Aug. 30, 1966 C. I. STEINBACK 3,269,672

PAY-OFF REEL FOR WIRE AND THE LIKE

Filed Jan. 6, 1965 4 Sheets-Sheet 1

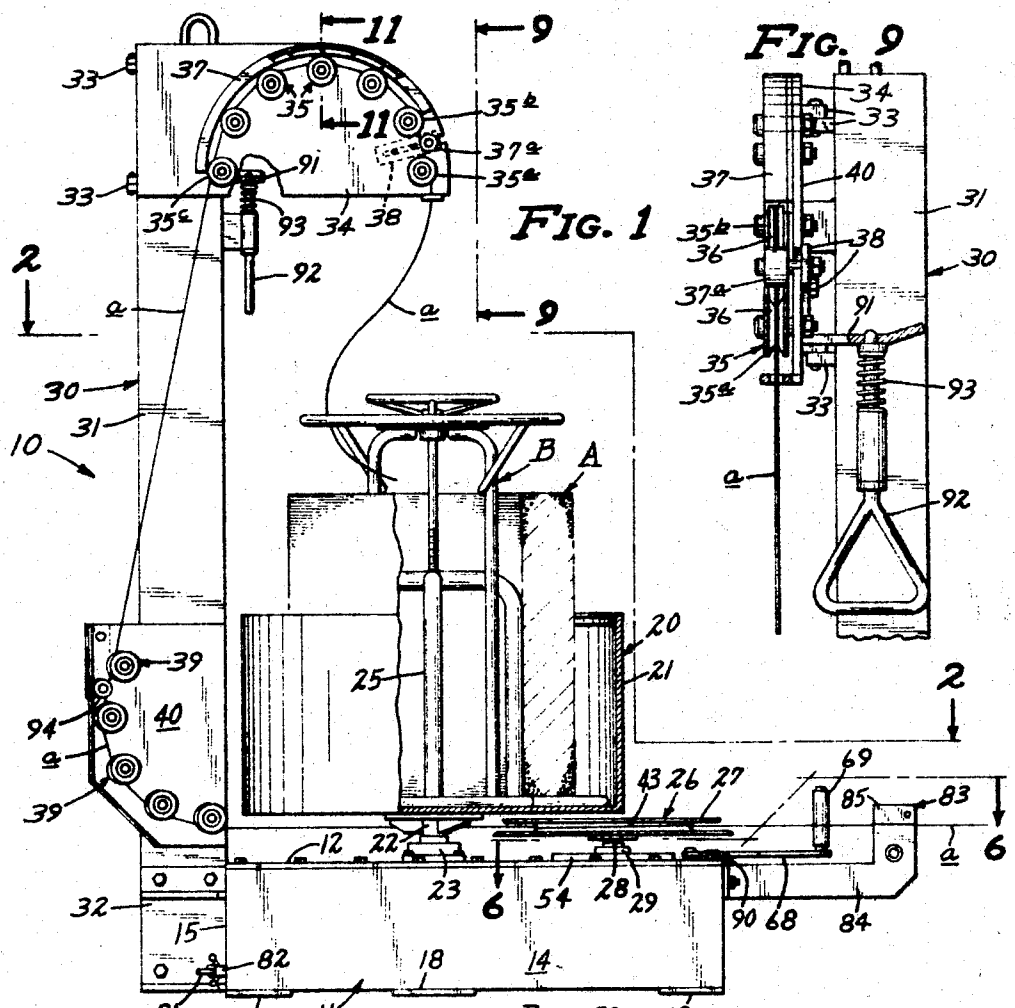
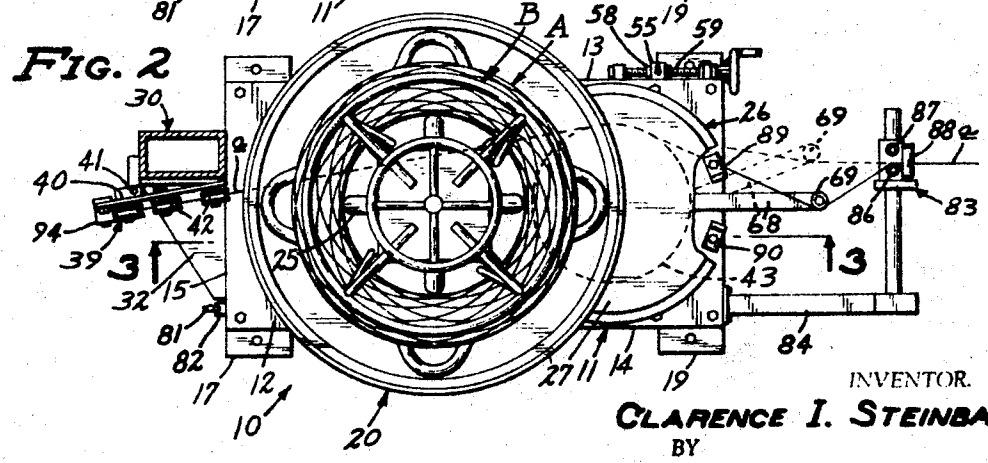


FIG. 1

FIG. 9

FIG. 2



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Filed Jan. 6, 1965 4 Sheets-Sheet 2

FIG. 3

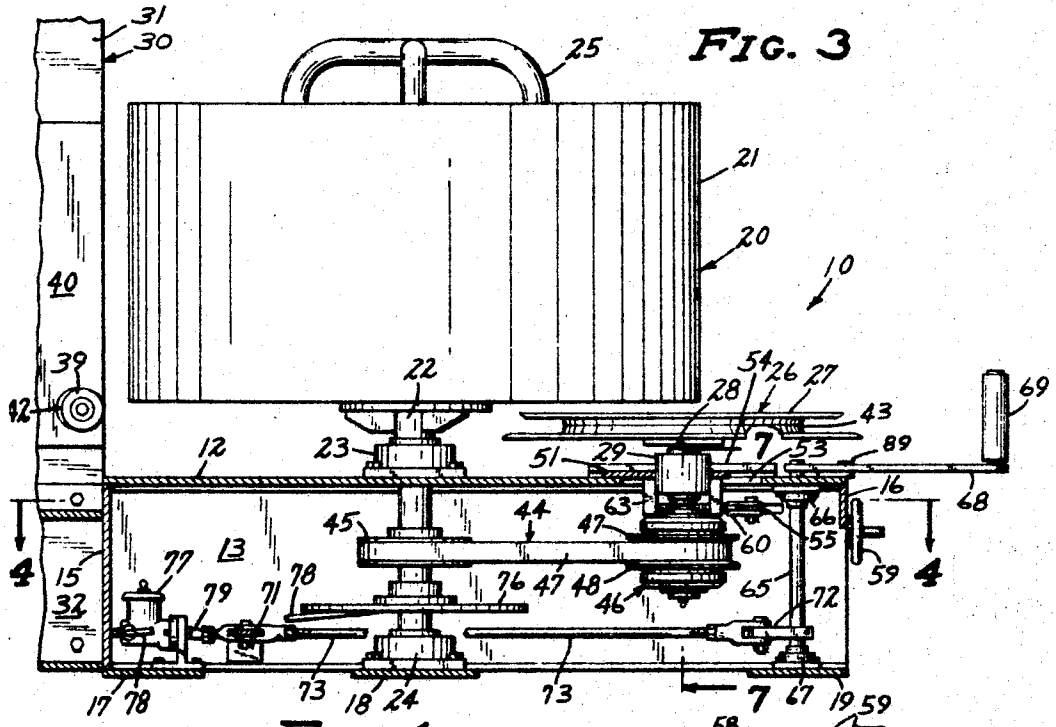
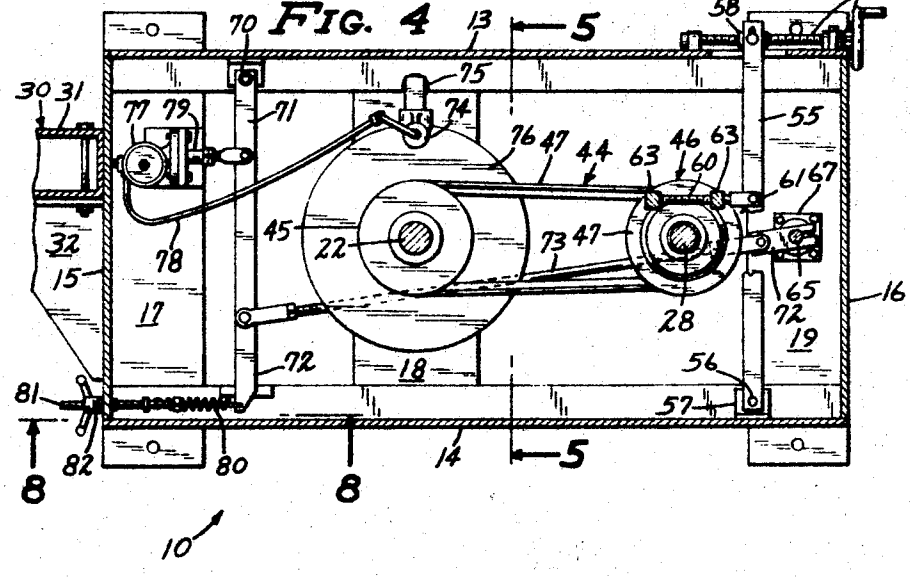


FIG. 4



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Filed Jan. 6, 1965 4 Sheets-Sheet 3

FIG. 5

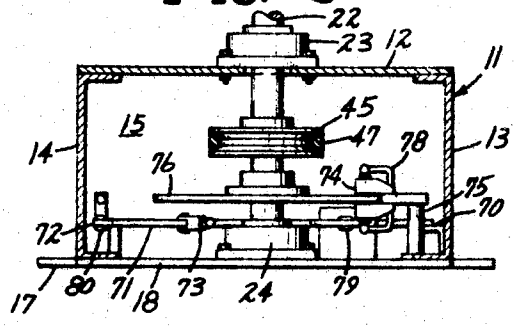


FIG. 7

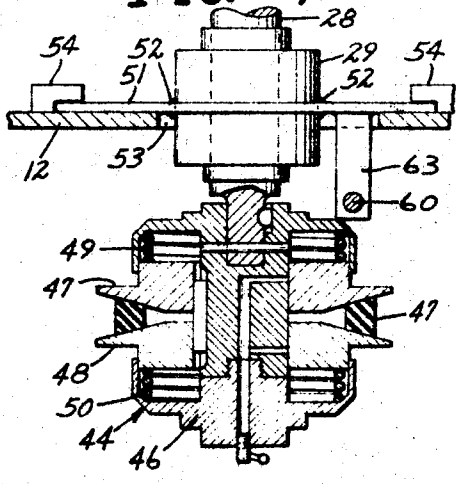


FIG. 6

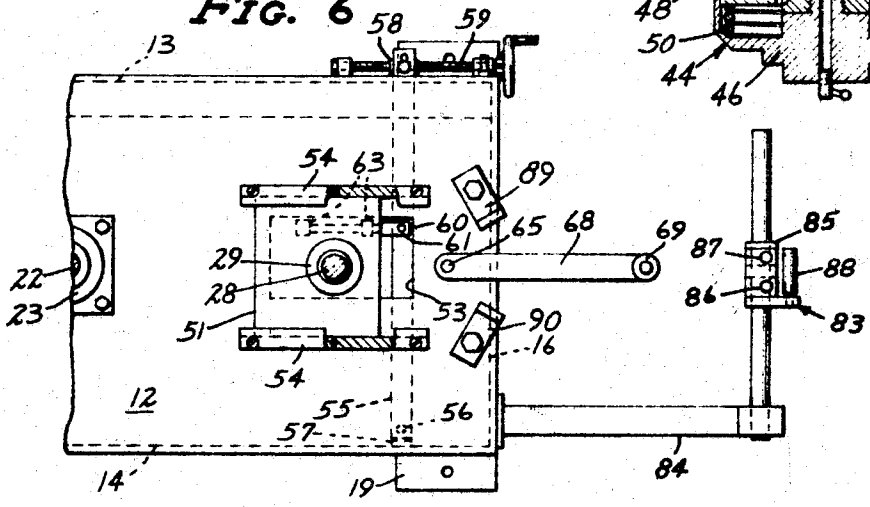
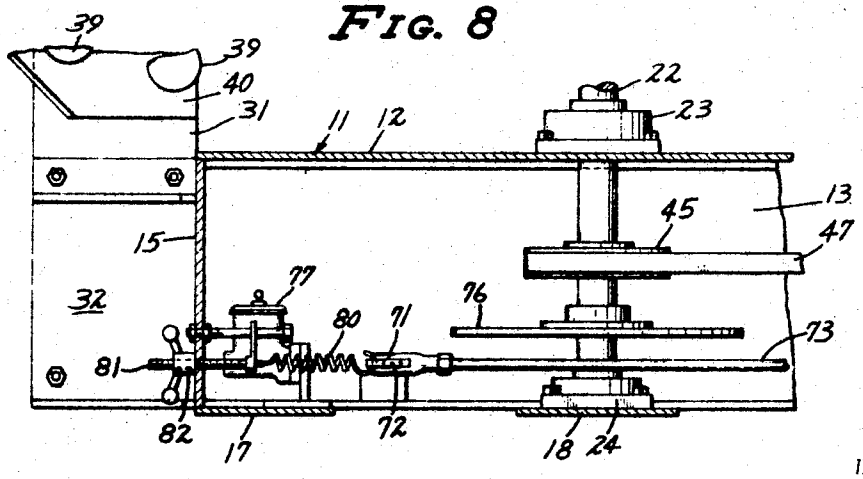


FIG. 8



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Aug. 30, 1966 C. I. STEINBACK 3,269,672

PAY-OFF REEL FOR WIRE AND THE LIKE

Filed Jan. 6, 1965 4 Sheets-Sheet 4

FIG. 10

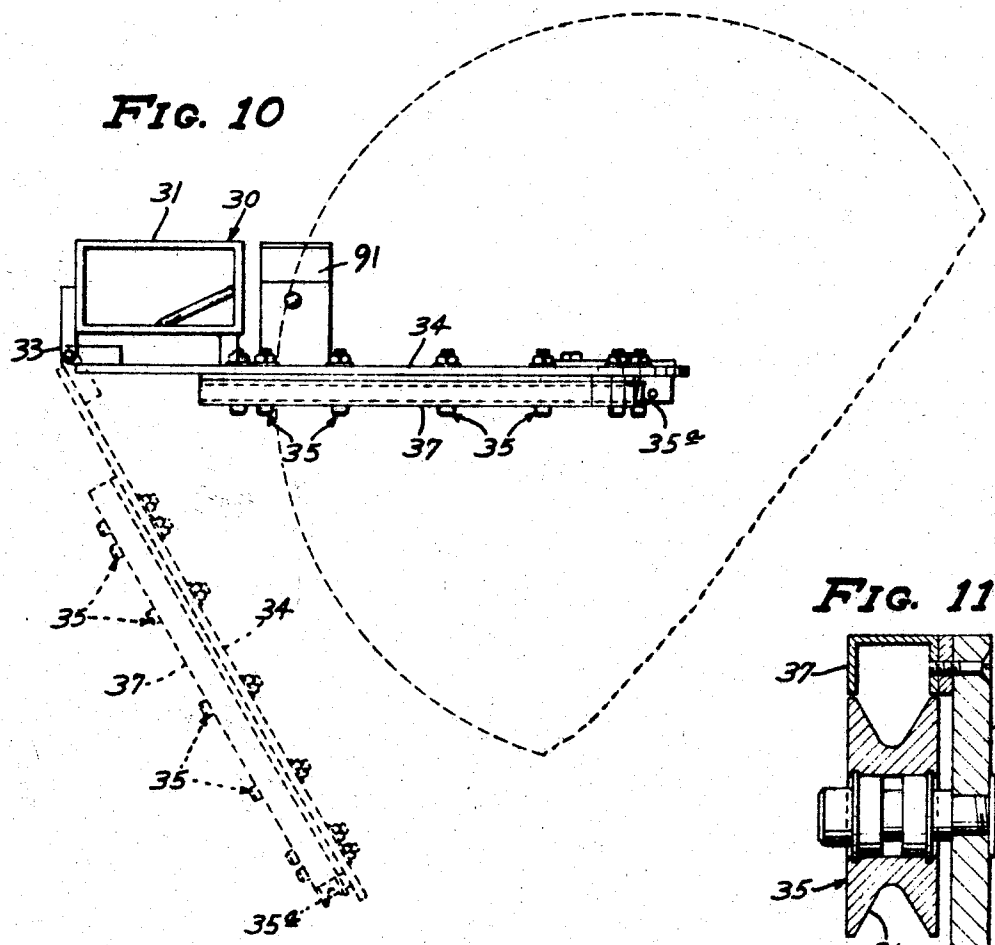


FIG. 11

FIG. 12

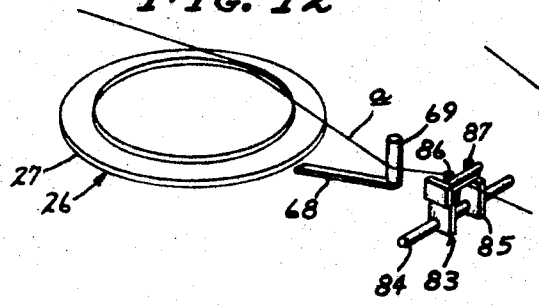
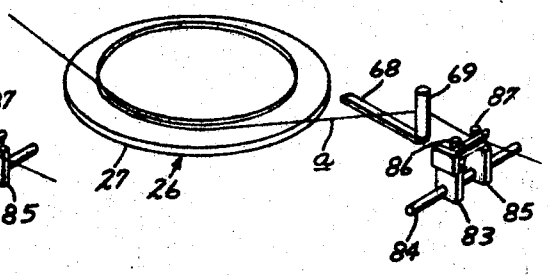


FIG. 12A



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United States Patent Office 3,269,672
Patented August 30, 1966

3,269,672

PAY-OFF REEL FOR WIRE AND THE LIKE

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Filed Jan. 6, 1965, Ser. No. 423,749
10 Claims. (Cl. 242—128)

My invention relates generally to wire handling machines, and more particularly to improvements in self-powered wire pay-off devices such as are commonly used by consumers in unwinding wire bundles.

Wire bundles under consideration comprise a plurality of coils which generally overlie each other in an off-center relationship with respect to the core upon which they are wound. Further, during winding of the bundle, the length of wire forming each coil is twisted to cause same to lie in a flat state. In pay-off machines heretofore produced, such bundles are placed within a rotatable basket having associated therewith suitable wire receiving and guiding means directing the wire to a capstan or drum directly connected to the basket to impart rotation thereto, the wire to be payed out being entrained on the capstan and leading therefrom to a power-operated wire pulling source.

In machines of the character above described, only bundles having coils equal in diameter to the diameter of the capstan **26** may be successfully unwound. Any deviation, either larger or smaller, of coil diameter with respect to capstan diameter, will result in contraction or expansion of the coil being removed therefrom. Contraction, of course, causes binding of the coil on the core or spool which carries the bundle and eventual breakage, while expansion results in entanglement of the coils within the basket. In either case, costly shutdown and repair occurs. Pay-off reels or devices heretofore produced have been woefully inadequate in preventing such occurrences and in adapting to bundles of wire having different diameter coils therein.

It is therefore a primary object of my invention to provide a device which includes means for varying the speed of rotation of the basket, on which the bundle of wire is supported, with respect to the rotary speed of the capstan which imparts rotation thereto whereby to pay off wire from bundles wherein the coils of one thereof vary in diameter with respect to the coils of other bundles.

It is a further object of my invention to provide a pay-off device for wire bundles which will pay out the wire from said bundles in direct proportion to the the needs of the wire pulling source, and without entanglement of the convolutions of coils due to over-riding movements of the bundle-supporting basket during termination of pay-off cycles.

It is still a further object of my invention to provide brake means whereby a minimum amount of slack is permitted betwen the capstan and said power-operated wire-pulling source during starting and stopping operations thereof, thus minimizing tension applied on said wire during initiation of pay-out cycles.

Another object of my invention is the provision of adjustable means for varying the tension required to release said brake means during initiation of pay-out cycles whereby to accommodate wire of various gauges.

A further object of my invention is the provision of a device wherein braking forces exerted by said brake means are in inverse proportion to the tension applied thereto by wire leaving said capstan, whereby maximum braking force is not exerted prior to termination of a wire-pulling cycle.

A further object of my invention is the provision of guide means for receiving wire from a basket, said guide means including a horizontally disposed arm pivotally

mounted for movement between an operative position overlying said basket and an inoperative position laterally offset from the vertically projected plane of said basket and means for releasably locking said arm in its operative position.

A further object of my invention is the provision of a wire pay-off device which will pay off wire from bundles which have either clockwise or counterclockwise coils wound thereon.

Another object of my invention is the provision of a device which is simple in construction, trouble-free in operation, and operable with but a minimum of skill.

A further and highly important object of my invention is the provision of a device wherein wire may be withdrawn from a bundle without damage thereto in spite of slight discrepancies in the diameters of the several convolutions thereof, and to this end, I initially withdraw the wire upwardly to overlying guide rollers in general alignment with the projected axis of the bundle.

The above and still further objects of my invention will become apparent from the following detailed specification, appended claims, and attached drawings.

Referring to the drawings wherein like reference characters indicate like parts throughout the several views:

FIG. 1 is a view in side elevation of a wire pay-off mechanism produced in accordance with this invention, portions thereof broken away and shown in section;

FIG. 2 is a view partially in horizontal section and partially in top plan as seen from the line **2—2** of FIG. 1, portions thereof broken away;

FIG. 3 is an enlarged view in vertical section as seen generally from the line **3—3** of FIG. 2, portions thereof broken away;

FIG. 4 is a view in horizontal section as seen from the line **4—4** of FIG. 3, portions thereof broken away;

FIG. 5 is a view in vertical section as seen from the line **5—5** of FIG. 4;

FIG. 6 is a view in horizontal section as seen from the line **6—6** of FIG. 1 on an enlarged scale;

FIG. 7 is a view in vertical section as seen from the line **7—7** of FIG. 3 on an enlarged scale;

FIG. 8 is an enlarged detail view in vertical section as seen from the line **8—8** of FIG. 4;

FIG. 9 is an enlarged view in elevation as seen from the line **9—9** of FIG. 1, portions thereof broken away and shown in section;

FIG. 10 is a fragmentary view in top plan of a portion of FIG. 1, portions thereof being broken away;

FIG. 11 is an enlarged view in vertical section as seen from the line **11—11** of FIG. 1; and

FIGS. 12, 12*a* are diagrammatic views in perspective illustrating the method of entraining wire on the capstan to pay off wire from wire bundles having either clockwise or counterclockwise coils wound therein.

Referring with greater particularity to the drawings, the numeral **10** indicates a wire pay-off device in its entirety. Pay-off device **10** includes a base **11** which is generally rectangular in shape and is formed with a top wall **12**, side walls **13**, **14**, rear wall **15**, partial front wall **16**, and cross brace members **17**, **18**, and **19** secured to the lower edge of the walls **13**, **14**, and **15**. Rotatably mounted on the base **11** is a basket **20** which includes a cup-like supporting platform **21** and a rotary shaft **22** depending therefrom. Rotary shaft **22**, as shown, is journalled for rotation on a vertical axis which intersects the longitudinal axis of base **11** in upper and lower bearings **23**, **24**. Bearings **23**, **24** are shown as being secured to the upper wall **12** and brace member **18** of base **11**, respectively. A coiled bundle of wire A wound about a spool B is adapted to be received within the cup-like platform **21** and supported thereon in axial align-

ment of the spool B therewith by means of a centering bracket 25 rigidly mounted in the platform 21.

Mounted on the base 11 radially of the basket 20 for rotation on a vertical axis which also intersects the longitudinal axis of the base 11 is a capstan 26. Capstan 26 includes a drum or pulley 27 overlying the top wall 12 and a depending shaft 28 which is journalled for rotation in a bearing 29 carried by the top wall 12 of base 11. Means for receiving wire *a* from the bundle A and guiding same to the drum or pulley 27 of the capstan 26 for passage therearound, for a reason which will hereinafter become apparent, is indicated generally by the numeral 30. Means 30 includes a vertically extending standard 31, the lower end of which is secured to the rear wall 15 of base 11, as indicated at 32. Pivotally secured to the upper end of standard 31 by means of the hinges 33 for pivotal movements about a vertical axis is a horizontally disposed arm 34. Arm 34 is provided with guide rollers 35, each of which is formed with a peripheral groove 36. A cross-sectionally U-shaped guide track 37 closely overlies the grooves 36 of all but the first of the guide rollers 35 and serves to guide one end of the wire *a* as it is being entrained or threaded through the grooves 36 of the rollers 35. Secured to the arm 34 intermediate the first and second guide rollers 35*a*, 35*b*, is a pressure roller 37*a* which serves to maintain wire *a* being received from bundle A within the grooves 36 of guide rollers 35*a*, 35*b*. As shown, roller 37*a* is mounted to the arm 34 for adjustments toward and away from the wire *a* within the grooves 36 of rollers 35*a*, 35*b*, as indicated at 38, thus providing for passage of different gauge wire *a* passing through the grooves 36 and also exerting different pressures required on the wire passing therethrough. As shown in FIG. 1, the rollers 35 are secured to the arm 34 in a semi-circular pattern with the last guide roller 35*c* guiding the wire *a* toward a plurality of guide rollers 39. Rollers 39 are likewise mounted in a semi-circular pattern on a vertically disposed mounting plate 40 which is pivotally carried as at 41 by the lower end portion of standard 31 for swinging movements about a vertical axis. Each of the guide rollers 39 is provided with a peripheral groove 42 with the groove of the lead or first roller 39*a* receiving wire *a* from the guide roller 35*c*, whereupon it is entrained over the other guide rollers 39 and is finally directed toward the groove 43 of the drum or pulley 27 of the capstan 26. Wire *a* received within the groove 43 of capstan 26 is looped thereabout and leads therefrom to a source of pulling power such as a wire handling machine (not shown). As wire *a* is consumed or pulled by the above mentioned wire handling machine, rotary movement is imparted thereby to the capstan 26.

Transmission means for imparting rotary movements to the basket 20, responsive to rotary movements of the capstan 26 as wire is being pulled therefrom, is indicated generally by the numeral 44. Transmission 44 includes a pulley 45 carried by the shaft 22 of basket 20, a second pulley 46 secured to the lower end of the shaft 28 of capstan 26 and a flexible V-belt 47 entrained over the pulleys 45, 46.

In machines of the character above described, only bundles having coils equal in diameter to the diameter of the capstan 26 may be unwound. Any deviation, either larger or smaller, of coil diameter with respect to capstan diameter, will result in contraction or expansion of the coil being removed therefrom. Contraction, of course, causes binding of the coil on the core or spool which carries the bundle and eventual breakage, while expansion results in entanglement of the coils within the basket. In either case, costly shutdown and repair occurs. Pay-off reels or devices heretofore produced have been woefully inadequate in preventing such occurrence and in adapting to bundles of wire having different coils therein.

Therefore, pulley 46 is in the nature of a variable diameter pulley having a pair of axially disposed pulley sections 47, 48, each thereof carried by shaft 28 for common rotation therewith and axial sliding movements thereon. Pulley sections 47, 48 are biased toward each other to provide a maximum pulley diameter by means of coiled compression springs 49, 50.

As shown particularly in FIGS. 4 and 6, capstan 26 is mounted on base 11 for movements toward and away from the basket 20. In the above arrangement bearing 29 is mounted on a plate-like support 51, as indicated at 52, with the lower end of the bearing 29 and shaft 28, journalled therein, projecting downwardly through an elongated aperture 53 formed in the top wall 12 of base 11. A pair of laterally spaced gibs 54 are secured to the top 12 of base 11 and serve to guide the plate 51 and parts associated therewith in their movements toward and away from the basket 20 longitudinally of the base 11. Means for imparting such movement include a lever 55 pivotally secured at one end in laterally and forwardly spaced relationship to capstan 26, as at 56, to a bracket 57 carried by the side wall 14 of base 11. Lever 55 extends through a slot formed in the wall 13 of base 11 and terminates in a nut 58 which has screw-threaded engagement with an adjustment screw 59 carried by the side wall 13, in such a manner as to impart movements to the lever 55 toward and away from the basket 20 in a horizontal plane. A link 60 pivotally connected at one end, as at 61, to the intermediate portion of the lever 55 has its other end secured to the plate 51 as at 63. Movement of the lever toward and away from the basket 20 by means of the adjustment screw 59 results in like movement to the capstan 26. When other bundles of wire having coils of a diameter different from that shown are placed in the basket 20, the relative speed of rotation of the basket with respect to the driving capstan must be changed to prevent either contraction or expansion of said coils. That is, if a bundle having coils with a larger diameter is placed thereon, the speed of rotation of basket 20 must be decreased with respect to the speed of rotation of capstan 26, thus a linear amount of wire equal to the circumference of the groove 43 of capstan pulley 27 will be removed during each revolution thereof. To accomplish this end one merely adjusts the variable pulley 46 by moving same away from the pulley 45 through the medium of the lever 55, link 60, and adjustment screw 59. Such adjustment causes pulley sections 47, 48 to move apart against the bias of springs 49, 50, thereby reducing the effective diameter of pulley 46 and resulting in a decrease in speed of rotation of basket 20 with respect to that of capstan 26. Alternately, if such coils are of a diameter smaller than that shown, the effective diameter of pulley 46 must be increased by adjustment in the reverse of that above described.

For the purpose of paying out wire *a* from the bundle A in direct proportion to the needs of the wire pulling source, without entanglement of the convolutions of coils due to overriding movements of the basket 20 during deceleration or termination of the pay-off cycle and to maintain a minimum amount of slack between the capstan 26 and wire-pulling source, I provide adjustable means for retarding rotation of basket 20. Such means includes a bellcrank lever 65 secured to the base 11 by means of the vertically spaced upper and lower bearings 66, 67, respectively, and with the vertical axis of bellcrank 65 intersecting the longitudinal axis of base 11. Secured to the laterally spaced outer end 68 of bellcrank lever 65 for rotation on a vertical axis parallel to the vertical axis of bellcrank 65 is a vertically disposed roller element 69. Disposed rearwardly of the shaft 22 of basket 20 and having one end pivotally secured to wall 13 of base 11, as at 70, is a second lever 71. Connecting the other end 72 of the bellcrank 65 to the intermediate portion of the lever 71 is a link 73. Braking mechanism for retarding rotation of basket 20 comprises a caliper-type hydraulic brake cylinder 74 secured to the cross brace 18 as indicated at 75 and operatively associated with a disc-like brake plate 76 fast on the shaft 22.

A master hydraulic cylinder **77** has connection with the caliper brake cylinder **74** through the medium of a fluid conduit **78** and is fixedly mounted to cross brace **17** of base **11** between lever **71** and rear walls **15** of base **11**. A short adjustable piston rod **79** operatively connects the piston (not shown) of master cylinder **77** to lever **71** in closely spaced relationship to the pivotal connection **70** thereof, whereby fluid pressure may be applied to cylinder **74** to cause braking action on disc **76**. Normally urging the lever **71** toward cylinder **77** to cause such braking action by cylinder **74** on disc **76** is a coiled tension spring **80**. One end of spring **80** is secured to the extended end of lever **71** and the other end is connected to an adjustment screw **81**. The outer end of screw **81** passes through wall **15** of base **11** and has screw-threaded engagement with a nut **82**.

It will be seen with particular reference to FIGS. 2 and 4 that wire *a* is entrained over roller **69** as it leaves capstan **22**. Under conditions where wire *a* is not being pulled from capstan **22**, roller element **69** is positioned with the axis thereof bisected by the projected plane of the longitudinal axis of base **11** under the bias of spring **80** and maximum braking force is applied by cylinder **74** to disc **76**. As a pulling cycle begins, enough tension is applied to roller element **69** to move same laterally about the axis of the bellcrank **65** against the bias of spring **80** thereby gradually releasing braking pressure of cylinder **74** on disc **76**. If for any reason there is an interruption in the operation of the wire handling machine supplying the pulling force, tension on roller element **69** is reduced and consequently roller element **69** will move toward a braking position, under the bias of spring **80**, wherein the axis thereof is disposed within the projected plane of the longitudinal axis of base **11**. Such movement causes a gradual braking force to be applied to disc **76** until the axis of roller element **69** is within the projected plane of base **11** whereupon maximum force is exerted. If it becomes necessary to vary the tension required to move the roller element **69**, such as when a bundle having different gauge wire is mounted on the basket **20**, it is but necessary to vary the tension of spring **80** by means of the adjustment nut **82**.

It will be noted from the above description that braking forces which are exerted are in inverse proportion to the tension applied to the roller element **69** by wire *a* leaving capstan **26**. Thus, maximum braking force is not exerted prior to termination of a wire pulling cycle.

To assure that sufficient tension is applied to the roller element **69** by wire *a* leaving capstan **26**, there is provided the guide element **83**. Guide element **83** is mounted by means of bracket **84** carried by base **11** for adjustments transversely to the path of travel of wire *a*. Guide element **83** includes a base **85** slidably mounted on bracket **84** and a pair of laterally spaced rollers **86, 87** mounted for rotation on vertical axes on the base **85**. A horizontally disposed roller **88** is also rotatably carried by the base **85** near the upper end of rollers **86, 87**, and serves to maintain wire *a* between rollers **86, 87**. As shown in FIG. 12 of the drawings, when wire *a* is wound clockwise on capstan **26** and from thence entrained over roller **69** and thereafter passed through rollers **86, 87** below roller **88**, the base **85** is moved to a position on bracket **84** wherein wire *a* is in engagement with roller **86**, and sufficient tension is applied to roller **69**, during pulling operations, to cause the arm of bellcrank **65** carrying roller **69** to come into engagement with stop member **89**, completely releasing braking cylinder **74** and permitting free rotation of basket **20**. As shown in FIG. 12*a* when wire *a* is wound counterclockwise on capstan **26**, base **85** is adjusted to a position wherein wire *a* engages roller **87** and assures sufficient tension being exerted on roller **69** to cause the arm carrying same to come into engagement with stop **90** and again in this case permitting free rotation of basket **20** during pulling operations.

To permit the insertion or removal of a bundle A from the basket **20**, it will be noted that horizontal arm **34**, pivotally secured to standard **31** by hinges **33**, is movable from an operative position overlying basket **20** to an inoperative position laterally of the vertically extended plane of basket **20**. To lock arm **34** in its operative position during wire pulling operations, there is provided a strike plate **91** which is carried by the plate **34** and is adapted to overlie a latch bar **92** carried by standard **31**. Latch bar **92** is biased into locking engagement with strike plate **91** by a coil compression spring **93** when arm **34** is in such operative position.

It will also be noted that mounting plate **40** is pivotally secured to standard **31** for movements to positions wherein wire *a* may be directed to either side of shaft **22** depending on whether such wire passes around capstan **26** either clockwise or counterclockwise. Further, plate **40** has mounted thereon a pressure roller **94** which, like roller **37***a*, maintains wire *a* in the grooves **42** of rollers **39** and together these pressure rollers **37***a*, **94** serve to maintain sufficient back pressure upon the wire *a* to maintain same in firm gripping contact with the capstan **26** at all times.

Finally, it should be pointed out that due to vibrations during transportation and the like, certain convolutions of a given bundle may increase or decrease slightly in diameter with respect to the other convolutions thereof. Normally, this fact would give rise to disorderly withdrawal. However, I avoid this possibility by placing the guide rollers vertically of the basket **20** and bundle A supported thereon so that the wire *a* is withdrawn generally axially upwardly therefrom.

My invention has been thoroughly tested and found to be completely satisfactory for the accomplishment of the above objects; and while I have disclosed a preferred embodiment thereof, same may well be capable of modification without departing from the scope and spirit of the appended claims.

What is claimed is:

1. In a pay-off reel for wire or the like,
- (a) a base,
- (b) a capstan rotatably mounted on said base,
- (c) a basket rotatably mounted on said base in radially spaced relation to said capstan and adapted to fixedly support a coiled bundle of wire substantially coaxial therewith,
- (d) means for receiving and guiding said wire generally axially from said basket and to said capstan for passage therearound,
- (e) independent transmission means connecting said basket to said capstan for rotation therewith responsive to lineal passage of said wire around said capstan,
- (f) means for varying the rate of rotation of said basket and bundle with respect to said capstan, and
- (g) adjustable means for retarding rotation of said basket and bundle and operative responsive to tension of wire being pulled from said bundle as same leaves said capstan.

2. The structure defined in claim **1** in which the means for varying the rotation of said basket with respect to said capstan comprises:
- (a) a pulley operatively secured to said basket,
- (b) a variable speed pulley operatively secured to said capstan,
- (c) a belt entrained over said pulleys, and
- (d) means for shifting the capstan and pulley associated therewith laterally with respect to the other of said pulleys to vary the operative diameter of said variable speed pulley.

3. The structure defined in claim **2** in which said variable speed pulley includes a pair of axially disposed pulley sections mounted for common rotation with said capstan and for axial movements one relative to the other thereof, one of said sections being yieldingly biased toward

the other of said sections, said last mentioned means comprising:

(a) a lever pivotally secured at one end to said base,

(b) linkage connecting the intermediate portion of said lever to said capstan,

(c) a screw threaded element on the other end portion of said lever, and

(d) a second screw threaded element carried by said base and having threaded engagement with said first mentioned element.

4. The structure defined in claim 1 in which said last mentioned means comprises:

(a) a bellcrank lever pivotally secured on a vertical axis intermediate its ends to said base,

(b) a vertically disposed roller element secured to one end of said bellcrank in radially outwardly spaced relation to said capstan and adapted to entrain thereover wire leaving said capstan,

(c) a second lever,

(d) means pivotally securing one end of said second lever to said base in laterally spaced relation to said bellcrank,

(e) linkage connecting the other end of said bellcrank to the intermediate portion of said second lever,

(f) braking mechanism associated with said basket,

(g) yielding means normally urging said braking mechanism toward braking engagement with respect to said basket,

(h) pressure applied to said roller element by wire entrained thereover being pulled from said capstan imparting movements to said levers about their respective axes to automatically release the braking action of said braking mechanism upon said basket against the bias of said yielding means.

5. The structure defined in claim 4 in further combination with means for varying the pressure required to be exerted by said wire upon said roller element to release said braking mechanism.

6. The structure defined in claim 5 in which said last mentioned means comprises an adjustment screw carried by the base in laterally spaced relation to the other end of said second lever and a spring interposed between said adjustment screw and said other end of said second lever.

7. The structure defined in claim 4 in further combination with a guide element for wire leaving said roller element, and means for adjustably moving said guide element generally transversely of the path of travel of wire leaving said roller element.

8. The structure defined in claim 1 in which said first mentioned means comprises:

(a) a standard extending upwardly from said base in radially offset relation to said basket,

(b) a horizontally disposed arm pivotally secured at one end to the upper end of said standard for swinging movements of its other end from an operative position overlying said basket to an inoperative position laterally offset from the vertically projected plane of said basket,

(c) a plurality of guide rollers mounted both on said arm and to the lower end of said standard and adapted to feed wire from a bundle supported by said basket to said capstan, and

(d) means for positively locking said arm in its said operative position.

9. The structure defined in claim 1 in which said first mentioned means comprises a plurality of guide rollers in vertically spaced relationship to said basket and adapted to receive wire from a bundle supported by said basket generally axially thereof.

10. The structure defined in claim 1 in further combination with means associated with said guide rollers for retarding the passage of wire over said guide rollers whereby to maintain said wire in snug contact not only with said guide rollers, but also with said capstan.

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FRANK J. COHEN, *Primary Examiner.*

LEONARD D. CHRISTIAN, *Examiner.*