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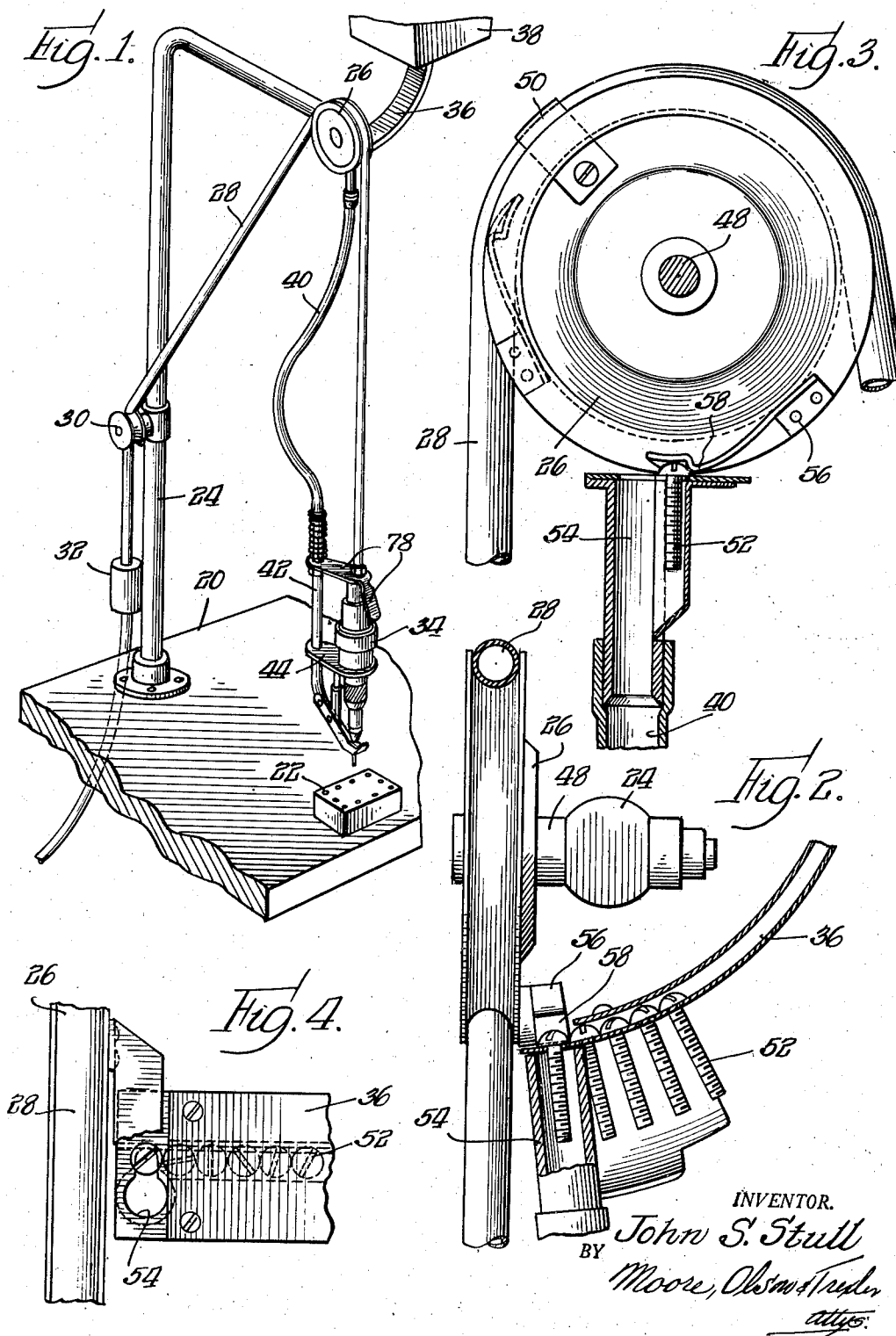
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FASTENER FEEDING AND SECURING APPARATUS

Filed May 7, 1945

2 Sheets-Sheet 1



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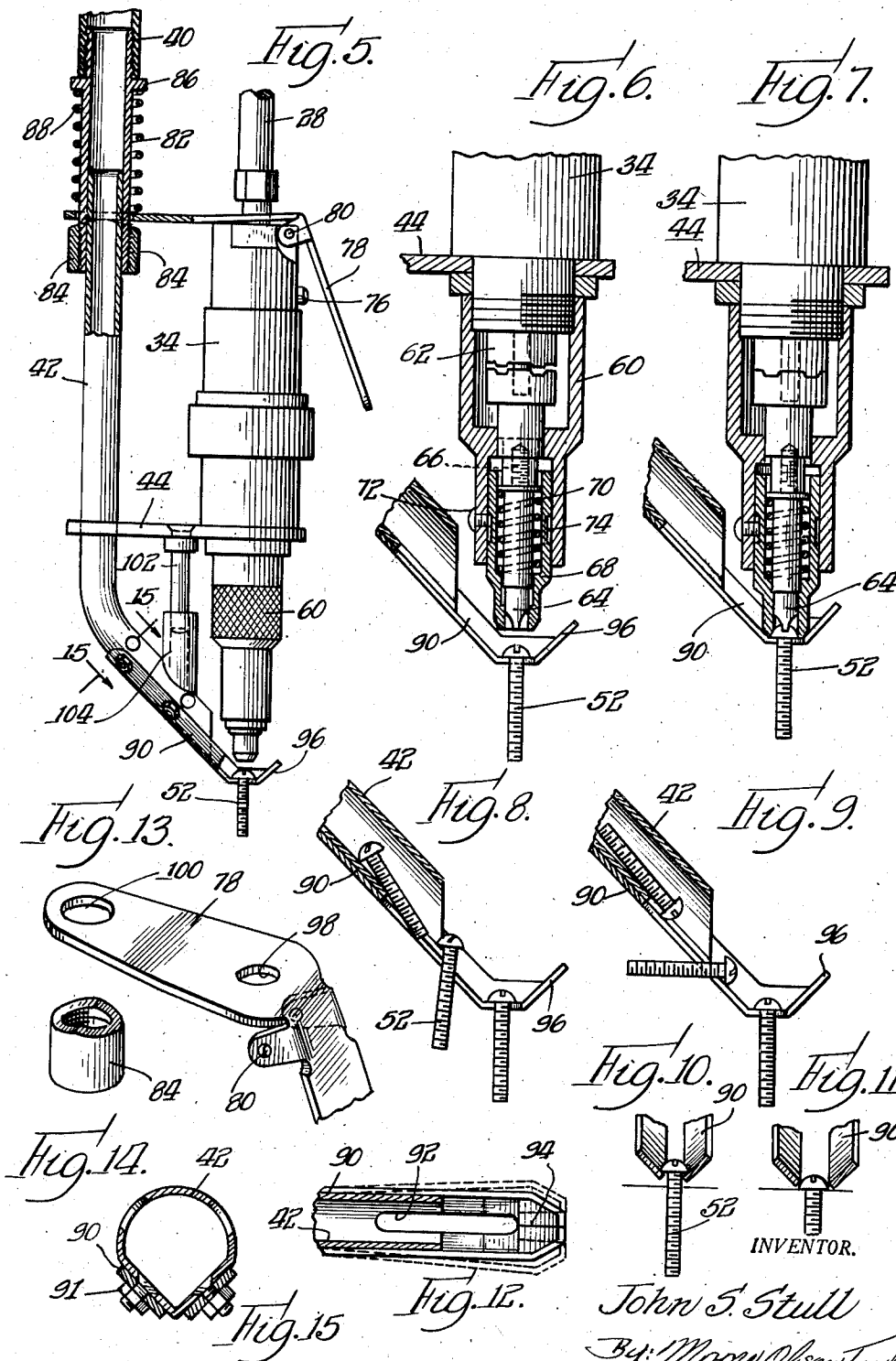
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2 Sheets-Sheet 2



## UNITED STATES PATENT OFFICE

2,471,793

## FASTENER FEEDING AND SECURING APPARATUS

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Application May 7, 1945, Serial No. 592,415

3 Claims. (Cl. 144—32)

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The present invention relates to article handling apparatus and more particularly to a motor driven fastener feeding and securing apparatus.

In manufacturing production lines it has been common to use motor driven tools for the application of fastening devices such as rivets and screws. To minimize the number of manual operations necessary in assembly, it has been found convenient to provide a power driven tool with a magazine or reservoir containing the fastening devices such as screws or rivets which are arranged to be supplied one at a time to the end of the tool. Such an arrangement provides a hopper or magazine mounted on the tool which is suspended above the work bench and which is moved down upon the work piece for the insertion of the fastening device such as the screw or rivet. Although such tools are commonly supported on spring devices or counterweight arrangements, the added weight of a hopper or reservoir increases the inertia which must be overcome when the tool is to be moved from one position to another in inserting and securing the fastening means. It, therefore, would be desirable to minimize this inertia.

Heretofore in the arrangements provided for supplying screws or rivets one at a time to the end of the tool, it has been necessary to use both hands on the tool, the work being held in a jig. One hand was used to guide the tool and to control the starting and stopping of the application of power whereas the other hand was used to release and position the fastening means adjacent the end of the tool. For many assembly operations the work would be made easier if only one hand were required to operate the tool whereas the other hand might be used to position and readily shift from one position to another the work piece to which the fastening means are to be applied.

In accordance with the present invention both the above mentioned advantages together with other and further advantages are obtained in a structure where operation by one hand serves to position and hold the fastening means adjacent the end of the tool, controls the starting and stopping of the tool, and guides the tool to the proper position. The inertia is reduced by eliminating the reservoir or hopper normally mounted on the tool and by providing a supply reservoir or magazine positioned on a rigid support some distance away from the tool.

It, therefore, is an object of the present invention to provide an improved article handling ap-

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paratus such as a power driven fastener feeding and driving apparatus.

It is a further object of the present invention to provide an improved article feeding, positioning, and holding apparatus for a portable hand controlled tool.

Still another object of the present invention is to provide an improved power driven fastener tool capable of being operated by one hand.

Other and further objects of the present invention subsequently will become apparent from the following description taken in connection with the accompanying drawings wherein

Figure 1 is a perspective view of a power driven apparatus embodying the present invention;

Figure 2 is a front view of a portion of the apparatus with certain elements shown in cross section;

Figure 3 is a view of the apparatus shown in Figure 2 viewed at right angles thereto;

Figure 4 is a top view of a portion of the apparatus shown in Figure 2;

Figure 5 is an enlarged view of the lower portion of the apparatus shown in Figure 1 with a portion thereof shown in cross section;

Figure 6 shows in cross section the lower portion of the tool shown in Figure 5;

Figure 7 shows the lower portion of the tool shown in Figure 6 with the fastening device moved into engagement with the lower end of the tool;

Figure 8 shows the manner in which fastening devices move down the lower portion of the guide and conduit into the proximity of the bottom of the tool;

Figure 9 is another view similar to Figure 8 showing the manner in which a fastening device is properly oriented when it moves down the conduit in reverse position compared to Figure 8;

Figure 10 is a cross sectional view through the guide member at the time that the fastening means is being driven home;

Figure 11 is a cross sectional view of the lower portion of the guide member at the time that a fastening device has been driven home;

Figure 12 is a plan view of the lower portion of the guide member which shows in dotted line representation the action which takes place as compared to Figures 10 and 11;

Figure 13 is a detail view of the upper portion of the operating lever shown in Figure 5;

Figure 14 shows one element adjacent the operating lever in Figure 5; and

Figure 15 is a cross sectional view of the con-

duit as seen in the direction of the arrows along the line 15—15 of Figure 5.

In Figure 1 there is shown a portion of a work bench 20 upon which is positioned a work piece 22 in which fastening members such as screws or rivets are to be provided. A support 24 is mounted on the work bench so as to leave adequate working space for the operator. The support 24 may be a standard of the type shown in Figure 1 or may be a support extending downwardly from the ceiling. The support 24 is provided with a pulley 26 over which is positioned a power conductor 28. The power conductor may extend over an idler pulley 30 and may be provided with a counterweight 32. The purpose of the counterweight 32 is to normally retract the tool above the surface of the work bench 20 a certain distance and to return the pulley 26 to a predetermined position. Obviously of course other biasing means may be provided for returning the pulley 26 to its original position.

The power conductor 28 may comprise an electric conductor where the tool is driven by an electric motor, or may be a flexible conduit containing a flexible drive shaft, or may be a pneumatic tube or line. For simplicity in describing the present invention, it may be assumed that the power conductor 28 is a pneumatic tube which supplies air under pressure to a pneumatic motor which drives the tool. At the end of the power conductor 28 there is positioned a power driven tool 34 which is arranged to be started and stopped by suitable means actuated by the hand of the operator.

Mounted adjacent the pulley 26 is an article magazine 36 which may be connected to a reservoir or supply hopper 38. The magazine 36 is arranged to supply articles one at a time to a hollow flexible conduit 40 which is connected between the magazine 36 and the tool 34. The lower end of the flexible conduit 40 is connected to a guide and positioning device 42 which is secured to the tool 34 by suitable support plates 44 and 78.

By referring to Figures 2, 3, and 4, it will be seen that the pulley 26 is suitably journaled on a support shaft 48 carried by the support 24. The flexible power conductor 28 passes over the pulley 26 and a clamp 50 secures the conductor 28 to a portion of the periphery of the pulley 26 so as to insure coordinated movement therebetween. The magazine 36 which extends between the supply hopper 38 and the pulley 26 is a channeled member having a central aperture on the bottom side.

Further to facilitate the description of the present invention it may be assumed that the tool 34 is a power driven screw driver and that screws are to be supplied one at a time to this tool. Accordingly the magazine 36 carries a plurality of screws 52 by their heads so that the bodies of the screws extend outwardly from the magazine 36. The magazine 36 extends to a point closely adjacent to the pulley 26 and is displaced to one side of an entrance tube 54 which is secured to the upper end of the flexible hollow conduit 40. Thus the screws or articles 52 tend to move downwardly by gravity to a point adjacent the hollow tube entrance 54, but of their own power cannot enter the tube 54.

The pulley 26 is provided with one or more feeder arms 56 suitably secured at proper points adjacent the outer periphery of the pulley. Each of the feeder arms is of a resilient construction so that in one direction of rotation the feeder

arm will slide over the head of a bolt or screw 52. Thus in a counter-clockwise movement of the pulley as seen in Figure 3, the feeder arm 56 produces no action upon the screw 52. With a clockwise motion of the pulley 26 the end of the feeder arm 56 will have a shoulder portion 58 which will engage the head of the screw 52 and move it toward the left so as to pass into the entrance 54 of the flexible conduit 40.

Figures 5, 6, and 7 show certain details of the tool 34 and the application of the invention thereto. Adjacent the lower portion of the tool 34 there is provided a housing 60 which contains a toothed clutch structure 62 which may be of the conventional variety provided to permit the screw driver to slide or stop whenever the screw has been driven home. The clutch 62 is connected to the screw driver bit 64 by a suitable threaded connection 66. Surrounding the screw driver bit 64 is a reciprocable sleeve 68 biased toward one position by a coiled spring 70 and limited to a certain amount of operation by a set screw 72 which cooperates with an annular recess 74. The sleeve 68 adjacent the lower extremity of the screw driver bit 64 is arranged to surround or engage the outer portion of the head or fastening means or screw 52. Adjacent the upper portion of the housing 34, there is provided a start-stop control button or switch 76 adapted to be engaged by a control handle or lever 78 pivotally mounted at 80. The control handle or lever 78 is preferably a stamped metal member of bell crank formation extending beyond the tool so as to surround a tubular member 82 connected to the lower portion of the flexible conduit 40. The tubular member 82 frictionally engages the hollow guide and positioning member 42 and is retained in position by a clamping nut 84. The upper portion of the hollow member 82 is provided with a shoulder 86 so that a spring 88 may be interposed between the shoulder 86 and the rearwardly extending portion of the control lever 78. The guide member 42 passes through a suitable aperture in the support plate 44 so that it may be reciprocally moved therethrough.

The lower portion of the guide member 42 which is generally V-shaped is provided with an extension 90 comprising tensioned spring members which may be secured to the lower portion of the tube 42 by a plurality of bolts and nuts 91 as is apparent from Figure 15. The lower portion of the extension 90 is so formed as to provide an elongated slot 92 to accommodate the stem of the bolt 52, but the width of the slot 92 is such that the heads cannot pass there-through. At the outer extremity beyond the slot 92, the member 90 is retained in position by cooperating shoulders 94. The extreme outer extremity on either side of the shoulders 94 is turned upwardly at 96 at an angle corresponding to the angle at which the lower side of the member 90 extends relative to a horizontal plane. The outer extremity 92 of the member 90 is set so as to be at the same angle relative to the horizontal as the member 90 whereby the screw head will engage that portion of the member 96 adjacent the shoulders 94 so as to be positioned midway between these two portions for ready positioning of the head of the screw with respect to the holding sleeve 68 of the tool.

Headed fastening devices such as screws or rivets are supplied to the upper extremity of the flexible conduit 40 one at a time so that these members move downwardly until they reach the

slot 92 whereupon they are correctly positioned in the guide 90. Irrespective as to whether such members pass downwardly head first or vice versa the members will be properly positioned. This is expressed by Figures 8 and 9 wherein the various bolts shown are merely representations of successive positions assumed by a bolt moving downwardly from the conduit 40 through the guide 42 on to the member 90. Thus in Figure 8 it is assumed that the bolt is moving downwardly so that the head follows the body of the bolt from which it will be seen that the body upon reaching the slot 92 passes downwardly and ultimately reaches the lowermost position shown.

If on the other hand the head precedes the body of the bolt as shown in Figure 9, the head moves on downwardly until the body clears the end of the member 42 whereupon the body will swing through the slot 92 and the bolt will come to rest in a similar position as shown in Figure 9.

The lever 78 surrounds the connection between the body of the tool 34 and the power conduit 28. To provide for such structure the operating lever 78 is provided with an aperture 98. The lever 78 extends an appreciable distance beyond the opening 98 and surrounds the sleeve 82. Thus there is provided for this purpose the apertures 100. When the lever 78 is pushed toward the tool 34, the outer extremity of the lever exerts a pressure against the spring 88 which pushes upwardly against the shoulder 86 so as to raise the guide tube 42. In order that the guide tube 42 may be retained in position without rotation, the support 44 is provided with a downwardly extending rod 102 which is arranged to telescope into a sleeve 104. The sleeve 104 is rigidly secured adjacent the upper side of the lower extremity of the tube 42. Thus an aligned reciprocal motion may be provided for the lower extremity of the guide member or tube 42. This upward movement of the member 42 changes the position of the member 90 from that shown in Figure 6 to that shown in Figure 7 so as to bring the head of the screw 52 into engagement with the screw driver bit 64. In this operation the sleeve 68 is raised and the spring 70 is compressed. Should at that time the screw head slot not be in alignment with the blade of the screw driver bit, the spring 88 will yield so that when the screw driver blade rotates, engagement will be made with the screw head slot. When this occurs the spring 88 will act to further raise the member 90 to retain the head of the screw 52 in position relative to the screw driver bit 64. The tool thereupon is oriented so that the screw engages a threaded aperture and the screw is driven home.

As previously mentioned the lower extremity of the member 90 is in effect bifurcated by the shoulders 94 so as to permit an operation which is explained in Figures 10, 11 and 12. In Figure 10 the screw 52 is very nearly driven home, but the head of the screw is still a sufficient distance above the surface of the work piece that there has been no spreading of the sides of the member 90.

In Figure 11, however, the screw has been driven home with the bottom of the head flush with the top surface of the work piece. This final movement of the screw has caused the head to exert sideward pressure upon the bifurcated portions of the member 90 so that they have been spread apart. This sideward movement of each

half of the member 90 is illustrated by the dotted line representation in Figure 12.

The advantages of applicant's invention will now become apparent by a brief description of the mode of operation. The pulley 26 is biased to a predetermined position by suitable means which may comprise the counterweight or counterbalance 32. This raises the tool 34 to a short distance above the work bench 20 so that a work piece 22 may be placed thereon in any desired position. It may be assumed that a screw 52 is positioned in the proximity of the bottom of the tool 34 as shown in Figure 5. With this condition obtaining the body of the tool 34 is grasped by one hand and moved in the proximity of where the screw is to be positioned in the work piece 22. The tool holds the screw so securely that the tool may be manipulated through any desired angular displacement so as to readily insert the screw into the work piece.

By pressure of the hand upon the lever 78, the guide 42 is moved upwardly so as to position and hold the screw adjacent the screw driver bit 64 as was shown in Figure 7. The tool 34 being moved downwardly to position the screw in the threaded hole produces rotation of the pulley 26 so that the movement of the pulley is in a counterclockwise direction as viewed in Figure 3. Thus one of the feeder fingers 56 is moved to the rear of the end of the magazine 36. Further pressure of the lever 78 causes engagement of the starting switch 76 so that the tool is started and the screw is driven home in the manner heretofore explained particularly in connection with Figures 10, 11, and 12. Thereupon the tool is released from its position adjacent the work piece 22 and is raised so as to permit new orientation of the tool relative to the work piece 22.

This may comprise either shifting the work piece 22 or shifting the tool 34. In either instance the tool 34 is raised a certain amount so that again rotation of the pulley 26 takes place. This rotation of the pulley 26 now causes a clockwise motion of the pulley as viewed in Figure 3 which forces one of the fastening members 52 out of the magazine 36 into the entrance 54 into the flexible conduit 40.

If the screw enters the flexible conduit 40 so as to move with the body preceding the head, the screw will move in the manner illustrated in Figure 8 so that the body extends through the slot 92 and the head becomes positioned adjacent the bottom of the guide member 90 for movement into engagement with the sleeve 68 and the screw driver bit 64 by a subsequent actuation of the hand lever 78. From the foregoing it will be seen that operation by one hand controls the positioning of the tool 34, the feeding of the fastening devices or screws one at a time to a point adjacent the tool bit, positioning of the fastening device or screw adjacent the end of the tool and starting and stopping of the tool motor. Thus the other hand is left free for other operations such as shifting the work piece 22 or assembly operations such as the placement of parts and washers to be secured in position by the screw.

While it has been mentioned for the purpose of illustrating the present invention that a new fastening device is supplied to the flexible conduit 40 when the tool 34 is raised a certain amount so as to bring about rotation of the pulley 26, a similar action might be provided by causing rotation of the pulley in the opposite

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direction to bring about a feeding action of one of the fastening devices. Thus by proper arrangement or reversal of parts, the tool 34 may be so arranged that each time that the tool is moved downwardly, a new fastening device is supplied thereto.

While for the purpose of illustrating and describing the present invention, as heretofore stated, certain assumptions were made to facilitate this description, it is to be understood that the invention is equally applicable to an electrically driven tool or other power driven device. Furthermore while fastening devices such as screws have been shown for illustration, rivets may be used and by suitable modification of the tool 34, a riveting action may be brought about.

While for the purpose of describing and illustrating the present invention, one embodiment has been shown in the drawings, it is to be understood that the present invention is not limited thereby since such variations and equivalents are contemplated as may be commensurate with the spirit and scope of the invention as defined in the following claims.

This invention is hereby claimed as follows:

1. The combination comprising a pulley, a flexible power conductor positioned over said pulley, a motor driven tool connected to one end of said conductor, a magazine mounted adjacent said pulley, a flexible conduit extending from said magazine to said tool, means biasing said pulley toward one position, means connected to said conduit for receiving therefrom an article and for positioning said article adjacent the end of said tool, a control handle for starting said tool, said control handle being arranged to operatively position said latter means relative to said tool, and a feeder arm mounted on said pulley and responsive to the movement of said pulley for releasing an article from said magazine.

2. The combination comprising a support, a pulley mounted on said support, a flexible power conductor positioned over said pulley, a motor driven tool connected to one end of said conductor, a supply magazine and guide mounted adjacent said pulley, a flexible hollow conduit extending from said magazine and guide to said tool, means biasing said pulley toward one position,

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guide and positioning means connected to said conduit for receiving therefrom a fastener and for positioning said fastener adjacent the end of said tool, a control handle for starting said tool, said control handle being arranged to operatively position said latter means relative to said tool, and fastener feeding means mounted on said pulley and responsive to the movement of said pulley relative to said support for releasing a fastener from said magazine and guide and for moving said fastener into said conduit.

3. The combination comprising a pulley mounted on a support, a flexible power conductor positioned over said pulley, a motor driven tool connected to one end of said conductor, a fastener magazine mounted adjacent said pulley, a flexible conduit extending from said magazine to said tool, finger means mounted on said pulley for releasing a fastener from said magazine and for feeding said fastener into said conduit in response to a movement of said tool, guide positioning and holding means connected to said conduit for receiving therefrom a fastener and for positioning and holding said fastener adjacent the end of said tool, a control handle connected to said guide positioning and holding means, said control means upon actuation adapted to operatively position said fastener relative to said tool, and means responsive to the actuation of said control handle for starting said motor.

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