

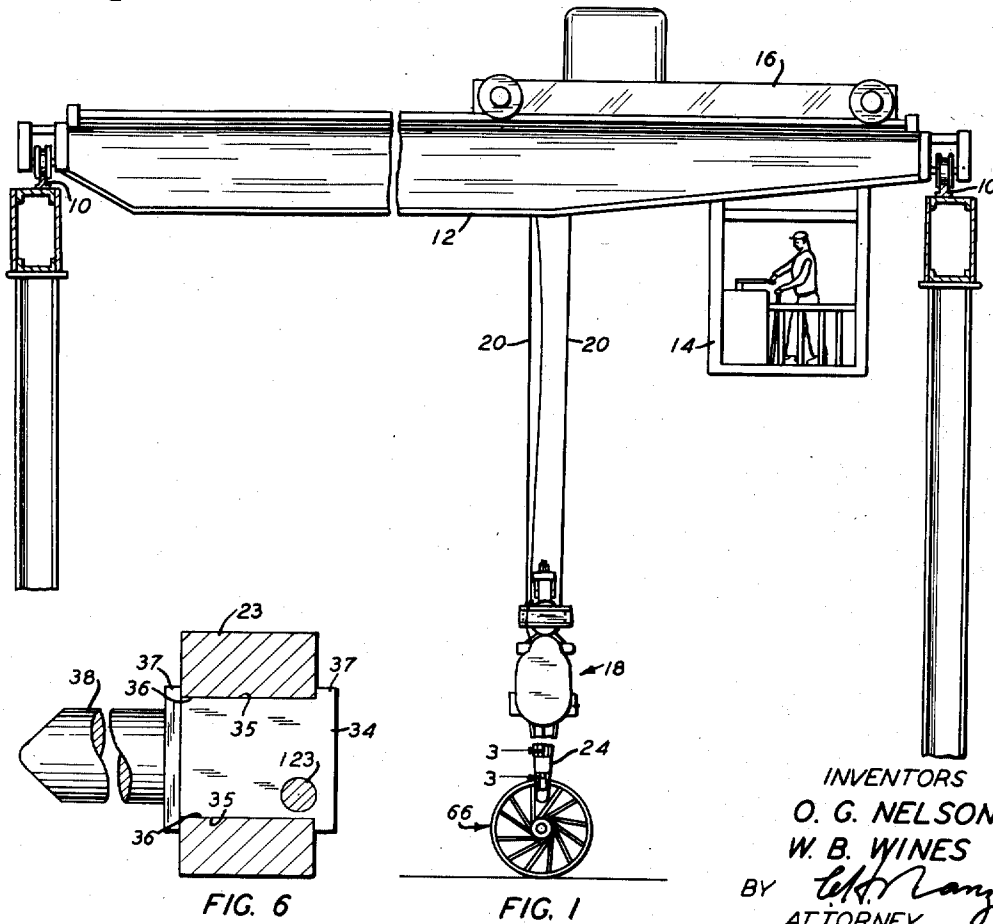
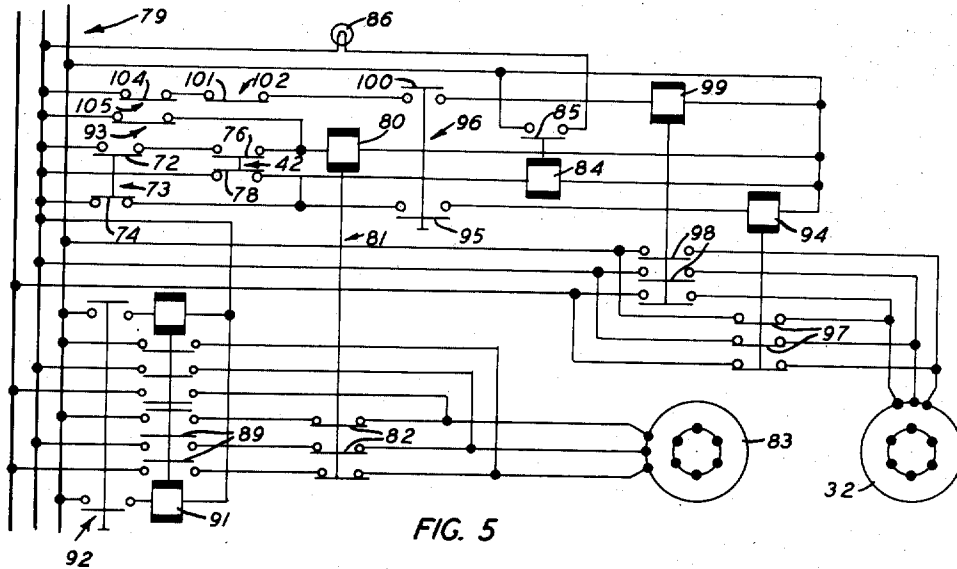
Sept. 20, 1955

O. G. NELSON ET AL
ARTICLE-HANDLING APPARATUS

2,718,320

Filed June 22, 1950

4 Sheets-Sheet 1



INVENTORS
O. G. NELSON
W. B. WINES
BY *Edw. J. Lang*
ATTORNEY

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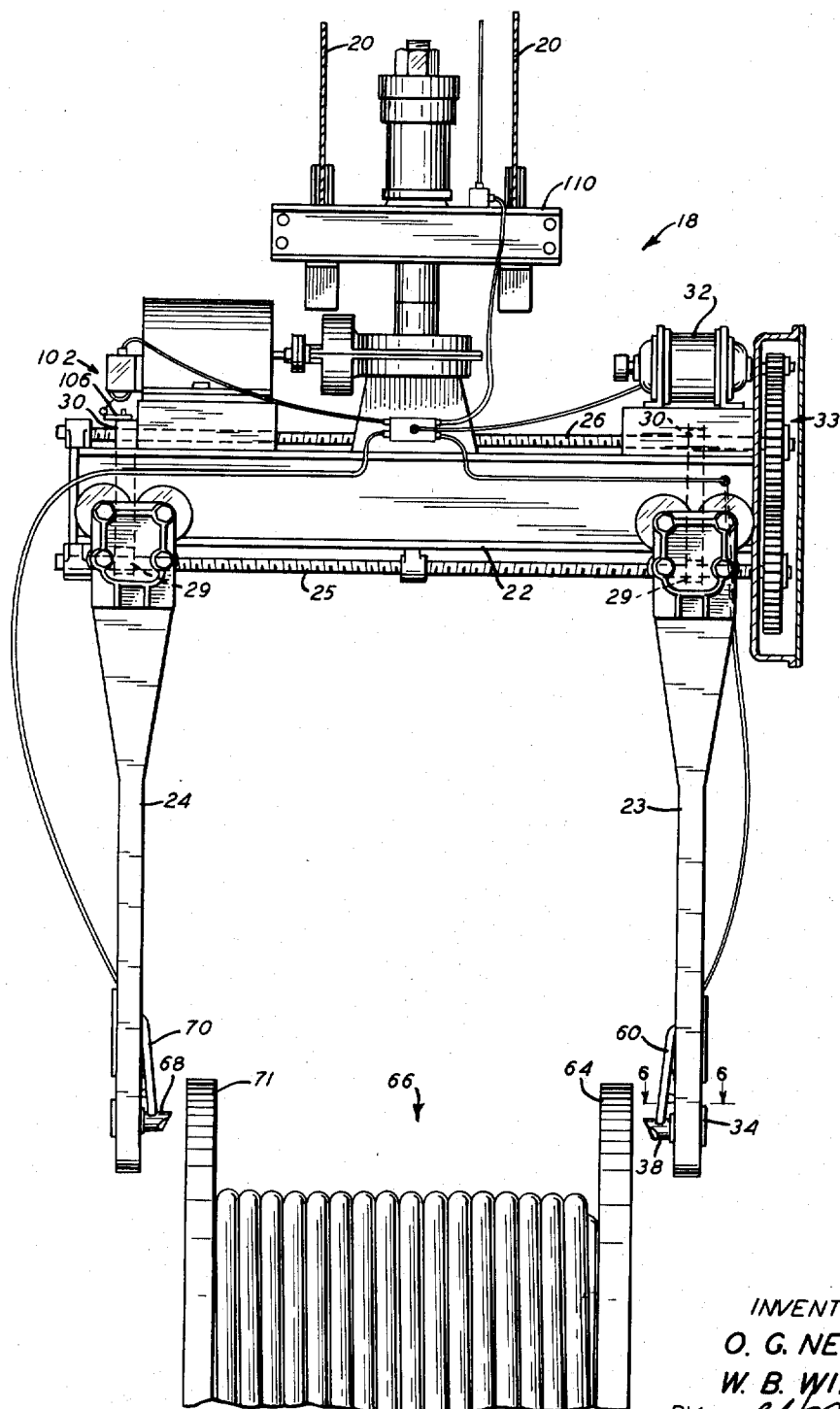


FIG. 2

INVENTORS
O. G. NELSON
W. B. WINES
BY *W. B. Wines*
ATTORNEY

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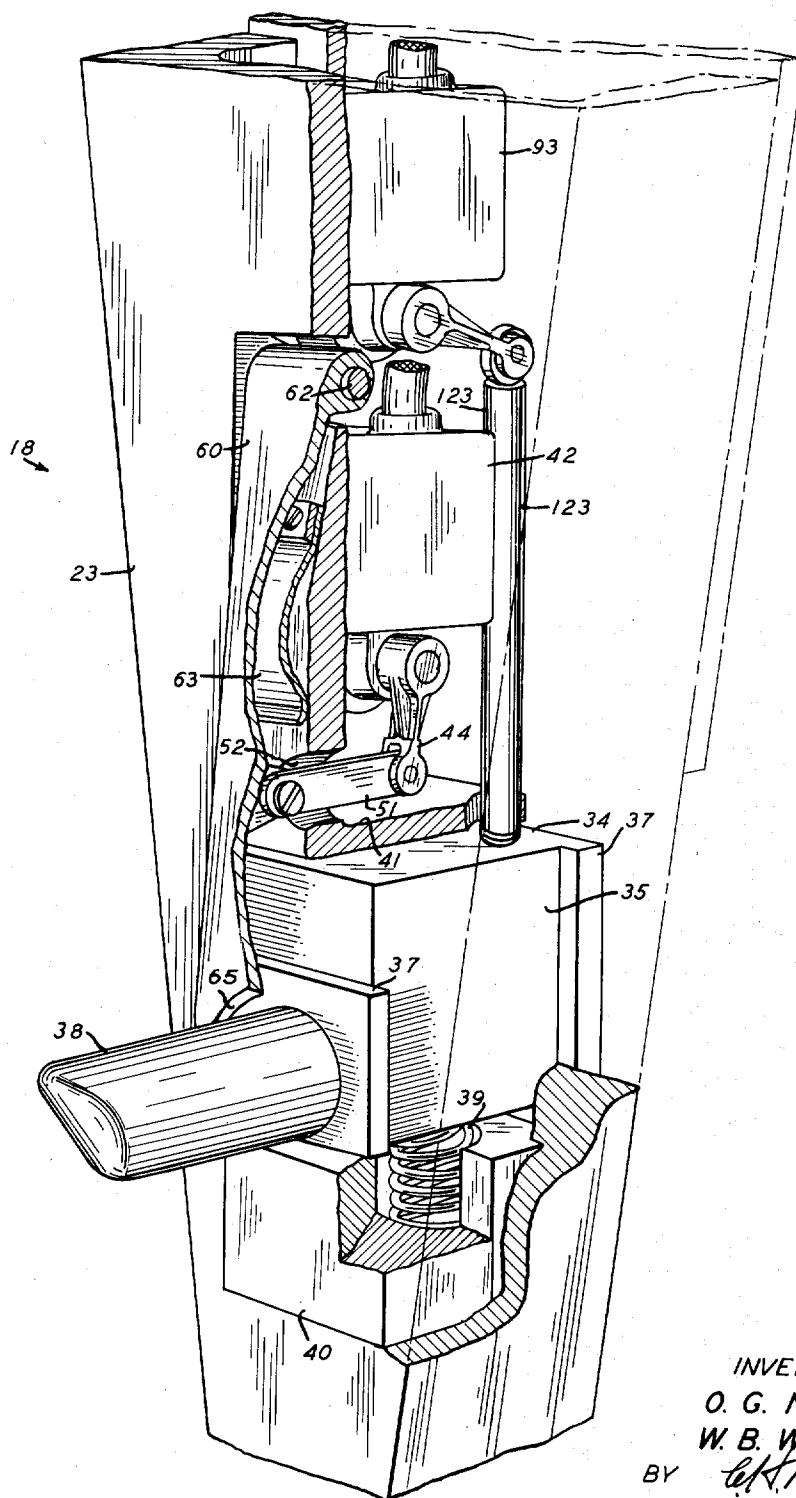


FIG. 3

INVENTORS
O. G. NELSON
W. B. WINES
BY *W. B. Wines*
ATTORNEY

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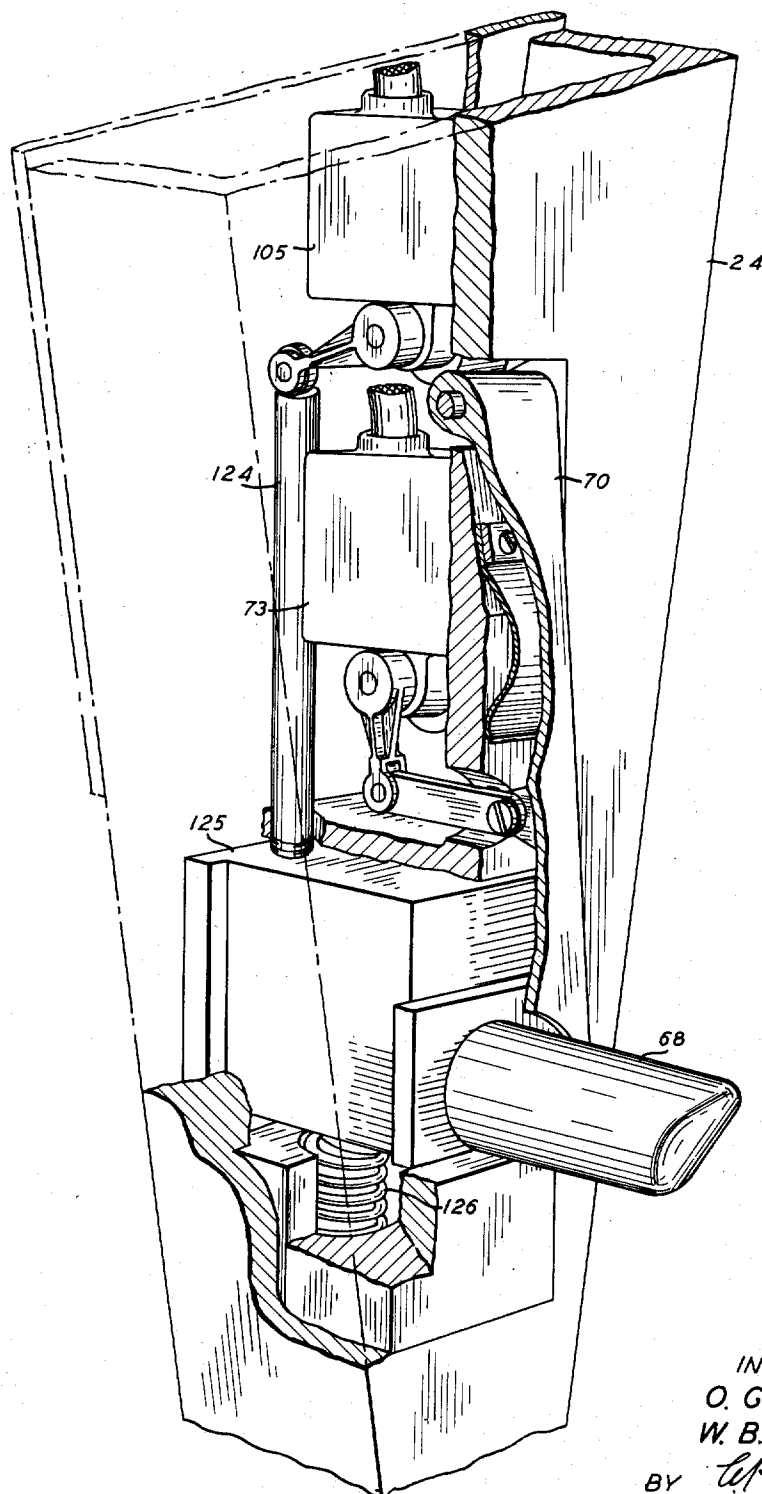


FIG. 4

INVENTORS
O. G. NELSON
W. B. WINES
BY *W. B. Wines*
ATTORNEY

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2,718,320

ARTICLE-HANDLING APPARATUS

Oscar G. Nelson, Baltimore, and William B. Wines, Towson, Md., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application June 22, 1950, Serial No. 169,708

3 Claims. (Cl. 214—658)

This invention relates to article-handling apparatus, and more particularly to apparatus for insuring positive engagement of articles by article-engaging elements.

In the manufacture of communication cables and the like, such a cable is wound upon a large reel, which sometimes must be transported relatively long distances in a plant. In the past, cranes having grapples provided with arms for engaging such reels have been used to transport the reels. In the normal use of such a grapple, the grapple is carried by a crane and may be lowered into proper position to pick up a reel, the arms of the grapple being moved into engagement with the reel by suitable motor driven means. The grapple and the reel then are lifted so that the reel may be transported without interference from objects on the floor. However, heretofore there has been no satisfactory apparatus for insuring that the grapple positively engages the reel before the grapple can be lifted, or for preventing separation of the grapple arms after a reel has been raised from the floor.

An object of the invention is to provide new and improved article-handling apparatus.

A further object of the invention is to provide apparatus for insuring positive engagement of articles by article-lifting apparatus.

A further object of the invention is to provide apparatus for insuring that a reel grapple positively engages a reel to be lifted and for preventing opening of the reel grapple after a reel engaged thereby has been lifted and is supported by the reel grapple.

An apparatus illustrating certain features of the invention may include a pair of opposed arms, means for moving the arms together to engage an article, means for lifting the opposed arms to lift an article engaged thereby, feeler means carried by each of the arms for preventing operation of the lifting means when the arms are not in correct positions relative to an article to be lifted thereby, and means carried by the arms responsive to a load on the arms for preventing movement of the arms away from one another while under a load.

A complete understanding of the invention may be obtained from the following detailed description of an apparatus forming a specific embodiment thereof, when read in conjunction with the appended drawings, in which:

Fig. 1 is a fragmentary, front elevation of an apparatus forming one embodiment of the invention;

Fig. 2 is an enlarged, fragmentary elevation of a portion of the apparatus shown in Fig. 1;

Fig. 3 is an enlarged, fragmentary, perspective view of a portion of the apparatus shown in Fig. 1;

Fig. 4 is an enlarged, fragmentary, perspective view of a portion of the apparatus shown in Fig. 1;

Fig. 5 is a diagrammatic view of a control circuit for the apparatus shown in Fig. 1, and

Fig. 6 is an enlarged horizontal section taken along line 6—6 of Fig. 2.

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Referring now in detail to the drawings, a crane system includes a pair of tracks 10—10 along which a bridge 12 may travel under the control of a crane operator in a cage 14 carried thereby. A carriage 16 may be moved to the right or left, as viewed in Fig. 1, under the control of the operator, and supports a grapple 18 by cables 20—20. The grapple 18 includes a horizontal track 22 (Fig. 2) on which arms 23 and 24 are mounted for movement together or apart by oppositely threaded screw shafts 25 and 26, engaging threaded collars 29—29 and 30—30, respectively. The arms 23 and 24 may be moved toward one another or apart by an electric motor 32 through gearing 33.

Since the arms 23 and 24 are identical, but reversed, only the arm 23 will be described in detail. A cross-head 34 (Figs. 3 and 6) having grooves 35—35 fits slidably in a guideway 36 with flanges 37—37 of the crosshead slidable along opposite faces of the arm 23. The cross-head supports a flange-engaging pin 38, and is urged upwardly, as viewed in Fig. 3, by a compression spring 39 seated in a block 40. A plate 41 secured to the arm 23 limits upward movement of the crosshead 34. A limit switch 42 fastened to the arm 23 has a pivotal, spring-pressed, actuating arm 44 connected to a link 51 extending through a hole 52 in the arm 23.

A feeler arm 60 pivotally mounted on the arm 23 by a pin 62 and connected to the link 51 normally is urged in a clockwise direction, as viewed in Fig. 3, by a leaf spring 63. The free end of the feeler arm has a notch 65 formed therein to permit the feeler arm to extend below the upper portion of the pin 38. The feeler arm 60 is moved in a counterclockwise direction by a reel flange 64 of a reel 66 when the pin 38 is moved to proper reel-lifting position under the flange 64. As the pin 38 is so positioned and the feeler arm 60 is pivoted by the reel flange 64, the feeler arm actuates the switch.

The grapple arm 24 (Fig. 2) includes a flange-engaging pin 68 and a feeler arm 70. As the pin 68 is positioned properly under a flange 71 of the reel 66, the feeler arm 70 is pivoted in a clockwise direction, as viewed in Fig. 2, to close a contact 72 of a limit switch 73 carried by the arm 24 and open a contact 74 of the limit switch 73. The limit switch 42 includes contacts 76 and 78. The contacts 72 and 76 are normally open and are in series with one another, two conductors of a three-phase power line 79 and a relay winding 80 of a relay 81 having contacts 82—82 in series with a hoist motor 83. When the contacts 74 and 78 are opened, a winding 84 is deenergized, and a contact 85 closes to light a lamp 86.

When the contacts 82—82 are closed, and up contacts 89—89 of a relay having a winding 91 in series with a manually operable, momentary switch contact 92 are closed, the motor 83 is energized to run in a direction lifting the grapple through the cables 20—20. For the contacts 82—82 to be closed, either both contacts 72 and 76 must be closed or a limit switch 93 must be closed.

The contacts 78 and 74 of the switches 42 and 73, respectively, are connected in parallel with one another and in series with a relay winding 94 and a normally open contact 95 of a manually operable, momentary switch 96. Armature contacts 97—97 closable by the winding 94 are in series with the grapple motor 32 in the closing circuit thereto. Thus, when both the pin 38 and the pin 68 have been moved sufficiently far under the flanges 64 and 71 that the feeler arms 60 and 70 have been actuated to open the contacts 78 and 74, the relay winding 94 is deenergized and the grapple motor 32 is deenergized.

Contacts 98—98 controlled by a relay winding 99 must be closed to drive the motor 32 in a direction opening the arms of the grapple. A contact 100 of the manually operable switch 96, a contact 101 of a limit switch 102 and a

contact 104 of a switch 105 also must be closed to energize the winding 99 to drive the motor 32 in a grapple-opening direction. When the contacts 98—98 are closed by energization of the relay winding 99, the grapple motor 32 is energized to run in a direction opening the arms 23 and 24 until the switch 96 is released or until an actuator 106 carried with the arm 23 (Fig. 2) actuates the switch 102, whichever occurs first.

When there is no load on the pins 38 and 68, the switches 93 and 105 are held in their closed positions by rods 123 and 124, respectively, carried with the crossheads 34 and 125, which are urged upwardly by compression springs 39 and 126. When the grapple is lifted, the weight of the reel compresses the springs 39 and 126 sufficiently that the switches 93 and 105 are opened by spring action. The switch 105 (Fig. 5) then prevents accidental energization of the grapple motor 32 in a grapple-opening direction, and the opening of the switch 93 prevents further energization of the hoist motor 83 unless both the contacts 72 and 76 are closed. Thus, accidental dropping of the reel by open condition of the grapple or by accidentally actuating the switch 96 is prevented.

Operation

The operator of the crane locates the grapple 18 in a position in which the arms 23 and 24 (Fig. 2) bracket the reel 66. The operator then actuates the switch 96 to close the contact 95, which energizes the grapple motor 32 in grapple-closing direction and the threaded shafts 25 and 26 are driven in a direction moving the arms 23 and 24 toward one another. This continues until both the pins 38 and 68 are positioned completely under the flanges 64 and 71, respectively, and the flanges 64 and 71 engage the feeler arms 60 and 70, respectively, and move them sufficiently to actuate the switches 42 and 73 to close contacts 76 and 72 and to open contacts 78 and 74. Opening of the contacts 74 and 78 deenergizes the motor 32, and causes the lamp 86 to be lighted, thereby indicating to the operator that the pins 38 and 68 are positioned properly.

The operator then manually closes the switch 92 to actuate the hoist motor 83 to raise the grapple 18. As the grapple begins to lift the reel 66 off the floor, the pins 38 and 68 bear directly the weight of the reel 66, compress the compression springs 39 and 126 and pull the rods 123 and 124 downwardly relative to the switches 93 and 105, thereby permitting the switches 93 and 105 to be opened by spring action. Opening of the switch 105 breaks the circuit to the relay winding 99 so that accidental actuation of the manually operable switch 96 will not energize the motor 32 to open the arms 23 and 24 of the grapple while there is any load on the grapple. Opening of the switch 93 causes deenergization of the relay winding 80 and the hoist motor 83 if either of contacts 72 and 76 are open.

After the reel 66 has been transported to its desired location, the grapple 18 is lowered to support the reel 66 independently thereof, and, as the load is taken off the pins 38 and 68, the compression springs 39 and 126 move the rods 123 and 124 upwardly to close the switches 93 and 105. The switch contact 100 then is closed manually to energize the relay winding which closes the armature contacts 98—98 to drive the motor 32 in a grapple-opening direction. After the arms 23 and 24 have been moved sufficiently apart to permit removal of the grapple from the reel, the switch contact 100 is permitted to open by spring action. The operator then closes the contact 92 to close the switch contacts 89—89, which, the relay winding 80 having been energized by the closing of the switch 93, energizes the hoist motor 83 in a grapple-raising direction, and the grapple is raised even though no load is thereon.

Certain features of the apparatus described hereinabove are disclosed and claimed in copending application Serial

No. 169,715, filed June 22, 1950, by C. H. Westermeyer for "Apparatus for Handling Articles".

The above-described apparatus positively prevents hoisting a reel which is not completely engaged by the grapple arms, and prevents opening of the grapple arms whenever the weight of a reel is supported thereby. Thus, both accidentally tipping a reel over and dropping it are prevented. Since the pins 38 and 68 and the crossheads 34 and 125 are the only elements normally supported by the springs 39 and 126, the springs are sufficiently light to make actuation of the switches 93 and 105 very sensitive while actuation thereof by inertia of the elements is avoided.

What is claimed is:

1. In article-handling apparatus including a crossbeam, a pair of vertically depending grapple arms mounted movably on the crossbeam, a pair of opposed, laterally projecting article-engaging pins positioned at the lower ends of the grapple arms, one for each grapple arm, a reversible electric motor for selectively moving the grapple arms toward and away from one another to facilitate the engagement of their respective article-engaging pins with an article and means for selectively raising and lowering the crossbeam and attached grapple arms, the improvement, which comprises guide means provided on the lower end of one of the grapple arms and defining a vertically extending guideway, a cross head slidably mounted in said guideway for limited vertical movement between predetermined upper and lower positions and having the article-engaging pin of that grapple arm attached fixedly thereto for movement therewith, resilient means normally urging the crosshead into its upper position when there is no article supported on its associated pin, an electric switch mounted on the grapple arm, and means operated when the crosshead assumes its lower position in the slideway due to the weight of an article supported on its associated article-engaging pin for actuating the switch, said switch when so actuated being designed to prevent the energization of the grapple operating motor in a grapple opening direction.

2. In article-handling apparatus including a crossbeam, a pair of vertically depending grapple arms mounted movably on the crossbeam, a pair of opposed, laterally projecting article-engaging pins positioned at the lower ends of the grapple arms, one for each grapple arm, means for selectively moving the grapple arms toward and away from each other to facilitate the engagement of their respective article-engaging pins with an article, a pair of movable feelers carried by the grapple arms and designed to be actuated when the article-engaging pins of their respective grapple arms are properly engaged for supporting an article and a reversible electric hoist motor for raising and lowering the crossbeam, the improvement which comprises guide means provided on the lower end of one of the grapple arms and defining a vertically extending guideway, a crosshead slidably mounted in said guideway for limited vertical movement between predetermined upper and lower positions and having the article-engaging pin of that grapple arm attached fixedly thereto for movement therewith, resilient means normally urging the crosshead into its upper position when there is no article supported on its associated pin, an electrical switch mounted on the grapple arm, and means operated when the crosshead assumes its lower position in the slideway due to the weight of an article supported on its associated article-engaging pin for actuating the switch, said switch when actuated preventing the energization of the hoist motor in a direction to raise the crossbeam if one or more of the feelers has not been actuated.

3. In reel-handling apparatus including a crossbeam, a pair of vertically depending grapple arms mounted movably on the crossbeam, a pair of opposed, laterally projecting reel-engaging pins positioned at the lower ends of the grapple arms, one for each grapple arm, and designed to be positioned by the grapple arms under the

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flanges of a reel for supporting the reel, a reversible, electric motor for selectively moving the grapple arms toward and away from one another, a pair of movable feelers carried by the grapple arms and designed to be actuated when the reel-engaging pins of their respective grapple arms are properly engaged under the flanges of the reel and a reversible electric hoist motor for raising and lowering the crossbeam, the improvement, which comprises guide means provided on the lower end of each of the grapple arms and defining a pair of vertically extending guideways, a pair of crossheads slidably mounted in said guideways for limited vertical movement between predetermined upper and lower positions and having the reel-engaging pins of their respective grapple arms attached fixedly thereto for movement therewith, resilient means normally urging the crossheads into their upper positions when there is no reel supported by the reel-engaging pins, a first electrical switch mounted on one grapple arm and actuable for preventing the energization of the hoist motor in a direction to raise the crossbeam when one or more

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of the feelers has not been actuated, a second electrical switch actuable for preventing the energization of the grapple arm operating motor in a grapple arm opening direction, and means operatively connecting the switches to the crossheads associated with their respective grapple arms and operated, when said crossheads assume their lower positions in the slideways, due to the weight of the reel supported by the reel-engaging pins, to actuate the switches.

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