United States Patent

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[54] **LET-OFF APPARATUS**
10 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **226/25,** 226/199; 242/78.6, 242/80
[51] **Int. Cl.** **B65h 23/00**
[50] **Field of Search** 226/11, 25, 196, 199, 200; 242/80, 78.6

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ABSTRACT: A funnel having a wire-admitting opening at the larger end thereof and a wire-discharging opening at the smaller end thereof is movable between a first position with the wire-admitting opening overlying a coil of wire on a first let-off stand and a second position with the wire-admitting opening overlying a coil of wire on a second let-off stand, said coils being successively connected. Funnel moving and holding means are provided for moving the funnel alternatively between the first and second positions and for temporarily holding the funnel in the respective first and second positions as wire is being pulled from successive coils on the first and second let-off stands. The wire is pulled through the funnel and over an elongated drum rotatably supported by the funnel adjacent to the wire-discharging opening. Snag control means are provided for stopping the wire as a snag in the wire reaches the drum.

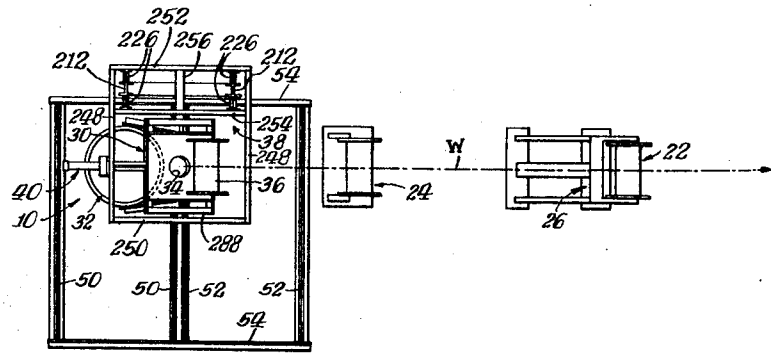


Fig. 1.

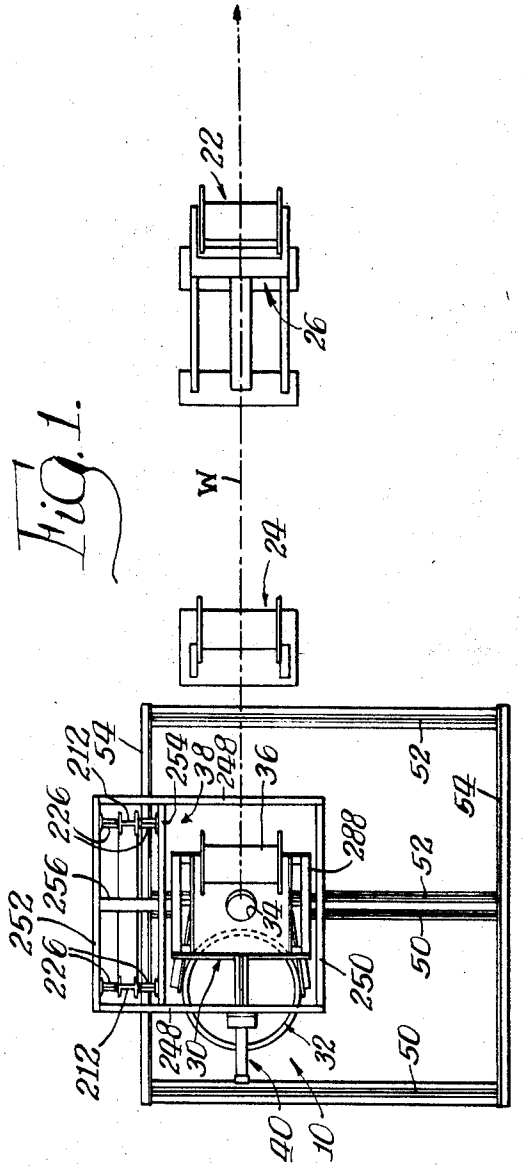
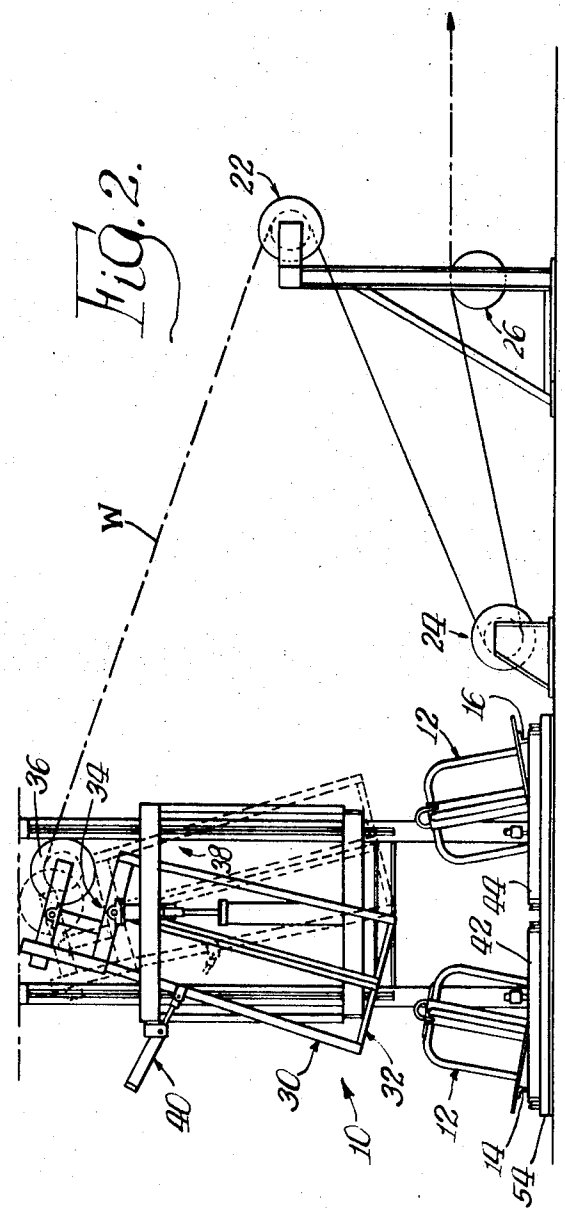


Fig. 2.



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Fig. 3.

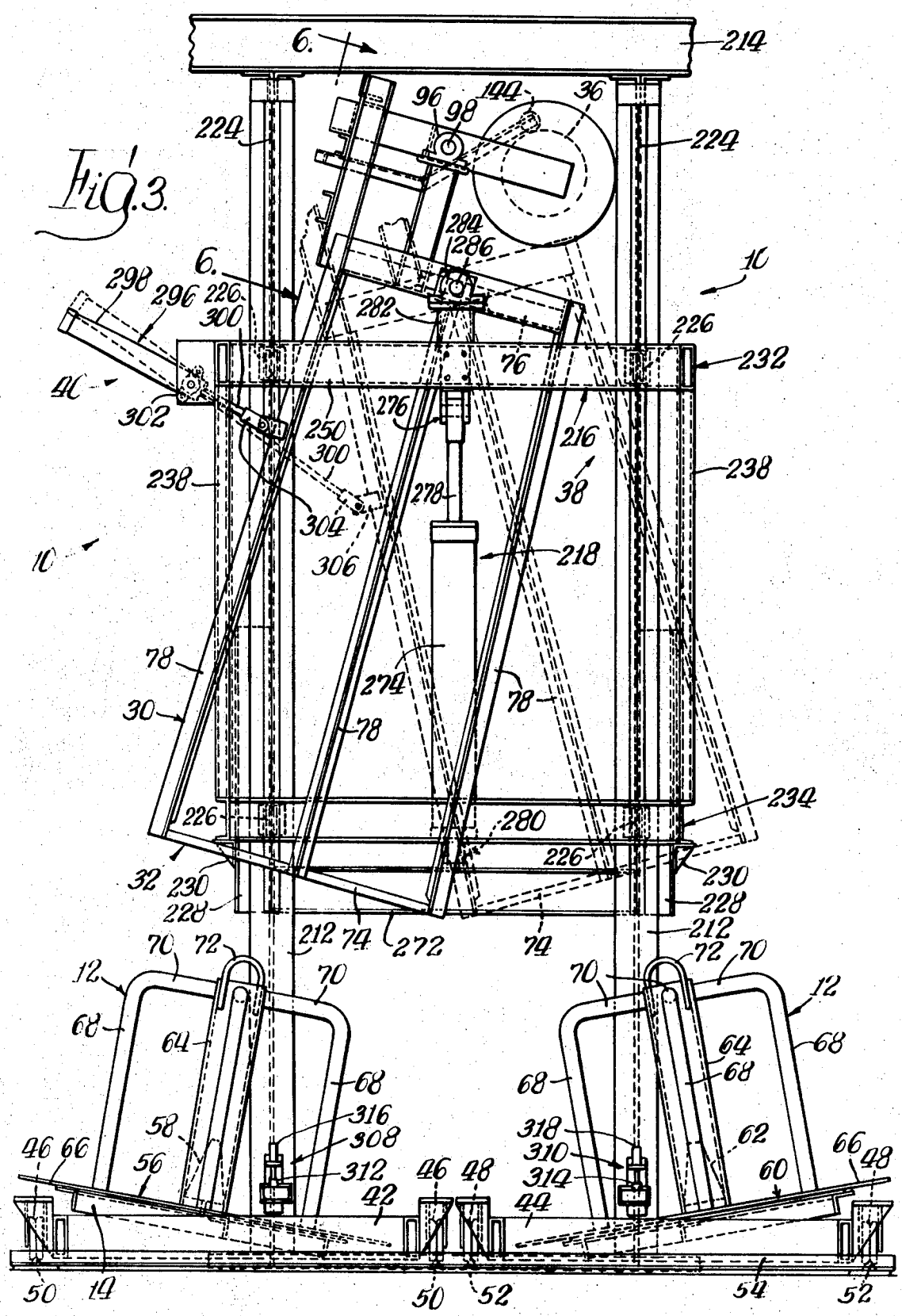

6.
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Fig. 5.

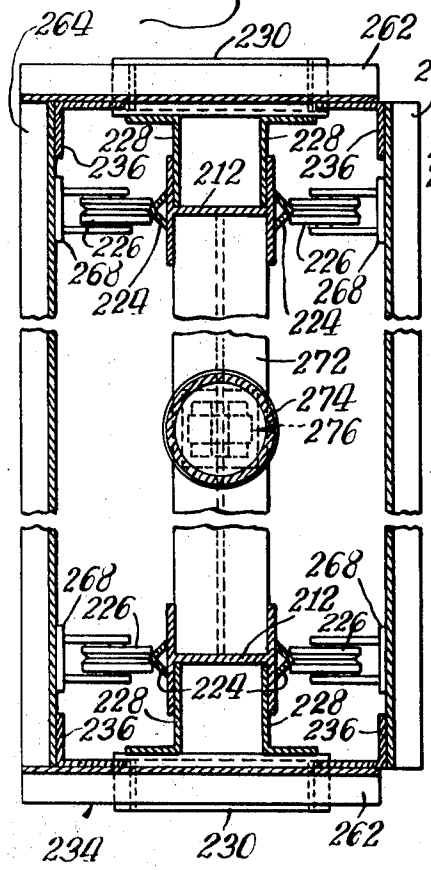

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Fig. 4.

148
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214
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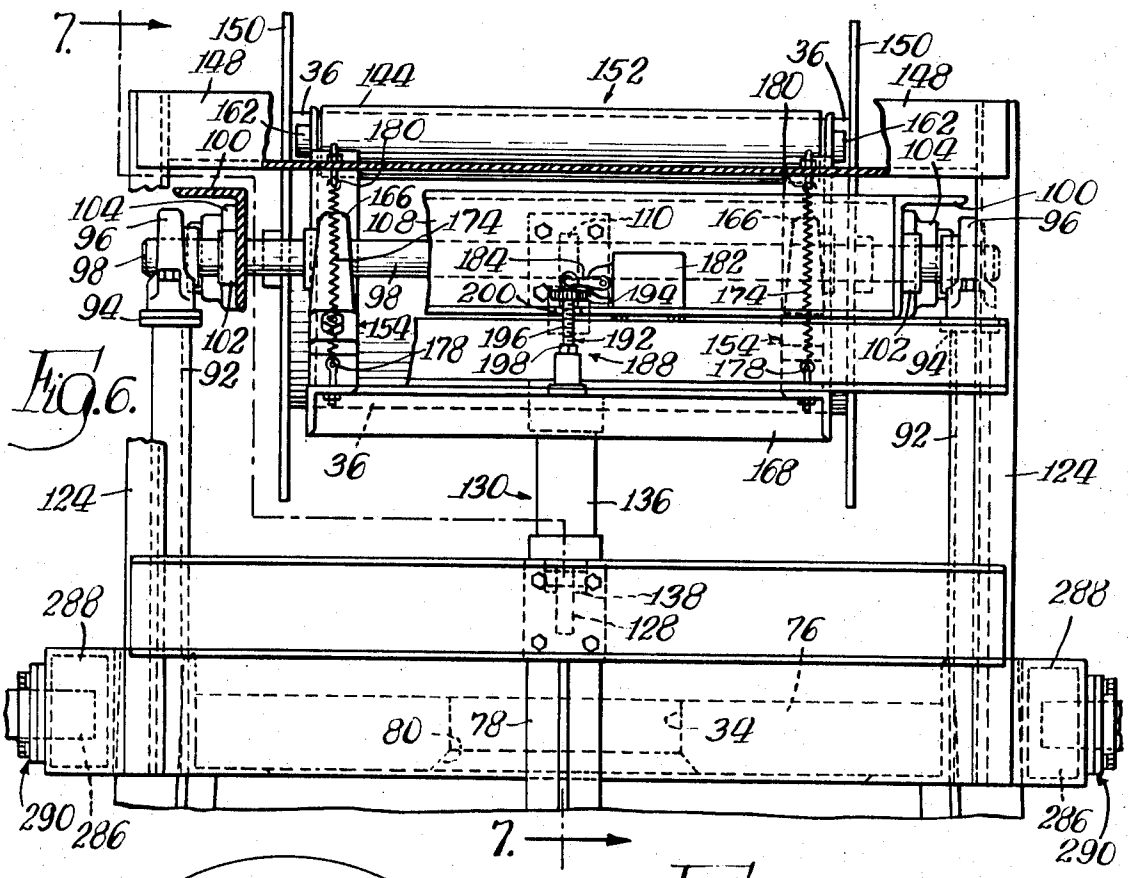

7.
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Fig. 6.

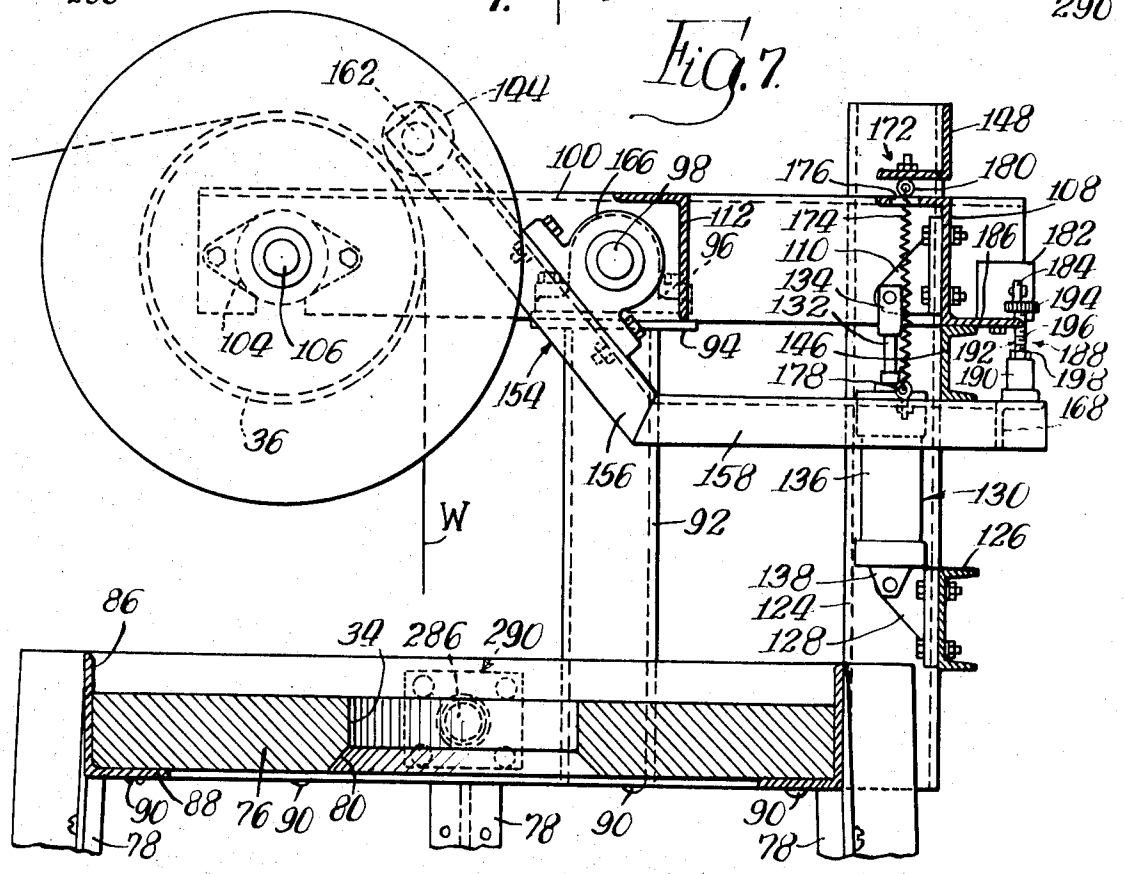

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188
198
168
106
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130
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W
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90
80
78

Fig. 7.

LET-OFF APPARATUS

BACKGROUND OF THE INVENTION

This invention pertains to let-off apparatus allowing wire to be pulled continuously from successively connected coils in such a manner as to prevent tangling and ballooning of the wire. Let-off apparatus embodying the principles of this invention is satisfactory for use with heavy gauge wire or wire rod of the order of one-eighth inch or more in diameter.

It is a common practice in industry to pull wire in an overhead direction from individual coils wound on stationary swifts. With this practice, the wire is pulled off the coils in loose turns, initially in a generally helical configuration. Usually, in order to substantially eliminate such turns, the wire is pulled over an overhead sheave. A certain amount of torsional strain is induced in the wire as the wire is pulled from the coils. Because of the torsional strain, the wire has a tendency to tangle and to balloon uncontrolledly in radially enlarging spirals, with the attendant additional disadvantage of exposing nearby personnel to injury and subjecting nearby equipment to damage.

In the past, let-off apparatus of various types have been used to control tangling and uncontrolled ballooning of wire which is being pulled in the aforesaid manner. With known let-off apparatus, the wire is pulled initially through an open ended, generally cylindrical or generally conical confining structure and then over an overhead sheave. The confining structure is provided for the purpose of confining the wire after it has been pulled from a supplying coil in loose turns, thereby reducing the tendency of the wire to tangle and preventing uncontrolled ballooning of the wire.

It is another common practice in industry to arrange a plurality of coils successively with the trailing ends of the respective coils connected to the leading ends of the next-succeeding coils. This arrangement permits wire to be drawn continuously from any number of coils. In some instances, the coils are arranged in rows on a work floor, and let-off apparatus is positioned over the individual coils in turn by means of an overhead traveling crane. In other instances, the successively connected coils are alternatingly arranged on first and second side-to-side let-off stands, and let-off apparatus is positioned overhead. In such instances, wire may be pulled continuously from a first coil on the first let-off stand and a second coil on a second let-off stand. Then, while wire is being pulled from the second coil after the first coil has been exhausted, a third coil may be moved into readiness in place of the first coil. These steps may be repeated with any number of additional, successively connected coils.

In the latter instances, known let-off apparatuses have been unsatisfactory for use with coils of heavy gauge wire or wire rod of the order of one-eighth inch or more in diameter, owning in part to the relative inflexibility of such materials and the magnitude of the torsional strains incurred by such materials. Known let-off apparatuses are unable to withstand the destructive action of heavy gauge wire or wire rod. There is a need for let-off apparatus which has utility with heavy-gauge wire or wire rod as aforenoted.

SUMMARY OF THE INVENTION

It is one object of this invention to provide let-off apparatus of a novel and useful type which may be employed advantageously with heavy-gauge wire or wire rod as aforenoted.

Let-off apparatus embodying the principles of this invention comprises an elongated funnel having at the larger end thereof a wire-admitting opening adapted to admit loose turns of wire pulled from the coils and at the smaller end thereof a wire-discharging opening adapted to substantially straighten wire pulled therethrough. An elongated drum is rotatably supported by the funnel outwardly of and proximate to the wire-discharging opening. The funnel confines the wire after it has been pulled from the supplying coil in loose turns, effectively reducing the tendency of the wire to tangle and preventing uncontrolled ballooning of the wire. Means may be provided for stopping the wire as a snag in the wire reaches the drum.

It is another object of this invention to provide let-off apparatus, of the foregoing type, in which the funnel has a rugged, open cagelike structure able to withstand the destructive action of heavy-gauge wire or wire rod.

It is another object of this invention to provide let-off apparatus, as described, in which the wire is pulled over an elongated drum.

It is a more particular object of this invention to provide let-off apparatus, as described, which allows wire to be pulled continuously from individual successively connected stationary coils arranged alternatingly on two side-to-side let-off stands.

Accordingly, the funnel is supported for movement between a first position with the wire-admitting opening overlying a coil on the first let-off stand and a second position with the wire-admitting opening overlying a coil on the second let-off stand. Means are provided for moving the funnel alternatively between the first and second positions and for temporarily holding the funnel in the respective first and second positions as wire is being pulled from successive coils on the respective first and second let-off stands.

It is a further object of this invention to provide let-off apparatus, as described, which is designed for semiautomatic operation with any number of successively connected coils.

Preferably hydraulic or pneumatic cylinder mechanism, of the type which has a cylinder and a retractable-extensible piston rod, is connected to the funnel so as to move the funnel to the first position during retraction of the rod and to move the funnel to the second position during extension of the rod. The hydraulic or pneumatic cylinder mechanism is actuated by first and second switch means. The first switch means effects extension of the rod as the trailing end of a coil on the first let-off stand is pulled from the first let-off stand. The second switch means effects retraction of the rod as the trailing end of a coil on the second let-off stand is pulled from the second let-off stand.

It is also preferred that an externally controlled jack be employed to adjust the elevation of the funnel with respect to the coils on the first and second let-off means.

These and other objects, features, and advantages of this invention should be evident from the following description with the aid of the attached drawings of the presently preferred embodiment of this invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of let-off apparatus embodying the principles of this invention, showing the let-off apparatus in use with auxiliary rollers in a typical wire pulling operation;

FIG. 2 is a front elevational view of the let-off apparatus and rollers;

FIG. 3 is a front elevational view of the let-off apparatus in isolation, showing the let-off apparatus on an enlarged scale;

FIG. 4 is a side elevational view taken from the right side of FIG. 3;

FIG. 5 is a sectional view, partly broken away, taken substantially along line 5–5 of FIG. 4 in the direction of the arrows;

FIG. 6 is a detail view, partly broken away and partly in section, taken substantially along line 6–6 of FIG. 3 in the direction of the arrows; and

FIG. 7 is a sectional view taken substantially along line 7–7 of FIG. 6 in the direction of the arrows.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The drawings illustrate let-off apparatus, indicated generally at 10, constituting the presently preferred embodiment of this invention. The let-off apparatus 10 is designed for use in confining heavy gauge wire or wire rod which is being pulled continuously from individual successively connected stationary coils (not shown). The coils are wound in conventional manner or similar swifts 12 and are arranged alternatingly on side-to-side first and second let-off stands 14 and 16 respectively.

The let-off stands **14** and **16** are designed to hold the swifts **12** in place to permit wire to be pulled from the coils in a generally overhead direction. FIGS. **1** and **2** show wire W being pulled through the let-off apparatus **10**, over a set of rotatably supported rollers **22**, **24**, and **26**, and therebeyond for treatment and use. Any suitable external pulling mechanism (not shown) may be used to pull the wire.

In FIGS. **1** and **2**, it may be seen that the let-off apparatus **10** generally comprises an elongated preferably somewhat conical funnel **30** having at the larger end thereof a wire-admitting opening **32** and at the smaller end thereof a wire-discharging opening **34**, an elongated roller or drum **36** rotatably supported by the funnel **30** outwardly of and approximate to the wire-discharging opening **34**, and funnel supporting structure **38** pivotally supporting the funnel **30** so as to permit pivotal movement of the funnel **30** between a first position with the wire-admitting opening **32** overlying a coil on the first let-off stand **14** and a second position with the wire-admitting opening **32** overlying a coil on the second let-off stand **16**. In FIGS. **2** and **3**, the funnel **30** is shown in the first position in full lines and in the second position in phantom lines. In addition, the let-off apparatus **10** generally comprises funnel moving and holding means **40** for moving the funnel **30** alternatingly between the first and second positions and temporarily holding the funnel **30** in the respective first and second positions as wire is being pulled from successive coils on the respective first and second let-off stands **14** and **16**.

The let-off stands **14** and **16** are supported on respective four-wheeled carriages **42** and **44** by means of which the respective let-off stands **14** and **16** are movable between a predetermined location generally beneath the funnel **30** and a removed location suitable for removal and replacement of the swifts **12**. The wheels **46** of the carriage **42** and the wheels **48** of the carriage **44** are grooved and spaced so as to ride upon respective pairs of parallel rails **50** and **52**. The pairs of rails **50** and **52** in turn are mounted in closely spaced parallel relation and are tied together with end members **54**. In FIG. **4**, the let-off stand **14** is shown generally beneath the funnel **30** in full lines and in the removed location in phantom lines. The first let-off stand **14** comprises a supporting table **56** and a conically tapered integral center post **58**. The second let-off stand **16** comprises a similar base **60** and a similar center post **62**. As shown, the respective let-off stands **14** and **16** are tilted to generally align the coils with the funnel **30**.

For cooperation with the center posts **58** and **62**, each swift **12** is formed with an axial tubular hub **64** to be positioned over the center post **58** or **62** which then centers the swift **12** on the let-off stand **14** or **16**. Each swift **12** also includes a base **66**, a plurality of rigidly connected longitudinal struts **68** extended perpendicularly from the base **66** and turned inwardly to the hub **64** to form a rigid upper framework **70**, and a U-shaped handle **72** upwardly extending from the hub **64**.

The funnel **30** has a rugged cagelike structure and comprises a lower ring **74** which defines the wire-admitting opening **32**, an upper solid plate **76** through which the wire-discharging opening **34** is formed, and a plurality of elongated lateral ribs **78**. The wire-admitting opening **32** through the ring **74** is large enough to admit loose turns of wire pulled from the coils. The lateral ribs **78** of the funnel **30** serve to confine the wire after it has been pulled from the coils in loose turns, thereby effectively reducing the tendency of the wire to tangle and preventing uncontrolled ballooning of the wire. The rugged cagelike structure of the funnel is not unduly cumbersome yet is effective with heavy-gauge wire or wire rod of the order of one-eighth inch or more in diameter. The wire discharging opening **34** is adapted to substantially straighten wire pulled therethrough. To this end, the opening **34** is considerably smaller than the loose turns of wire pulled from the coils yet is large enough to allow substantially straightened wire to pass freely therethrough. Furthermore, bottom edge **80** of the opening **34** is flared (FIGS. **6** and **7**) to facilitate passage of the wire across the edge of the opening **34**.

As may be best seen in FIGS. **6** and **7**, the aforementioned elongated drum **36** forms part of the structure carried at the upper end of the funnel **30**. The lateral ribs **78** are welded or otherwise rigidly attached to a generally square frame **86** which has a radially inwardly directed flange **88**. The aforementioned upper solid plate **76** fits upon the flange **88** and is secured to the flange **88** by means of a plurality of screws **90**.

A pair of similar upright posts **92** are welded or otherwise rigidly attached to opposite portions of the frame **86**. An integral flange **94** is provided at the upper end of each channel post **92**. A pillow block **96** is bolted to each flange **94**, and a pivot shaft **98** is journaled in the respective pillow blocks **96**.

Inwardly of the respective pillow blocks **96**, respective elongated beams **100** are supported by the pivot shaft **98** at respective intermediate sleeves **102** which are suitably secured to the respective beams **100** and fixed by set screws (not shown) to the pivot shaft **98**. A journal bearing **104** is suitably secured to one end of each beam **100**. The elongated drum **36** is rotatably supported on a central axle **106** which is journaled in the respective journal bearings **104**. The axle **106** is parallel to the pivot shaft **98**.

A Z-beam **108** is welded otherwise rigidly connected across the opposite ends of the respective beams **100**. A bracket **110** is bolted to the inside of the beam **108** at a middle portion of the beam **108**. A reinforcing beam **112** is welded or otherwise rigidly connected across the respective beams **100** at intermediate portions thereof.

A pair of similar upright posts **124** are welded or otherwise rigidly attached to opposite portions of the frame **86** opposite rigidly attached to opposite portions of the frame **86** opposite to the elongated drum **36** and outwardly of the respective beams **100**. A beam **126** is welded or otherwise rigidly connected across the lower portions of the respective beams **100** beneath the beam **108**. A bracket **128** is bolted to the inside of the beam **126** beneath the bracket **110**.

Externally adjustable hydraulic cylinder mechanism **130** is connected between the bracket **110** on the beam **108** and the bracket **128** on the beam **126**. The piston rod **132** of the hydraulic cylinder mechanism **130** carries a clevis **134** by means of which the piston rod **132** is pivotally connected to the bracket **110** for pivotal movement on an axis parallel to the pivot shaft **98**. The cylinder case **136** of the hydraulic cylinder mechanism **130** has mounted thereto an inverted U-shaped bracket **138** by means of which the cylinder case **136** is pivotally connected to the bracket **128** for pivotal movement on an axis similarly parallel to the pivot shaft **98**.

A sensing roller **144** is associated with the drum **36** in a manner to be described hereinafter. A beam **146** is welded or otherwise suitably connected across the posts **124** beneath the beams **100**. The beam **146** serves to limit the pivotal movement of the beams **100** in one direction. When the drum **36** is in an operating position with respect to the sensing roller **144**, the beams **100** rest against the beam **146**, as shown. A beam **148** is welded or otherwise suitably connected across the post **124** above the beams **100**. The beam **148** serves to limit the pivotal movement of the beams **100** in the other direction and thus to limit the amount by which the drum may move downwardly from the aforementioned operating position.

Under normal operating conditions, the wire passing over the drum **36** and beneath the sensing roller **144** produces a downward pull on the drum **36**. Minor fluctuations in such downward pull may occur under normal operating conditions. The hydraulic cylinder mechanism **130** is designed to react against the downward pull on the drum **36** with sufficient internal pressure to hold the drum **36** in the aforementioned operating position under normal operating conditions. The hydraulic cylinder mechanism **130** permits other than negligible extension of the piston rod **132**, and consequent downward movement of the drum **36**, only upon such marked increase in the downward pull on the drum **36** as would occur, for example, if plural turns of the wire were to become entangled with each other and to be pulled from the supplying coil, in which instance the added weight of the wire between the

drum 36 and the supplying coil would overcome the internal pressure of the hydraulic cylinder mechanism 130, or if the wire being pulled from the supplying coil were to become entangled with or caught on the remaining wire of the supplying coil or swift on which the supplying coil is wound, in which instance the wire between the drum 36 and the supplying coil would be drawn taut such that the downward pull on the drum 36 would be even more substantially increased. In the latter instance, there would be the added risk that the wire might snap or that the swift might begin to be lifted. However, upon such downward movement of the drum 36 in opposition to the hydraulic cylinder mechanism 130, the wire is stopped in a manner to be described hereinafter.

The hydraulic cylinder mechanism 130 is of a type well known in the art for the purposes set forth and further details thereof may be supplied readily by those skilled in the art.

Because of torsional strain, the wire may tend to snake back and forth over the surface of the drum 36. For this reason the elongated drum 36 is used instead of a narrow sheave. From FIGS. 6 and 7, it may be seen that the elongated drum 36 is provided with enlarged rims 150. The enlarged rims 150 effectively prevent the wire from snaking entirely off the drum 36. Any snag in the wire is sensed by the aforementioned sensing roller 144 which is biased against the surface of the drum 36. The sensing roller 144 forms part of snag control means 152 for stopping the wire as a snag in the wire reaches the drum 36. The snag control means 162 also serves to stop the wire upon downward movement of the drum 36.

In addition to the sensing roller 144, the snag control means 152 comprises a pair of generally L-shaped pivot arms 154. Each pivot arm 154 comprises a first angle beam 156 and a second angle beam 158 rigidly joined together end-to-end at an obtusely mitered joint 160. The first angle beam 156 of each pivot arm 154 carries a journal bearing 162 in which the sensing roller 144 is rotatably supported on a central axle (not shown). The pivot arms 154 are pivotally supported on the pivot shaft 98, by means of pivot bearings 166 which are bolted to the respective first angle beams 154, such that the sensing roller 144 may be pivoted between the rims 150 of the drum 36 and against the surface of the drum 36. An angle beam 168 is welded or otherwise rigidly connected across the pivot arms 154 at the extremities of the respective second angle beams 158.

The snag control means 152 further comprises means 172 biasing the sensing roller 144 toward the surface of the drum 36. The biasing means 172 comprises a pair of coiled springs 174 which are connected to the respective pivot arms 154 by means of eyelets 178 suitably fastened to the respective second angle beams 158. The springs 174 pass through suitable openings 176 in the beam 108 and are supported from the beam 148 by means of eyelets 180 suitably fastened to the beam 148. The aforementioned beam 148 serves to limit the pivotal movement of the pivot arms 154, thereby limiting the movement of the sensing roller 144 toward the drum 36.

The snag control means 152 further comprises an electrical switch 182 which is connected in a control circuit for whatever external pulling mechanism (not shown) is used to pull the wire. The switch 182 has an external two-position switch arm 184 and is arranged to allow the pulling of the wire when the arm 184 is in an "up" or "on" position and to stop the pulling of the wire when the arm 184 is in a "down" or "off" position. The arm 184 is biased toward the "down" or "off" position. The switch 182 is bolted to an outwardly extending flanged portion 186 of the beam 108. The switch 182 is actuated by relative movement of an actuator 188 which is fixedly supported on the beam 168 beneath the downwardly biased switch arm 184.

The actuator 188 comprises an internally threaded socket member 190 which is welded or otherwise rigidly connected to the beam 168, a thumb screw 192 having an enlarged head 194 and a threaded shank 196, and a nut 198. The threaded shank 196 of the thumb screw 192 passes freely through a cutaway opening 200 in the outwardly extending flanged portion 186 of the beam 108 and is threaded initially through the nut 198 and then into the socket member 190. The overall length of the actuator 188 is adjusted, by screwing the thumb screw 192 into and out of the socket member 190, such that the enlarged head 194 of the thumb screw 192 engages the switch arm 184 and holds the switch arm 184 in the "up" or "on" position while unsnagged wire is being pulled between the drum 36 and the sensing roller 144 and such that the downwardly biased switch arm 184 is restored to the "down" or "off" off position either when the drum 36 is pulled downwardly against the reaction of the hydraulic cylinder mechanism 130, as aforementioned, or when a snag in the wire reaches the drum 36 and lifts the sensing roller 144 away from the drum 36. The nut 198 is backthreaded against the socket member 190 to lock the thumb screw 192 in place with respect to the socket member 190.

The funnel supporting structure 38 of the let-off apparatus 10 is next to be described such structure 38 pivotally supporting the funnel 30 so as to permit pivotal movement of the funnel 30 between a first position with the wire-admitting opening 32 overlying a coil on the first let-off stand 14 and a second position with the wire-admitting opening 32 overlying a coil on the second let-off stand 16, as mentioned hereinbefore.

The funnel supporting structure 38 comprises a pair of fixed upright I-beam stanchions 212 suitably suspended from a suitably anchored transverse I-beam 214 and firmly anchored to the floor beneath, a framework 216 supported by the fixed stanchions 212 for translation of the framework 216 therealong, and a hydraulic jack 218 for adjusting the translated position of the framework 216 along the fixed stanchions 212. As the framework 216 is lowered and raised along the fixed stanchions 212, the funnel 30 is moved respectively closer to and farther from the let-off stands 14 and 16. This permits the let-off apparatus 10 to accommodate swifts of various heights. It is important that the wire-admitting opening 32 of the funnel 30 to be close to the top of the swift from which wire is being pulled. Otherwise, uncontrolled ballooning of the wire may occur in the unconfined space between the top of the swift and the wire-admitting opening 32.

An opposed pair of upright rails 224 are bolted to each stanchion 212, each stopping somewhat short of the bottom of the stanchions 212. The framework 216 is carried on eight grooved wheels 226 which are arranged in four inwardly directed pairs so as to ride upon the opposed pairs of rails 224. See FIG. 5.

A pair of angle members 228 are welded or otherwise rigidly connected to each stanchion 212 approximately at the lower ends of the rails 224. A suitably shaped web-reinforced stop member 230 is welded or otherwise suitably connected to each pair of angle members 228. The stop members 230 limit the downward movement of the framework 216 upon the rails 224.

As may be best seen in FIGS. 1 and 3—5, the framework 216 is welded or otherwise rigidly constructed assembly of an upper frame structure 232, a lower frame structure 234, four upright corner beams 236, and two bracing beams 238.

The upper frame structure 232 comprises a pair of elongated parallel side beams 248 spaced outwardly from the respective stanchions 212, an elongated front beam 250 interconnecting the front ends of the respective side beams 248, and an elongated back beam 252 interconnecting the back ends of the respective side beams 248. The front beam 250 is parallel to the back beam 252. The upper frame structure 232 further comprises an elongated intermediate beam 254, parallel to the back beam 252, interconnecting the side beams 248 intermediate the ends thereof, and a short cross beam 256 interconnecting the intermediate beam 254 and the back beam 252 intermediate the ends thereof. The intermediate beam 254 and the back beam 250 are disposed on opposite sides of the stanchions 212 with the cross beam 256 disposed between the stanchions 212. See FIGS. 1, 3 and 5.

The lower frame structure 234 comprises a pair of short side beams 262, an elongated front beam 264 interconnecting the

front ends of the respective side beams **262**, and an elongated back beam **266** interconnecting the back ends of the respective side beams **262**. See FIGS. **3**, **4** and **5**.

The upper frame structure **232** is rigidly connected to the lower frame structure by means of the four upright corner beams **236** and by the two bracing beams **238**. See FIGS. **3**, **4** and **5**.

The aforementioned wheels **226** are journaled to suitable wheel brackets **268**, which in turn are welded or otherwise rigidly attached to the framework **216**, four to the upper frame structure **232** and four to the lower frame structure **234**. See FIGS. **4** and **5**.

A cross beam **272** is welded or otherwise rigidly connected between the stanchions **212** approximately at the lower ends of the rails **224**. The cylinder case **274** of the aforementioned hydraulic jack **218** is connected to the cross beam **272** by means of suitable pinned brackets **276**. The piston rod **278** of the hydraulic jack **218** is connected to the aforementioned cross beam **256** of the upper frame structure **232** of the framework **216** by means of suitable pinned brackets **280**. The hydraulic jack **218** is designed to be externally controllable to lower and raise the framework **216** along the fixed stanchions **212**. Adjustable stop means (not shown) are provided to hold the framework **216** in place along the fixed stanchions **212**.

Details of conduits and controls suitable to effect the described operation of the hydraulic jack **218** are conventional and may be supplied readily by those skilled in the art.

A pair of upright posts **282** are welded or otherwise rigidly attached to the upper frame structure **232** of the framework **216**, one at the middle of the front beam **250** and the other at the middle of the intermediate beam **254**. A pillow block **284** is bolted or otherwise suitably attached to each post **282**. The funnel **30** is pivotally supported from the pillow blocks **284** by means of a pair of pivot shafts **286** journaled respectively in the pillow blocks **284**.

As may be best seen in FIGS. **1**, **4**, **6** and **7**, the pivot shafts **286** outwardly extend from respective suitable supporting structures **288** which in turn are welded or otherwise rigidly attached to respective opposite portions of the aforementioned generally square frame **86** at the upper end of the funnel **30**. The pivot shafts **286** are fixedly held in suitable facings **290** which are bolted to the supporting structures **288**.

Next to be described is the aforementioned means **40** for moving the funnel **30** alternatingly between the first and second positions and for temporarily holding the funnel **30** in the respective first and second positions as wire is being pulled from successive coils on the respective first and second let-off stands **14** and **16**.

Such funnel moving and holding means **40** preferably comprises pneumatic cylinder mechanism **296**. Alternatively, hydraulic cylinder mechanism may be used. The cylinder case **298** of the pneumatic mechanism **296** is pivotally connected to the framework **216**, and the piston rod **300** of the pneumatic cylinder mechanism **296** is pivotally connected to the funnel **30**. The cylinder case **298** is pivotally suspended in a suitable manner between the legs of a U-shaped bracket **302** which in turn is welded or otherwise rigidly connected to one of the side beams **248** of the upper frame structure **232** of the framework **216** in a position permitting the piston rod **300** to be pivotally connected to one of the lateral ribs **78** of the funnel **30**. The piston rod **300** carries a clevis **304** having a pinned connection to a bracket **306** which is welded or otherwise rigidly attached to the same lateral rib **78**.

Retraction of the piston rod **300** causes the funnel **30** to assume the first position whereas extension of the piston rod **300** causes the funnel **30** to assume the second position. See FIG. **3**.

The funnel moving and holding means **40** further comprises first switch means **308** for effecting extension of the piston rod **30** as the trailing end of a coil on the first let-off stand **14** is pulled from the first let-off stand **14** and second switch means **310** for effecting retraction of the piston rod **300** as the trailing end of a coil on the second let-off stand **16** is pulled from the second let-off stand **16**.

Any suitable electromechanical wire-detecting switches may be used for the respective first and second switch means **308** and **310**. Details of suitable switches are conventional and may be supplied readily by those skilled in the art.

In the present example, use is made of conventional plunger-type switches **312** and **314** respectively. These switches **312** and **314** have respective mechanical actuators **316** and **318** of a type commonly used in wire handling apparatus and are arranged to be reset when slack wire is laid over the respective actuators **316** and **318** and to be tripped when such slack wire is pulled off the respective actuators **316** and **318**. The first switch **312** is located on the stanchion **212** which is nearer to the first let-off stand **14**, and the second switch **314** is located on the stanchion **212** which is nearer to the second let-off stand **16**.

In use, the first switch **312** is reset when slack wire taken from the trailing end of a coil on the first let-off stand **14** to the leading end of a coil on the second let-off stand **16** is laid over the actuator **316** and tripped when the last turn of the coil on the first let-off stand **14** is pulled from the first let-off stand **14** causing such slack wire to be pulled from the actuator **316**. The first switch **312** is arranged to control the aforementioned pneumatic cylinder mechanism **296** such that when the first switch **312** is tripped the piston rod **300** is extended and the funnel **30** is pivoted from the first position to the second position.

In use, the second switch **314** is reset when slack wire taken from the trailing end of a coil on the second let-off stand **14** to the leading end of a coil on the first let-off stand **16** is laid over the actuator **318** and tripped when the last turn of the coil on the second let-off stand **16** is pulled from the second let-off stand **16** causing such slack wire to be pulled from the actuator **318**. The second switch **314** is arranged to control the aforementioned pneumatic cylinder mechanism **296** such that when the second switch **314** is tripped the piston rod **300** is retracted and the funnel **30** is pivoted from the second position to the first position.

Details of conduits and controls suitable to effect the described operation of the pneumatic cylinder mechanism **296** and the first and second switches **312** and **314** are conventional and may be supplied readily by those skilled in the art.

Accordingly, the let-off apparatus **10** is capable of semiautomatic operation whereby wire may be pulled continuously from any number of coils. While wire is being pulled from a first coil on the first let-off stand **14** with the funnel **30** in the first position, a second coil may be moved into readiness on the second let-off stand, the trailing end of the first coil being connected to the leading end of the second coil and the intermediate slack wire being laid over the actuator **316** of the first switch **312**. Thereafter, as the last turn of the first coil is pulled from the first let-off stand **14**, the first switch **312** is tripped and as a result the funnel **30** is pivoted from the first position to the second position. Thus, wire is pulled continuously from the first and second coils. Then, while wire is being pulled from the second coil on the second let-off stand **16** with the funnel **30** in the second position, a third coil may be moved into readiness on the first let-off stand **14**, the trailing end of the second coil being connected to the leading end of the third coil and the intermediate slack wire being laid over the actuator **318** of the second switch **314**. Thereafter, as the last turn of the second coil is pulled from the second let-off stand **14**, the second switch **314** is tripped and as a result the funnel **30** is pivoted from the second position to the first position. Thus, wire is pulled continuously from the second and third coils. These steps may be repeated with a fourth coil on the second let-off stand **16** as well as with any number of additional successively connected coils.

It should be understood that the let-off apparatus **10** has been described solely by way of example and that numerous changes within the scope of this invention may be suggested by the present disclosure to those skilled in the art. For example, where hydraulic means are shown, equivalent pneumatic means may be used, and vice versa. Accordingly, the scope of this invention should be determined from the following claims.

I claim:

1. Let-off apparatus for confining wire which is being pulled continuously from individual successively connected stationary coils arranged alternatingly on side-to-side first and second let-off stands said let-off apparatus comprising an elongated funnel having at the larger end thereof a wire-admitting opening adapted to admit loose turns of wire pulled from the coils and at the smaller end thereof a wire-discharging opening; an elongated drum rotatably supported by said funnel outwardly of and proximate to said wire-discharging opening, funnel supporting structure supporting said funnel so as to permit movement of said funnel between a first position with said wire-admitting opening overlying a coil on said first let-off stand and a second position with said wire-admitting opening overlying a coil on said second let-off stand, and funnel moving and holding means for moving said funnel alternatingly between said first and second positions and temporarily holding said funnel in said respective first and second positions as wire is being pulled from successive coils on said respective first and second let-off stands through said funnel and over said drum.

2. The let-off apparatus of claim 1, in which said funnel supporting structure pivotally supports said funnel adjacent said wire-discharging opening so as to permit pivotal movement of said funnel between said first and second positions.

3. The let-off apparatus of claim 2, in which said funnel moving and holding means comprises cylinder mechanism having a cylinder case pivotally supported by said funnel-supporting structure and having a retractable-extensible rod pivotally connected to said funnel, said mechanism being adapted to move said funnel to said first position during retraction of said rod and to move said funnel to said second position during extension of said rod.

4. The let-off mechanism of claim 3, in which said funnel moving and holding means further comprises first switch means for effecting extension of said rod as the trailing end of a coil on said first let-off stand is pulled from said first let-off stand and second switch means for effecting retraction of said rod as the trailing end of a coil on said second stand is pulled from said second let-off stand.

5. The let-off apparatus of claim 2, in which said funnel supporting structure comprises a framework pivotally supporting said funnel, fixed stanchion means supporting said framework for translation of said framework along said stanchion means and corresponding movement of said funnel closer to and farther from said first and second let-off stands, and adjusting means for adjusting the translated position of said framework along said stanchion means.

6. The let-off apparatus of claim 5, in which said adjusting means comprises a jack fixedly supported with respect to said stanchion means an operatively connected to said framework.

7. The let-off apparatus of claim 5, in which said funnel moving and holding means comprises cylinder mechanism having a cylinder case pivotally supported by said framework and having a retractable-extensible rod pivotally connected to said funnel, said mechanism being adapted to move said funnel to said first position during retraction of said rod and to move said funnel to said second position during extension of said rod.

8. The let-off mechanism of claim 7, in which said funnel moving and holding means further comprises first switch means for effecting extension of said rod as the last turn of a coil on said first let-off stand is pulled from said first let-off stand and second switch means for effecting retraction of said rod as the last turn of a coil on said second let-off stand is pulled from said second let-off stand.

9. The let-off apparatus of claim 1, further comprising snag control means for stopping the wire as a snag in the wire reaches said drum.

10. The let-off apparatus of claim 1, wherein said snag control is arranged to stop the wire upon a marked increase in the downward pull of the wire on said drum over the downward pull of the wire on said drum under normal operating conditions.