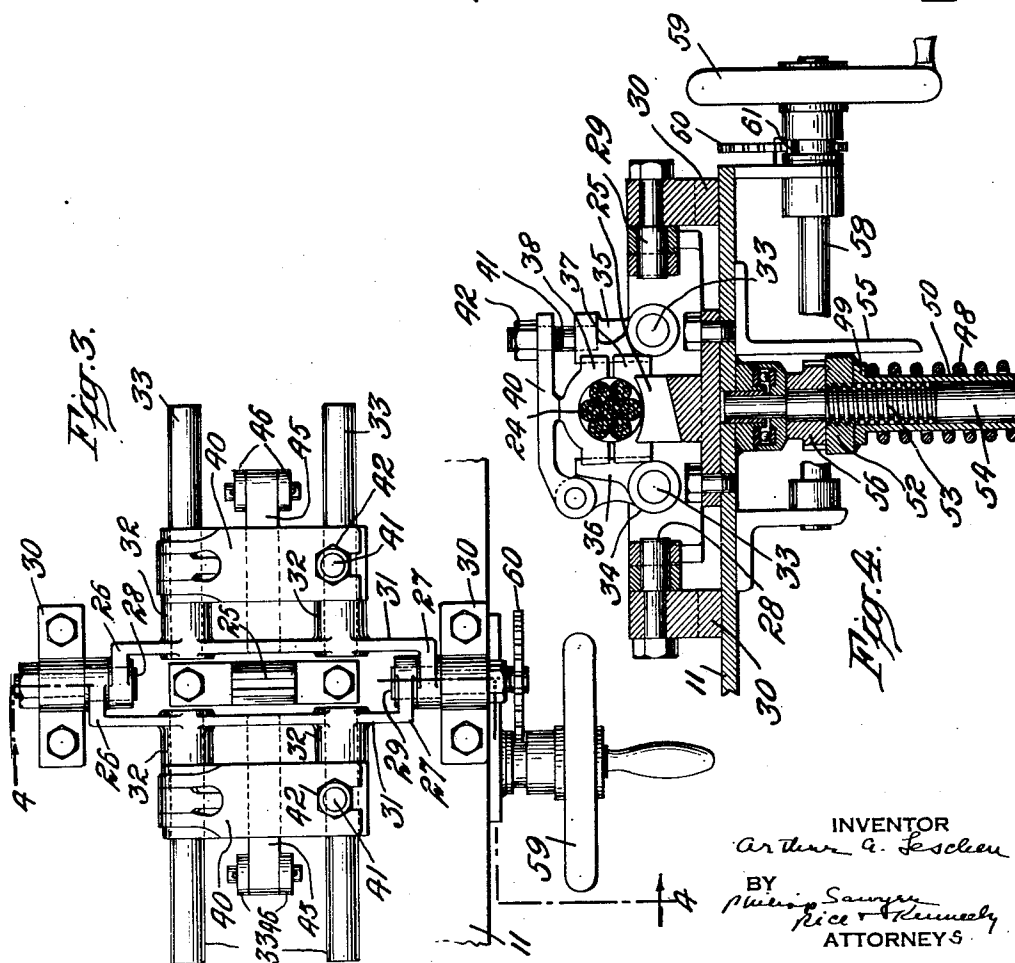
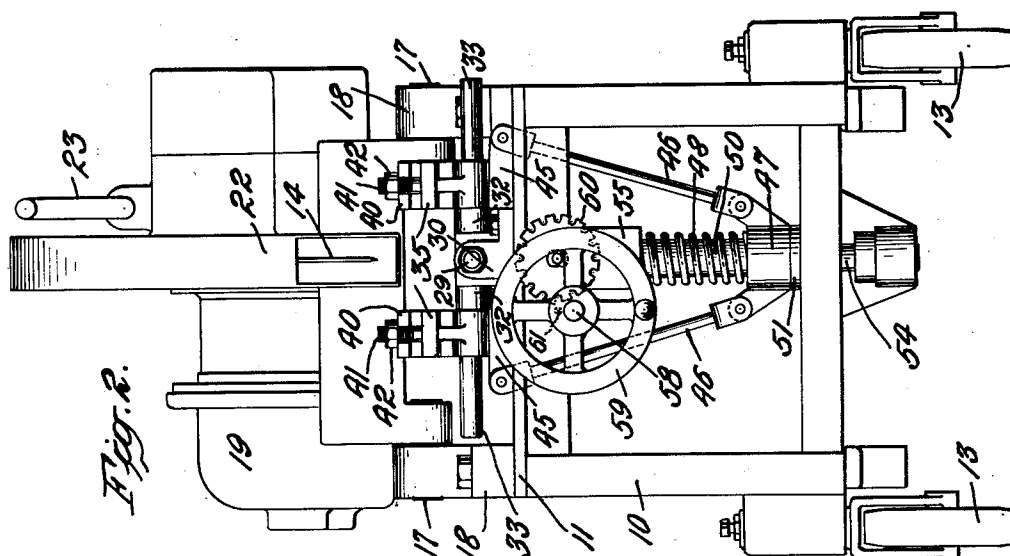
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APPARATUS FOR CUTTING WIRE ROPE, CABLE AND THE LIKE

Filed Sept. 18, 1936

3 Sheets--Sheet 2



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Dec. 15, 1936.

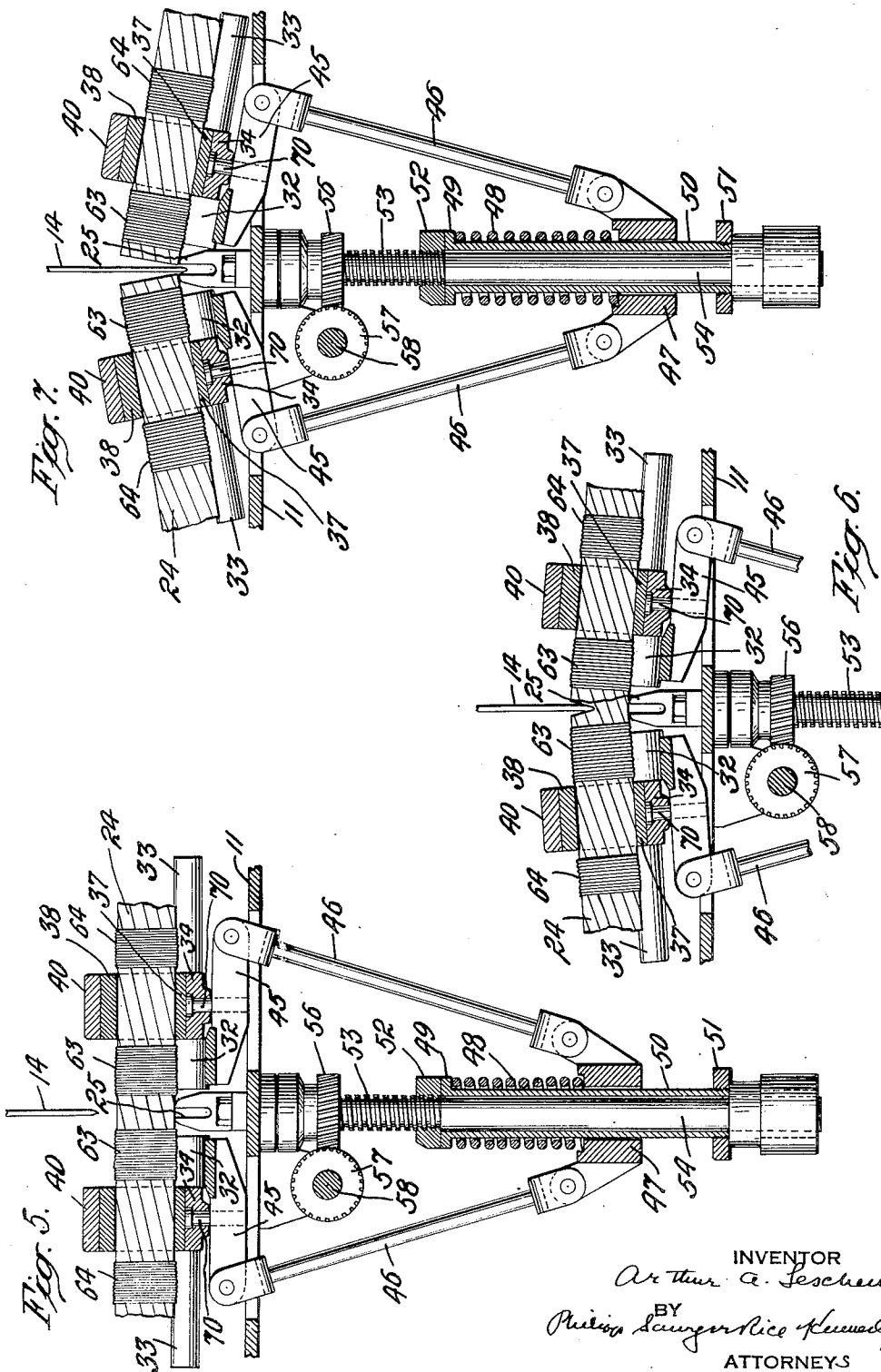
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APPARATUS FOR CUTTING WIRE ROPE, CABLE AND THE LIKE

Filed Sept. 18, 1936

3 Sheets-Sheet 3



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2,064,017

APPARATUS FOR CUTTING WIRE ROPE,
CABLE, AND THE LIKE

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Application September 18, 1936, Serial No. 101,396

23 Claims. (Cl. 51—98)

This invention relates to apparatus for cutting wire rope, cable and the like.

Considerable difficulty has been experienced in cutting wire rope of the larger diameters, particularly with an abrasive wheel. The shifting and untwisting action of the individual wires of the respective strands, which is due to the twist put in the rope when it is made, tends to jam the wheel and breakage of the wheel is almost inevitable. Similar difficulties are met with in using other forms of cutters.

It is an object of the present invention to provide an improved apparatus for cutting wire rope and the like such that suitable clearance is provided between the cutting instrument and the rope wires.

With this general object and others in view, the invention consists in the features, details of construction and arrangements of parts which will first be described in connection with the accompanying drawings and then more particularly pointed out.

In the drawings,—

Figure 1 is a view in side elevation of a rope cutting apparatus constructed in accordance with the invention, the rope being shown in cross-section;

Figure 2 is a view of the apparatus in front elevation;

Figure 3 is a plan view (enlarged) of part of the apparatus;

Figure 4 is a sectional view taken on the line 4—4 of Figure 3;

Figures 5-7 are fragmentary sectional views illustrating the course of rope cutting; and

Figure 8 is a similar view showing a modification.

While the invention is not limited to any particular type of machine or cutting instrument, it is particularly useful in connection with power operated cutters and with abrasive wheels and is here illustrated in connection with such a machine of a well known type.

Referring to the drawings, in the embodiment here illustrated as an example, there is provided a cutting wheel mounted so as to be movable toward and away from the rope to be cut. As here shown as an example, a carriage 10, having a table or platform 11, supports the rope in cutting position as later described. The carriage is mounted on front and rear wheels 12, 13 so as to be readily portable.

Above the carriage is located a cutting wheel 14 constructed of suitable abrasive material. This wheel is so mounted as to be capable of

a rotary and bodily edgewise movement simultaneously. To this end, as here shown as an example, the cutting wheel is mounted on a shaft (not shown) on which is mounted a sprocket indicated conventionally at 15. This shaft and sprocket are carried by a tilting frame 16 pivoted on trunnions 17 mounted in brackets 18 secured to table 11. Also carried by frame 16 is a motor represented by its housing 19. The motor armature drives a sprocket indicated at 20 and sprockets 15, 20 are operatively connected by a drive chain 21. Thus, cutter 14 may be rotated regardless of the angular position of frame 16. It will be understood that current may be supplied to the motor in any suitable manner.

The cutting wheel is enclosed by a housing or hood 22 cut away, as appears in Figures 1 and 2, to permit access of the wheel to the rope. On the frame 16 is an operating handle 23 by which the wheel may be drawn down against the rope for the cutting operation.

The apparatus, so far as above described, is of a well known form and is shown only as illustrating one type of apparatus out of many to which the invention may be applied.

The invention in its entirety includes means for bending or arcing the rope as the cutting progresses, thereby to pull apart the cut faces of the rope and provide and maintain suitable clearance for the cutting wheel. This may be accomplished, for example, by a pair of movable clamps for grasping the rope at opposite sides of the cutting point, a fixed support or abutment for the grasped section and means for moving the clamps as the cutting progresses.

Although capable of various constructions, in that illustrated as an example in Figs. 1-7, mounted on the carriage table is a fixed supporting abutment for the bottom of the rope 24 in the form of a saddle 25, bifurcated or notched, as appears in Figures 3-7, to accommodate the cutting wheel at the end of a cut. On opposite sides of the support 25, and hence the line of cut, are two units which may be described as lever units and which carry the clamps.

One of the lever units, for example, the right-hand unit in Figure 3, comprises two lever arms 26, 27 mounted, respectively, on pivot pins or fulcrums 28, 29. The pivot pins are carried by brackets 30 mounted on the carriage table. The lever arms are connected by a cross-bar 31. Integral with bar 31 are two bosses 32 in which are secured rods 33 on which the clamps are mounted. Bosses 32 are so positioned that they are on opposite sides of the axis of the rope

when the latter is in cutting position. The other lever unit is a reverse hand duplicate except that its lever arms and cross-bar are so arranged that the two units are staggered with respect to each other, as appears in Figure 3, so that both may pivot on the same axis. As appears in Figure 4, the pivotal axis of the lever units lies below the bottom of the rope. Thus, the rope is under tension, with no compression.

Secured to the rods 33 of each lever unit, in a manner to be described, is a clamp housing 34, roughly U-shaped. Slidable between the opposing faces of legs 35, 36 of the clamp housing are lower and upper clamp members 37, 38. The ends of these clamps are mortised so that they have a sliding fit on the faces of the clamp housing, as indicated in Figures 1 and 4. The opposing faces of the clamps are arcuate so that when assembled they grasp the rope in the manner exemplified in Figure 4. Since the clamp members are separable, they adapt themselves to minor differences in diameter. For greater differences in rope diameter, different sets of clamp members may be substituted as required. After the rope is in place and the upper clamp members assembled, the clamps are locked. To this end, pivoted to leg 36 of the housing clamp is a locking bar 40 having a notched end. On the other leg 35 of the clamp housing is a threaded pin or bolt 41. After the clamp is assembled, bar 40 is swung down against the upper clamp member, its notched end straddling pin 41. The locking bar is then tightened and locked by a locking nut 42 threaded on to the end of pin 41.

As is hereinafter more fully described, when the parts are in what may be termed initial position, i. e. when the rope is clamped ready to be cut, the grasped section of the rope is substantially horizontal. This means, of course, that the axes of the clamps and of bars 33 are substantially horizontal. It will now be apparent that a tilting of the lever units to pull the clamps downwardly will tend to bend the grasped section of rope about abutment 25. If a suitable force is applied to the levers, the rope section, as soon as a partial cut is made, will start to bend and the further the cut extends the more the rope bends. As a result, the opposing cut edges are continuously pulled away from each other (Figures 6, 7), thus providing proper clearance for the cutting wheel.

While the lever units may be operated in various ways, in carrying out the invention to what is now considered the best advantage, the operation will be automatic. This may be accomplished, for example, by setting up a potential lever-operating force which is insufficient to make any substantial bend in the rope while the rope is in integral condition but which is sufficient to start the bending after a partial cut and which automatically expends itself in bending the rope more and more as the resistance diminishes because of the increasing depth of cut.

As here shown as an example, integral with the respective lever units are oppositely disposed rocker arms 45. Pivoted to each rocker arm is a connecting rod or link 46, the opposite end of which is pivoted to a ring-like cross head 47. It will be seen that vertical movement of the cross head will, through links 46 and rocker arms 45, swing the lever units on their pivots.

The potential force for lowering the cross head to pull down the levers is set up by de-

veloping tension in a spring 48 confined between the cross head and a collar 49 on the upper end of a tubular sleeve 50. This sleeve extends downwardly and freely through cross head 47 and has a collar 51 on its lower end. Forming part of the sleeve unit is a square nut 52 secured to sleeve collar 49. Nut 52 is in threaded engagement with a screw 53 formed on the end of a shaft 54 embraced by the sleeve and journaled in suitable bearings mounted on the carriage. The sleeve unit is prevented from turning as the screw rotates by a guide plate 55 against which nut 52 engages. Consequently, rotation of the screw will cause the sleeve unit to move up or down, depending on the direction of rotation.

While the shaft 54 and its screw 53 may be rotated in any suitable manner, in the embodiment here shown as an example, on shaft 54 is a helical gear 56 meshing with a complementary gear 57 mounted on a drive shaft 58. The latter is rotated by a hand wheel 59.

In the initial position of the parts, to which they are set as later described, the sleeve unit is in its furthest upward position with nut 52 engaging gear 56 which serves as a stop (Figure 4). The cross head 47 is in the position of Figure 5. This means that spring 48 is extended and hence under what may be considered zero tension.

To develop tension in the spring and thus set up the potential force for arcing the rope, hand wheel 59 is rotated to rotate screw 53. Since nut 52 cannot turn, the sleeve unit, of which the nut is a part, is caused to move downwardly. If there were nothing to prevent movement of the lever units and associated parts, this downward movement of the sleeve unit would tend, through the spring, to displace cross head 47 downwardly and there would be no substantial tensioning effected. But with a rope present, the resistance of the rope to bending overcomes this tendency. That is, since the relative rigidity of the rope prevents the clamps and levers from moving, cross head 47 is, in effect, held stationary. Consequently, upon the downward movement of the sleeve unit, spring 48 is compressed as nut 52 approaches the cross head.

The amount of spring tension developed depends on the extent to which screw 53 is rotated by the hand wheel and the relative amount may be indicated to the operator by means of an indicator disk 60. This disk is notched around its periphery and is advanced the angular distance of one notch for each complete rotation of hand wheel 59 by means of a stud 61 engaging the notches as the hand wheel turns. Suitable indicia (not shown) may be carried by disk 60 to indicate the relative amount of spring tensioning. The amount will normally vary for different ropes, depending on the rope diameter or its characteristics or both. The proper tension for a given type and size of rope is best determined by experience.

There is provided means whereby the distance between the clamps can be varied to suit ropes of different diameters or stiffness. This may be accomplished, for example, by adjustably mounting the clamp housings on rods 33. As here shown, in the bottom of each U-shaped clamp housing 34 is a hole for receiving a positioning dowel 70. These dowels take into corresponding holes in rocker arms 45 (Figures 5-7). When the clamps are assembled and locked about a rope section the assembly holds the dowels 70 in 75

place and the clamp housings are thus rigidly secured to the lever units. By providing different holes along the length of rocker arms 45 the relative position of the clamps may be varied.

In operation, the parts being in the initial position above referred to, with the clamp and lever units horizontal, the rope to be cut is seated in the lower clamp members 37 and in the saddle of supporting abutment 25 with the point of cut directly over the slot of the abutment. As here illustrated, the rope is provided with suitable wrappings or servings 63 of wire or the like at opposite sides of the point of prospective cut 15 to prevent the rope from untwisting after the cut. Supplemental wrappings 64 are provided at points outside the respective clamps.

The upper clamp members 38 are then assembled and the clamps tightened and locked as above described.

In the construction here illustrated as an example, the position of the clamps, when horizontally positioned, is such that the bottom of all the ropes, within the capacity of the apparatus, lie in the same plane regardless of rope size, i. e. diameter. The clamps, being formed in two parts, can adjust themselves to different diameters. This construction simplifies design and permits the supporting abutment 25 to be permanently fixed.

The rope being thus locked in the clamps, tension in the rope is built up by tensioning spring 48 as described. The position of the parts following this tensioning is shown in Figure 5.

The tilting frame 16 is now lowered to force cutting wheel 14 against the rope to make the cut. As the cutting progresses, there is a progressive reduction in metallic cross-section area and consequently a gradual reduction in resistance to bending. As shown, therefore, as soon as a substantial amount of cut has been made, the tension set up is such that spring 48 can now force cross head 47 downwardly. This, through the connections described, starts to pull down the lever units, thus bending or arcing the rope over abutment 25. As a result, the edges of the cut are spread apart so that a sufficient gap is provided to clear the cutter wheel. This movement of the parts continues as the cut deepens, both the tension set up and the resistance to bending progressively diminishing. Finally, as the rope is completely severed, all resistance from the rope is released and the clamps drop down and away from each other, whereby the two ends of the severed rope move apart and clear the wheel completely.

Figure 6 illustrates the position after the rope has been cut about one-third through, with the rope bending so that a wheel-clearing gap is formed in the cut. Figure 7 shows the parts at the end of the cut with the cut ends clearing the wheel.

After the clamps have been opened and the rope sections removed, the parts are returned to initial position by a reverse movement of hand wheel 59. The consequent reverse rotation of screw 52 causes the sleeve unit to be elevated. This brings lower collar 51 into engagement with cross head 47. Thereupon the cross head is carried upwardly by the collar and this movement of the cross head, through the links and rocker arms, swings the lever units up again. The parts are so arranged that as nut 42 reaches gear 56, and hence the end

of its travel, the lever units are in substantially horizontal position, this being the initial position above described.

With the apparatus described there is always sufficient clearance for the cutter and the danger of cutter breakage is practically eliminated. Moreover, once the necessary potential force has been set up, the bending of the rope to attain this clearance is automatic.

Figure 8 illustrates a modification in which the rope is pulled down on only one side of abutment 25. This may be accomplished by providing one movable and one stationary clamp. As shown as an example in Fig. 8, the right hand clamp and its associated parts are the same as in the construction above described. The other movable clamp and its associated parts are omitted. There is substituted, at the left of abutment 25 as viewed in Figure 8, a stationary clamp housing 73 mounted in any suitable manner on table 11 and roughly U-shaped in form. Slidable between the legs of this clamp housing are lower and upper clamp members 74, 75, like clamp members 37, 38. After the rope is in place and the upper clamp member 25 assembled, the clamp is locked by a locking bar 76 like bar 40.

The operation is the same as that described except, of course, that only one clamp is pulled downwardly. The movement of this clamp bends the rope over abutment 25. This pulls one cut face of the rope away from the other to clear the cutter, as indicated in Figure 8.

It is to be understood that the term "wire rope" as used herein, is intended to include all forms of wire strand, wire rope or wire cable, used for all purposes, and either covered or uncovered.

What is claimed is:

1. In a device of the class described, and in combination, a rope cutting instrument, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, the cutter and abutment being capacitated for relative bodily movement, and means for bending the rope against said abutment, during the cutting operation, thereby to cause the cut faces of the rope to pull apart as the cut progresses.

2. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two movable clamps for grasping the rope on opposite sides of the line of cut, and means for moving said clamps transversely during the cutting operation, thereby to bend the rope against said abutment and cause the cut faces of the rope to be pulled apart.

3. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two oppositely disposed lever units, a clamp for grasping the rope mounted on each of said lever units and means for moving said lever units, during the cutting operation, thereby to bend the rope against said abutment and cause the cut faces of the rope to be pulled apart.

4. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two oppositely disposed lever units having a pivotal axis located below the bottom of the rope when the latter is positioned for cutting, a clamp for grasping the rope mounted on each of said lever units and means for moving said lever units, during the cutting operation, thereby to bend

the rope against said abutment and cause the cut faces of the rope to be pulled apart.

5. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two oppositely disposed lever units, a clamp for grasping the rope mounted on each of said lever units, rocker arms connected to the respective lever units, links pivoted to the respective rocker arms, a cross head to which said links are pivoted and means for moving said cross head, thereby to operate said lever units.

6. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two clamps for grasping the rope on opposite sides of the line of cut and means whereby said clamps are automatically moved transversely as the cutting operation progresses, thereby to bend the rope against said abutment and cause the cut faces of the rope to be pulled apart.

7. In combination with a rope cutter, means for holding a section of rope in a position to be acted on by said cutter, and means for setting up in said section a tension such that as the cutting progresses the rope section will arc, thereby to cause the cut faces of the rope to pull apart.

8. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two movable clamps for grasping the rope on opposite sides of the line of cut, a spring, means for tensioning said spring and an operating connection between the spring and said clamps whereby the tension set up causes the clamps to be displaced transversely as the cutting operation progresses, thereby to bend the rope and cause the cut faces thereof to be pulled apart.

9. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two movable clamps for grasping the rope on opposite sides of the line of cut, a movable cross head, an operating connection between said cross head and the clamps, a collared sleeve associated with said cross head, a spring confined between said collar and the cross head, and means for causing said spring to be compressed.

10. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two movable clamps for grasping the rope on opposite sides of the line of cut, a movable cross head, an operating connection between said cross head and the clamps, a collared sleeve associated with said cross head, a spring confined between said collar and the cross head and means for moving said sleeve to compress the spring against the cross head, movement of the cross head, during such compression, being opposed by the resistance of the rope to bending.

11. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two movable clamps for grasping the rope on opposite sides of the line of cut, an annular movable cross head, an operating connection between said cross head and the clamps, a rotatable screw shaft, a sleeve embracing said screw shaft and passing freely through said cross head, a collar on the upper end of said sleeve, a spring confined between said collar and the cross head, means for rotating said screw shaft

and means for causing such rotation of the screw shaft to effect axial movement of said sleeve.

12. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two movable clamps for grasping the rope on opposite sides of the line of cut, an annular movable cross head, an operating connection between said cross head and the clamps, a rotatable screw shaft, a sleeve embracing said screw shaft and passing freely through said cross head, a collar on the upper end of said sleeve, a spring confined between said collar and the cross head, and a collar on the sleeve below the cross head.

13. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two movable clamps for grasping the rope on opposite sides of the line of cut, a movable cross head, an operating connection between said cross head and the clamps, a collared sleeve associated with said cross head, a spring confined between said collar and the cross head and means for moving said sleeve to compress the spring against the cross head, movement of the cross head, during such compression, being opposed by the resistance of the rope to bending, the tension so set up in the spring being such as to overcome such resistance upon the rope being cut, whereby the spring causes the cross head to move down and displace the clamps to bend the rope, and means for returning the cross head to initial position after a rope has been cut through.

14. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two oppositely disposed lever units, a clamp for grasping the rope mounted on each of said lever units, rocker arms for operating said lever units, an annular cross head, links pivotally connected to said cross head and rocker arms respectively, a sleeve passing freely through said cross head, a collar on the upper end of said sleeve, a spring confined between said collar and the cross head, a screw shaft embraced by said sleeve, a flat sided nut threaded on said screw and rigidly connected with said sleeve, a guide plate for engagement by said nut to prevent rotation thereof as the screw rotates, and means for rotating said screw shaft.

15. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two oppositely disposed lever units, a clamp for grasping the rope mounted on each of said lever units, rocker arms for operating said lever units, an annular cross head, links pivotally connected to said cross head and rocker arms respectively, a sleeve passing freely through said cross head, a collar on the upper end of said sleeve, a spring confined between said collar and the cross head, a second collar on said sleeve below the cross head, a screw shaft embraced by said sleeve, a flat sided nut threaded on said screw and rigidly connected with said sleeve, a guide plate for engagement by said nut to prevent rotation thereof as the screw rotates, and means for rotating said screw shaft.

16. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two oppositely disposed lever units, a clamp associated with each lever unit for grasping the rope to be cut, means for adjustably securing said

clamps on said lever units in different relative positions, and means for operating said lever units to bend the rope against said abutment.

17. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two oppositely disposed lever units, a clamp housing secured to each lever unit, separable upper and lower clamp members carried by each of said clamp housings for grasping the rope, means for locking said clamp members together after the rope has been assembled between the same, and means for operating said lever units to bend the rope against said abutment.

18. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two oppositely disposed lever units, a U-shaped clamp housing secured to each lever unit, a lower clamp member carried by each clamp housing, a separate upper clamp member slidable in each clamp housing, said clamp members being formed to grasp the rope between them, a locking bar pivoted to one leg of each clamp housing, a bolt on the other leg of each housing, nuts threaded on said bolts for tightening and securing said locking bars, and means for operating said lever units to bend the rope against said abutment.

19. In combination with a rope cutter, a supporting abutment for a length of rope located in line with the cutting plane of said cutter, two movable clamps for grasping the rope on opposite sides of the line of cut, a spring, means for tensioning said spring and an operating connection between the spring and said clamps whereby the tension set up causes the clamps to be displaced transversely as the cutting operation progresses, thereby to bend the rope and cause the cut faces thereof to be pulled apart, and means for indicating the relative amount of tension set up in said spring.

20. In combination with a rope cutter, a sup-

porting abutment for a length of rope located in line with the cutting plane of said cutter, two movable clamps for grasping the rope on opposite sides of the line of cut, a cross head, an operating connection between said cross head and the clamps, a collared sleeve associated with said cross head, a spring confined between said collar and the cross head, means including a hand wheel for causing said spring to be compressed, an indicator disk and means for advancing said indicator disk one step for each rotation of said hand wheel.

21. In a device of the class described, and in combination, a supporting abutment for a length of rope to be cut, two movable clamps for grasping the rope on opposite sides of the prospective line of cut, a rotatable cutting wheel movable transversely of the rope in cutting engagement therewith, and means for moving said clamps transversely during the cutting operation, thereby to bend the rope against said abutment and cause the cut faces of the rope to be pulled apart.

22. In a device of the class described, and in combination, two movable clamps for grasping a length of rope on opposite sides of the line of cut, a supporting abutment for the rope located below the line of cut, and means for moving said clamps transversely during the cutting operation, thereby to bend the rope against said abutment and cause the cut faces of the rope to be pulled apart.

23. In a device of the class described, and in combination, two clamps for grasping a length of rope on opposite sides of the line of cut, a supporting abutment for the rope located below the line of cut, and means for moving at least one of said clamps transversely during the cutting operation, thereby to bend the rope against said abutment and cause a separation of the cut faces of the rope.

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