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Sarff et al.

[11] **3,880,204**

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[54] **WIRE TYING MECHANISM**

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[52] **U.S. Cl.** ..... **140/93 A**; 140/93.6; 140/119

[51] **Int. Cl.** **B21f 15/04**

[58] **Field of Search** ..... 140/57, 93 A, 93.6, 119, 140/120

[56] **References Cited**

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3,810,495	5/1974	Pack	140/93

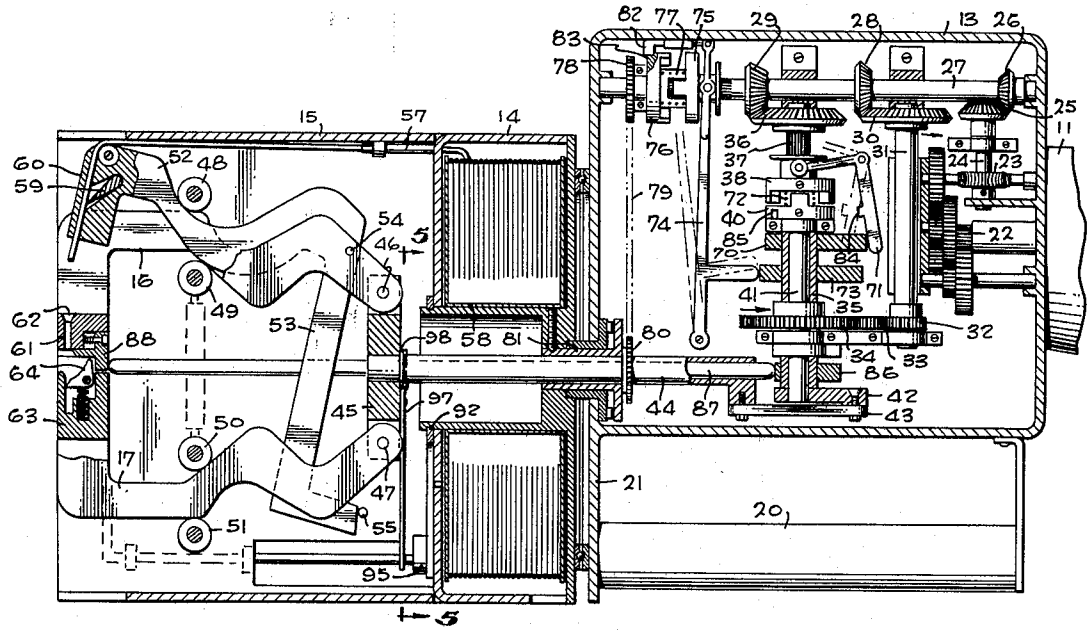
Primary Examiner—Lowell A. Larson

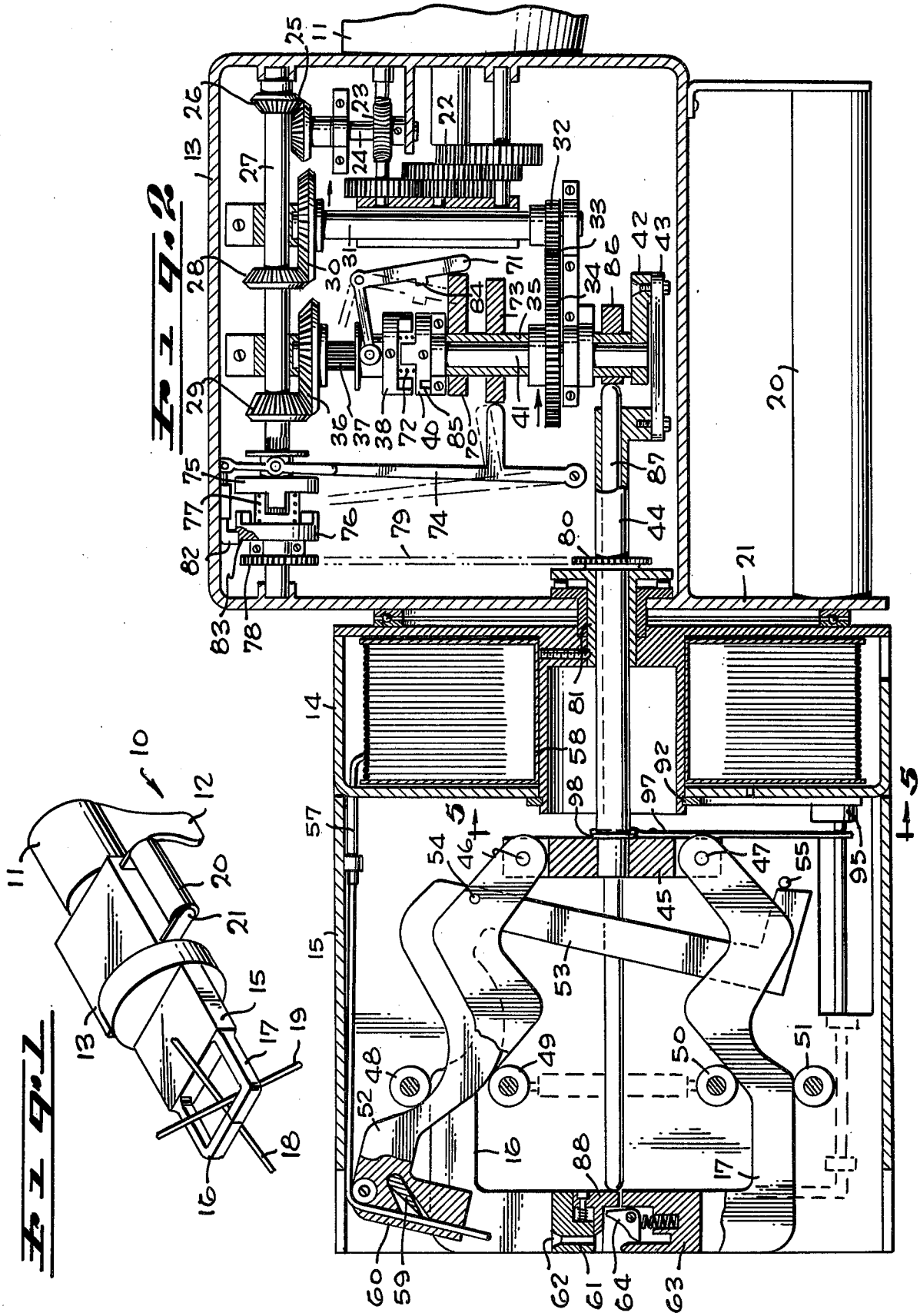
Attorney, Agent, or Firm—Roger A. Marrs

[57] **ABSTRACT**

A power driven mechanism is disclosed herein for feeding a length of wire about an object to be tied and for twisting the wire into a closure about the object. The mechanism includes a motor for driving a pair of arms for positioning the wire length and for twisting the wire into securement. The motor also drives a cutting mechanism for severing the wire. Reduction gearing, cams and cam followers and pivotal linkage operably interconnect the mechanism so as to provide a predetermined operating sequence.

10 Claims, 8 Drawing Figures




FIG. 1
FIG. 2
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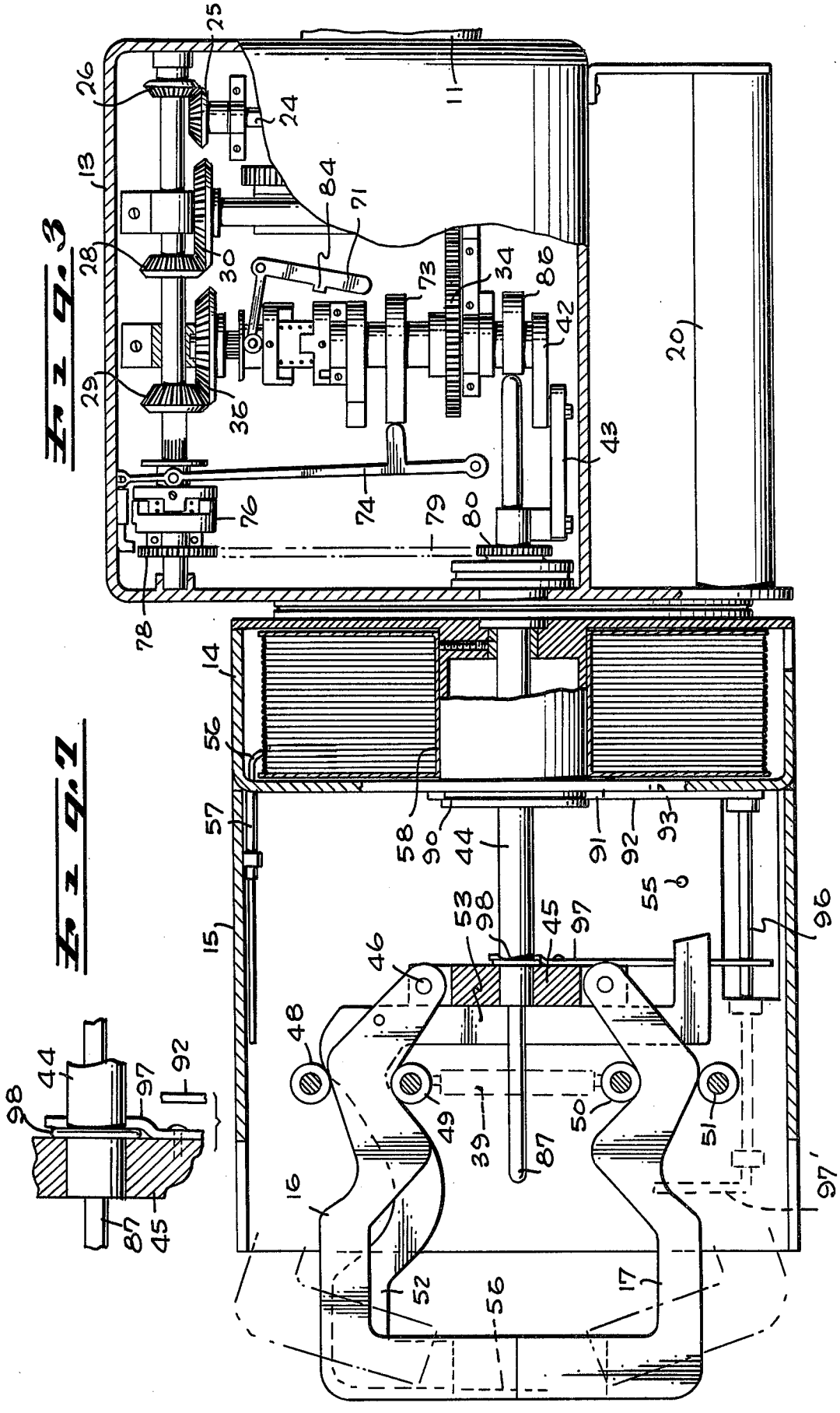

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Fig. 3

Fig. 2

Fig. 5

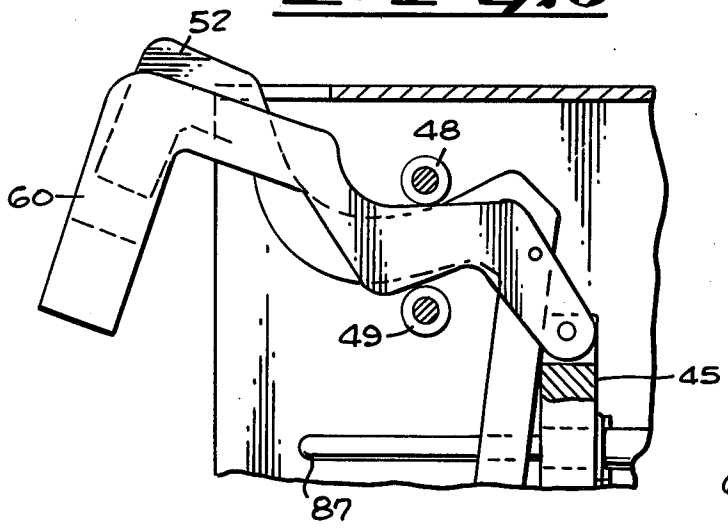
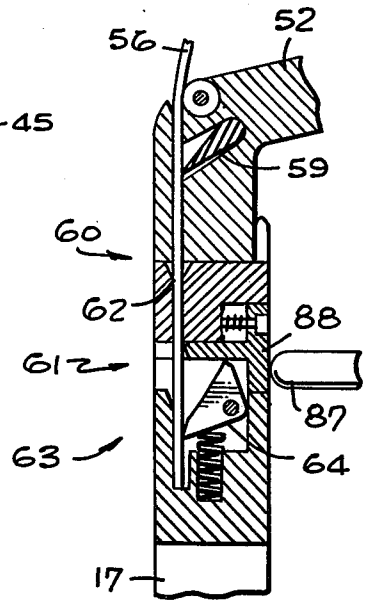


Fig. 8



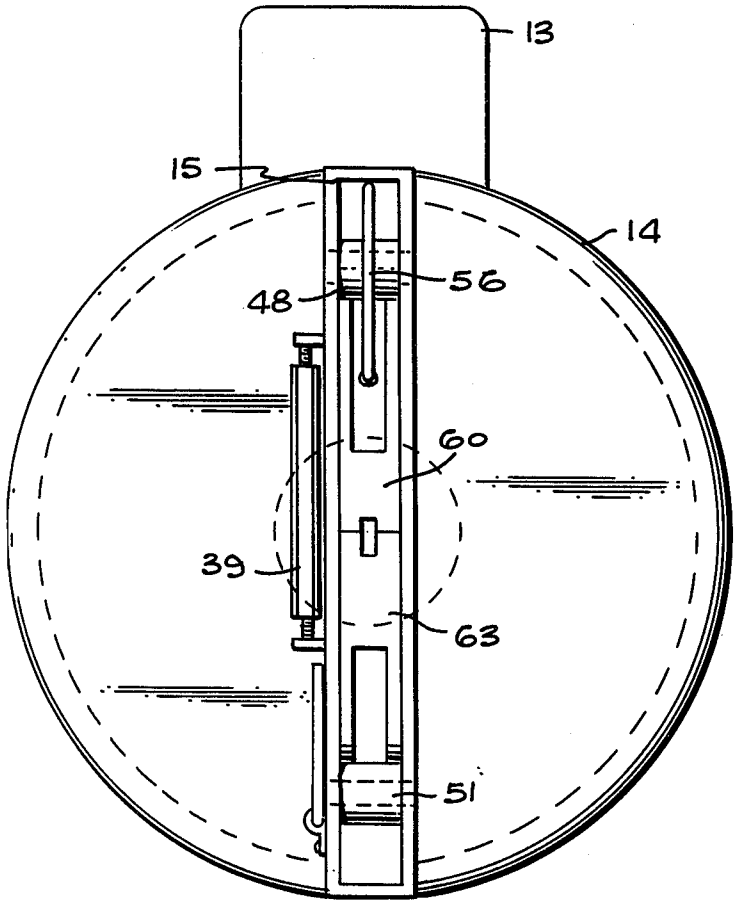
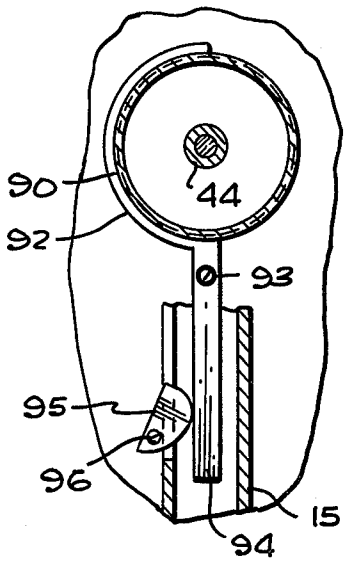


Fig. 9

Fig. 6



WIRE TYING MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a wire tying mechanism and more particularly to a novel power driven mechanism for automatically threading a sufficient length of wire about an object, securing the wire and severing the wire.

2. Brief Description of the Prior Art

In the past, it has been the conventional practice to employ wire tying mechanisms for making wire ties for the purpose of bundling materials. The bundling of materials may take the form of tying the tops of sacked material, tying reinforcing steel together prior to placing concrete in reinforced concrete structures, for tying assemblies together such as garden stakes, fencing and similar packages or the like.

Difficulties and problems have been encountered with prior mechanisms which stem largely from the fact that the mechanisms employed are highly inefficient in making wire ties and the procedure is extremely time consuming. Some prior attempts to provide wire tying mechanisms are disclosed in U.S. Pat. No. 3,391,715; 3,487,280 and 2,617,971. Furthermore, an attempt has been made to significantly increase the speed and efficiency in making wire ties by providing a portable power-driven wire tying mechanism which is disclosed in U.S. Pat. No. 3,677,308.

Although the latter patent discloses an automatic mechanism for rapidly tying a length of wire, the mechanism is somewhat ackward and cumbersome. Also, prior devices have no means for adjusting the length of wire intended to be wrapped. In some cases, too much wire is provided at the location of the tie while in other cases, not enough wire is available. Therefore, a long standing need is present for providing a rapid wire tying mechanism incorporating means for feeding the tie wire, twisting the wire tight, cutting the wire off, and terminating the mechanism operation after each wire tying cycle. Furthermore, the wire tying mechanism should be made as safe as possible so as not to injure the operator or those present in close proximity.

SUMMARY OF THE INVENTION

Accordingly, the problems and difficulties encountered with prior wire tying mechanisms are obviated by the present invention which provides a novel power driven mechanism for automatically feeding and placing a sufficient length of tie wire about an object and for twisting the wire tight about the object followed by automatically cutting the wire off and retracting the mechanism and terminating the wire tying cycle. The invention provides for a drive motor which continuously operates during a tying cycle and is selectively coupled via operative links to the feeding mechanism, twisting mechanism, cutting mechanism and stopping mechanism in accordance with a predetermined sequence.

Therefore, it is among the primary objects of the present invention to provide a novel wire tying mechanism which is automatic and provides a safe means for making a wire tie for a wide variety of purposes and which is adjustable for different lengths of wire needed for a given tie.

Another object of the present invention is to provide a novel wire tying mechanism including a power driven

means coupled to suitable linkage for providing a variety of functions according to a predetermined sequence.

Still another object of the present invention is to provide a novel power driven wire tying mechanism which is portable and may be hand held by the operator which incorporates a common drive means for operating a variety of mechanisms in a predetermined sequence incorporating the functions of feeding a tie wire twisting the wire tight, cutting the wire off and terminating the wire tying cycle.

Yet another object of the present invention is to provide a novel power driven wire tying mechanism which is highly reliable and which has greatly improved efficiency over conventional mechanisms.

A further object of the present invention provides for an adjustable pair of jaw members capable of maintaining a wide or narrow opening for accommodating wide or narrow articles to be tied.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of the novel power driven wire tying mechanism of the present invention;

FIG. 2 is an enlarged longitudinal cross-sectional view of the mechanism shown in FIG. 1 preparatory to a wire tying procedure;

FIG. 3 is a cross-sectional view similar to that shown in FIG. 2 illustrating the wire placed about an object via extension of the jaw members preparatory for tying or securement thereto;

FIG. 4 is an end-elevational view of the wire tying mechanism;

FIG. 5 is a fragmentary view of the wire placement and feeding mechanism;

FIG. 6 is a fragmentary cross-sectional view taken in the direction of arrows 6—6 of FIG. 2 showing the release mechanism for the wire storage spool;

FIG. 7 is an enlarged view of the release mechanism shown in FIG. 6; and

FIG. 8 is a sectional view of the cutting device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, the novel power driven wire tying mechanism of the present invention is illustrated in the general direction of arrow 10 which includes a motor (not shown) enclosed by a housing 11 having a pistol grip 12 complete with a finger trigger actuator for starting and stopping the motor operation. Immediately ahead of the motor housing 11, there is provided a case 13 which encloses the gear reduction train and other linkages including timing cams and the like. Ahead of the mechanism case 13, there is provided a wire storage housing 14 and a yoke case 15 which encloses arm or jaw members 16 and 17 that retract within case 15 and extend therefrom as shown during a wire tying procedure.

As illustrated, the wire tying mechanism 10 is in position to tie intersecting reinforcing steel bars 18 and 19.

The arm or jaw members **16** and **17** are illustrated extending from the case **15** to encircle the intersection of rods **18** and **19** preparatory to retracting the arm members so that a sufficient length of wire will be wrapped around the intersecting rods. The sequence of operation will be described later.

A feature of the invention is the fact that the device **10** is portable and pistol grip **12** may be held in the right hand of the operator while his left hand may readily grasp a stabilizing handle **20** which is cantilevered outwardly from the mechanism case **13** by a bracket **21**. Therefore, the device **10** is adaptable for use in any position or attitude as well as in confined spaces. The device is truely portable and lightweight and it can be readily operated by depressing a single switch energizing the motor within motor housing **11**. A wire basket guard **19** is carried on the case **13** and encircles the housing **14** and case **15**. The guard serves as a safety guard and as a spacer to prevent the case from coming in contact with any object. Only a portion of the basket **19** is illustrated for clarity purposes. However, the basket is the same as shown in U.S. Pat. No. 3,677,308.

The motor within housing **11**, as shown in FIG. **2**, rotates a gear reduction train via a drive shaft **22** which rotates a worm gear **23** on shaft **24** which turns a bevel gear **25**. Bevel gear **25** is mated with a bevel gear **26** which is fixed to shaft **27** that also rotates bevel gears **28** and **29**.

Bevel gear **28** rotates bevel gear **30**, shaft **31** and spur gear **32** which rotates idler gear **33** and spur gear **34**, which in turn rotates hollow shaft **35**. Bevel gear **29**, rotates bevel gear **36** and splined shaft **37** upon which dog **38** is moveably mounted. Dog **38** engages dog **40** fixed to shaft **41** and turns crank **42** one revolution which, through link **43** pushes hollow shaft **44** axially out and back the prescribed distance required to operate the arm or jaw mechanism comprising arms **16** and **17** and return to a lock or end of cycle position.

Hollow shaft **44** is moveably attached to a yoke **45** to which cam arms **16** and **17** are moveably attached by pins **46** and **47** respectively. Cam arm **16** passes between rollers **48** and **49**, and cam arm **17** passes between rollers **50** and **51** causing the outer ends of the cam arms to separate widely and close to meet in the extended position, as shown in FIG. **3**, and to open and close again upon retraction as shown in FIG. **2**. Cam arm **52** also passes between rollers **48** and **49** causing it to move externally from its initial position to a position similar to cam arm **16** when extended and to move to a retracted (open) position upon retraction of the jaws by the leverage action of lever **53** rotating on pin **54** and striking against stop pin **55**.

The opening or separation between the jaws may be adjusted so as to be narrow or wide by modifying the distance between cam rollers **49** and **50**. This is achieved by interconnecting the rollers by a turnbuckle assembly **39** as shown more clearly in FIGS. **3** and **4**.

When cam arm **16** and **17** move to the extended position, cam arm **52** pulls a tie wire **56** through tube **57** from a wire storage reel **58** because the end of wire **56** is securely held by a dog **59** in dog assembly **60**. The end of wire **56** having previously been severed in the jaw assembly **61** on the previous cycle will be projecting from dog assembly **60**, as shown in FIG. **2**, and when dog assembly **60** moves in against tube **62** and across into jaw assembly **63** where dog **64** engages and holds it securely as shown in FIG. **8**.

When cam arms **16** and **17** retract, the end of wire **56** is pulled back by cam arm **17** and the end of the wire is in effect transferred from jaw assembly **61** to jaw assembly **63**.

While the jaw assemblies are being extended and retracted, cam **70** causes crank **71** to cause dog **38** to remain engaged with dog **40**. Upon retraction of the jaws, cam **70** is disengaged from crank **71** and spring **72** expands to instantly disengage dog **38** from dog **40**. Crank **71** is shown in its position by broken lines in FIG. **2**.

When dogs **38** and **40** are disengaged, cam **73** moves lever **74** to engage dog **75** in dog **76** as shown in broken lines in FIG. **2** against spring **77** and turn sprocket **78**, thereby moving sprocket chain **79** and sprocket **80** attached to hollow shaft **81** to which the rotating head assembly is securely attached. This operation spins the head assembly when the jaw members are retracted to twist the wire length **56** tight about the rod intersection.

Upon completion of the wire tying operation, cam **73** releases lever **74** to disengage dogs **75** and **76** and simultaneously move dog **82** into notch **83** in dog **76** thereby holding the moving head of the device in a fixed position and oriented with the fixed part of the mechanism. Similarly, when dog **38** is disengaged from dog **40**, a projection **84** on crank **71** moves into notch **85** in dog **40** to hold the crank **42** in a locked position.

At the completion of the cycle, cut off cam **86** rotates to move push rod **87** axially to depress knife **88** to sever wire **56** and to simultaneously depress dog **64** to release the other end of the twisted wire.

Referring now to FIGS. **3** and **6**, means are shown for releasably holding the wire storage reel **58** onto hollow shaft or sleeve **44**. The reel includes a hub **90** that is coaxially disposed with respect to the sleeve **44** and includes a groove **91** for receiving a semi-circular latch **92** the latch is pivotally carried by pivot **93** fixed to the structure. The opposite end of the latch from end **92** is indicated by numeral **94** and projects over a cam **95**. The cam **95** is carried on rod **96** which is provided with a handle **97**. Also, a second latch **98** is provided as shown in FIG. **7** which is fixedly attached to yoke **45**. A semi-circular end of latch **97** is disposed about shaft **44** and bears against an integral collar **98** carried on the shaft and abutting against yoke **45**.

When the rod **96** is pivoted, cam **95** causes both of the latches to pivot so that their semi-circular portions disengage with the tube or shaft or sleeve **44**. Once the latches have been released from the sleeve **44**, the wire storage reel may be slid from the assembly and another reel may be placed thereon.

In view of the foregoing, it can be seen that the novel wire tying apparatus of the present invention provides a novel means for portably carrying a spool of wire and a drive mechanism for extending and retracting a pair of draw members carrying a length of wire to a work piece intended to be tied. Adjustable means are provided for widening or narrowing the opening between the jaws in order to accommodate passage around articles or structures of varying thickness and shape. Cams, cam followers and linkages interconnect the drive motor with the operating jaws for achieving a sequence for feeding wire, wrapping wire, and severing the wrapped wire from the reel.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this inven-

tion in its broader aspects and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

What is claimed is:

1. A portable power driven wire tying mechanism comprising the combination of:

a housing;

motor means carried in said housing;

a pair of jaw members longitudinally movable to extend and retract with respect to said housing;

linkage means operably connecting said jaw members to said motor means for automatic reciprocating movement thereof;

a source of wire carried on said housing and having a portion thereof trained about one of said jaw members adapted to engage the other of said jaw members when in their extended position; and

means coupled to said motor means via said linkage means for twisting said wire portion when said jaw members are retracted and severing said twisted wire portion.

2. The invention as defined in claim 1

including means interconnecting said pair of jaw members for adjusting the opening between their opposing ends.

3. The invention as defined in claim 2

wherein said last mentioned means comprises a turnbuckle.

4. The invention as defined in claim 2

including a second housing rotatably carried on said first housing and enclosing said jaw members in their retracted position.

5. The invention as defined in claim 4

wherein said linkage means includes cams and cam followers operably coupled to said jaw members for time sequencing the operation of wire feeding, wire twisting and wire cutting.

6. The invention as defined in claim 5

including a pair of handles for manually holding said mechanism wherein one handle is grasped by each hand of the operator.

7. The invention as defined in claim 6

wherein said jaw members are pivotal carried on a yoke and roller cams engage with shaped edges of said jaw members to open and close their opposing ends responsive to said timing means.

8. The invention as defined in claim 7

wherein said jaw members are articulated arms having a cutting assembly carried on a selected one of their opposing ends.

9. The invention as defined in claim 8

including a bearing means disposed between said first and second housings.

10. The invention as defined in claim 9

including a third pivotal arm operably in response to said jaw members for feeding wire from a spool to said jaw members.

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