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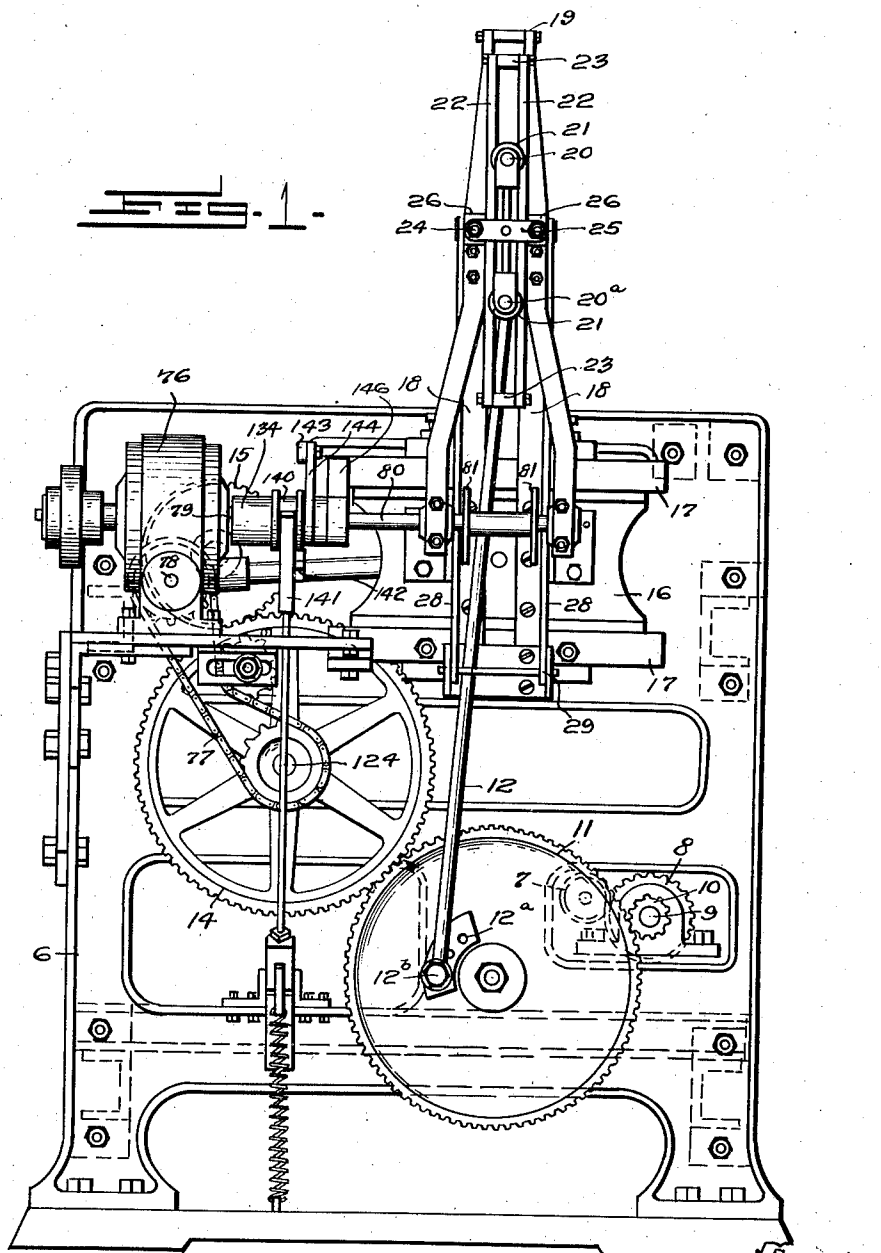
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2,061,579

WIRE FOLDING, CUTTING, AND HANDLING MACHINE

Filed May 16, 1935

10 Sheets-Sheet 1



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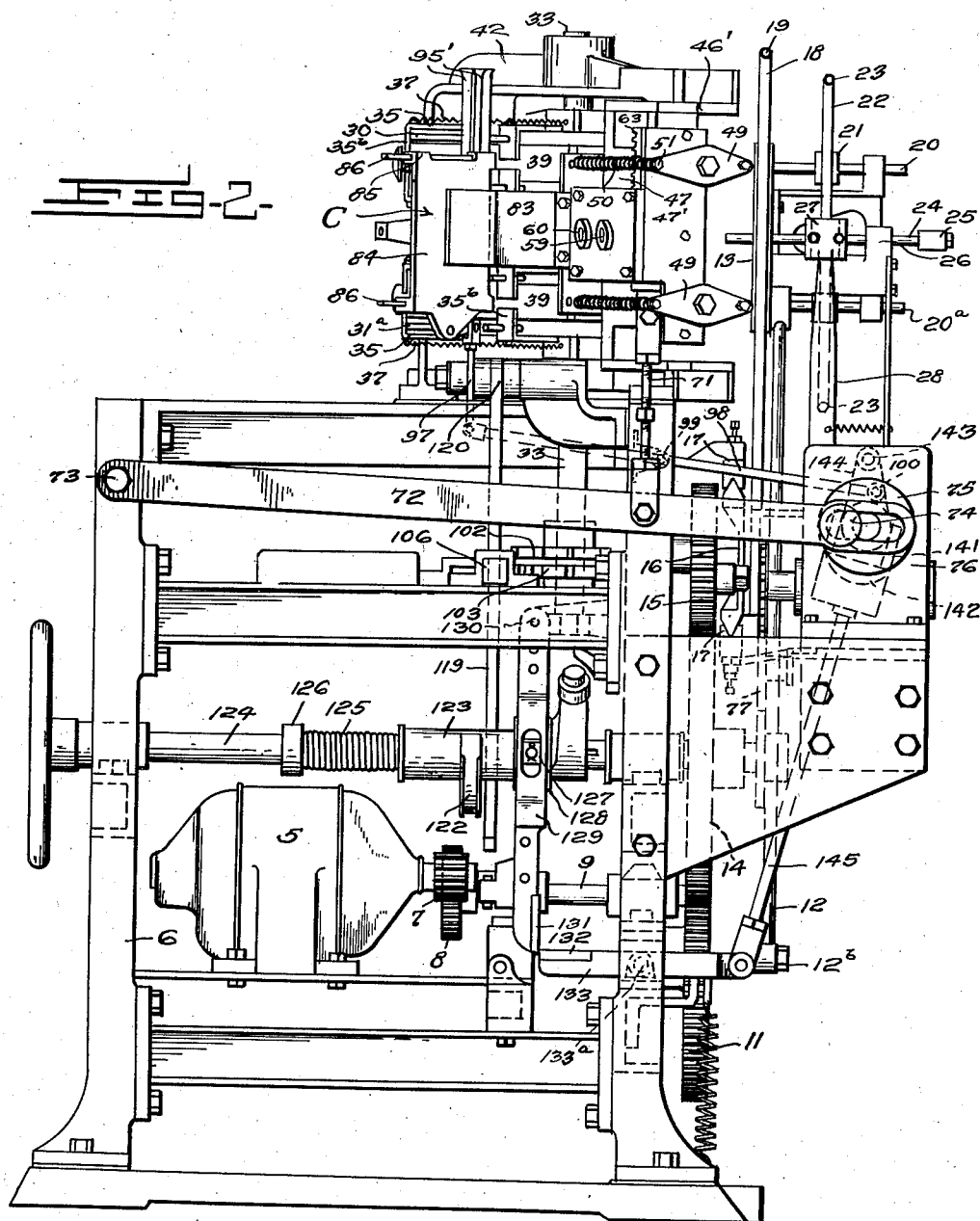
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WIRE FOLDING, CUTTING, AND HANDLING MACHINE

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10 Sheets-Sheet 2



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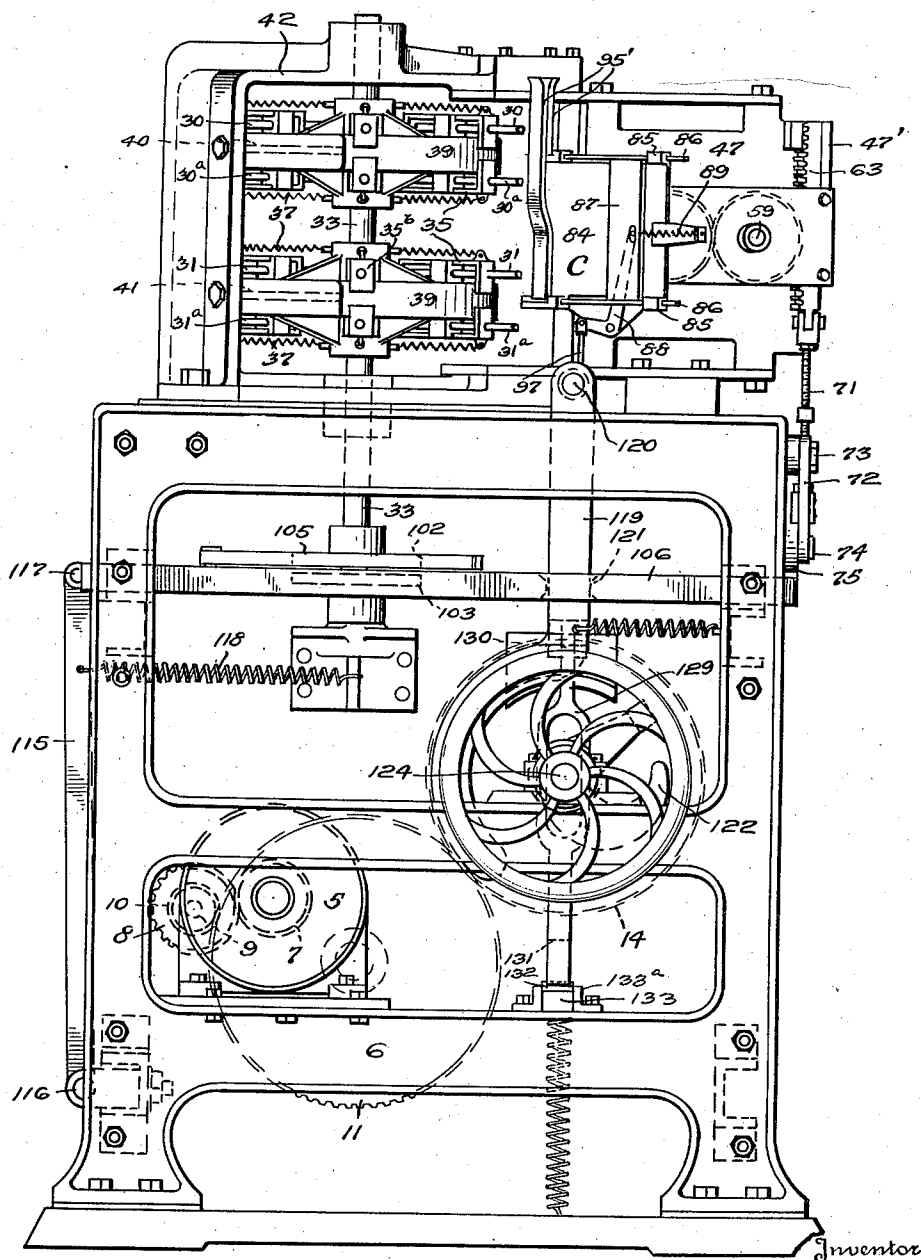
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WIRE FOLDING, CUTTING, AND HANDLING MACHINE

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10 Sheets-Sheet 3



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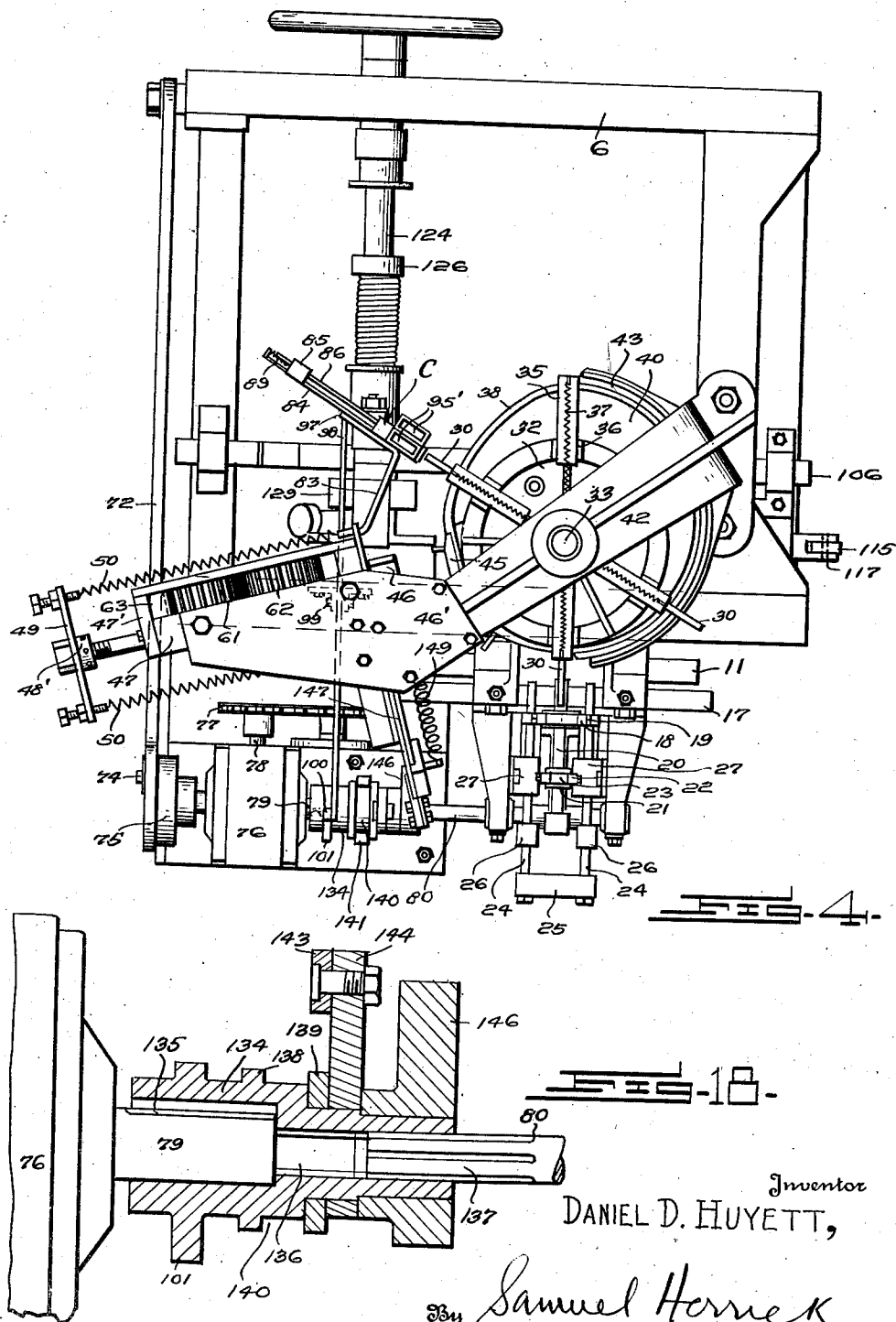
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WIRE FOLDING, CUTTING, AND HANDLING MACHINE

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10 Sheets-Sheet 4



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WIRE FOLDING, CUTTING, AND HANDLING MACHINE

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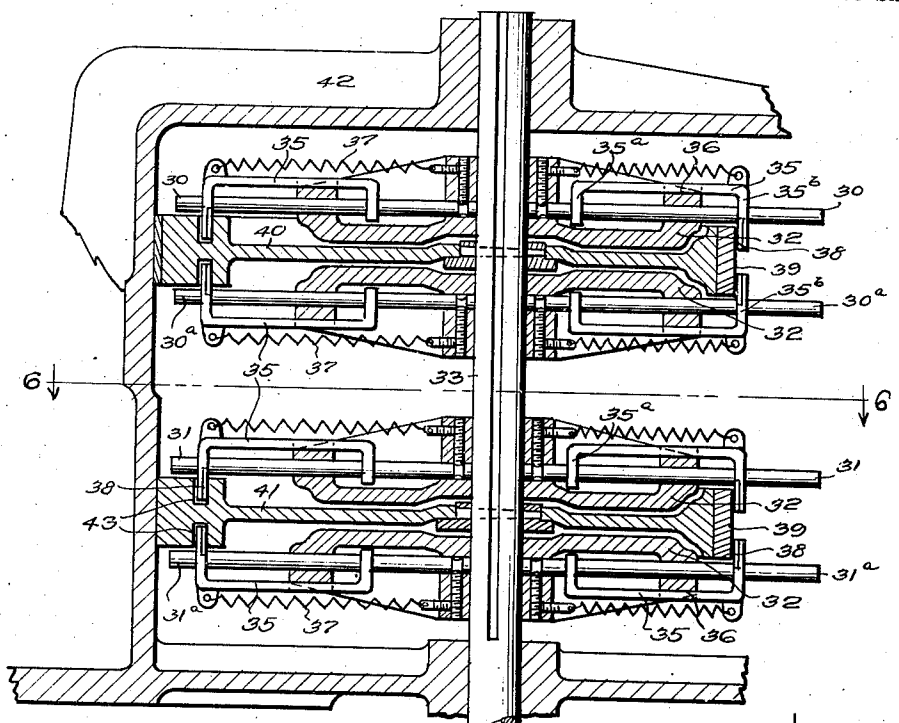


FIG. 5.

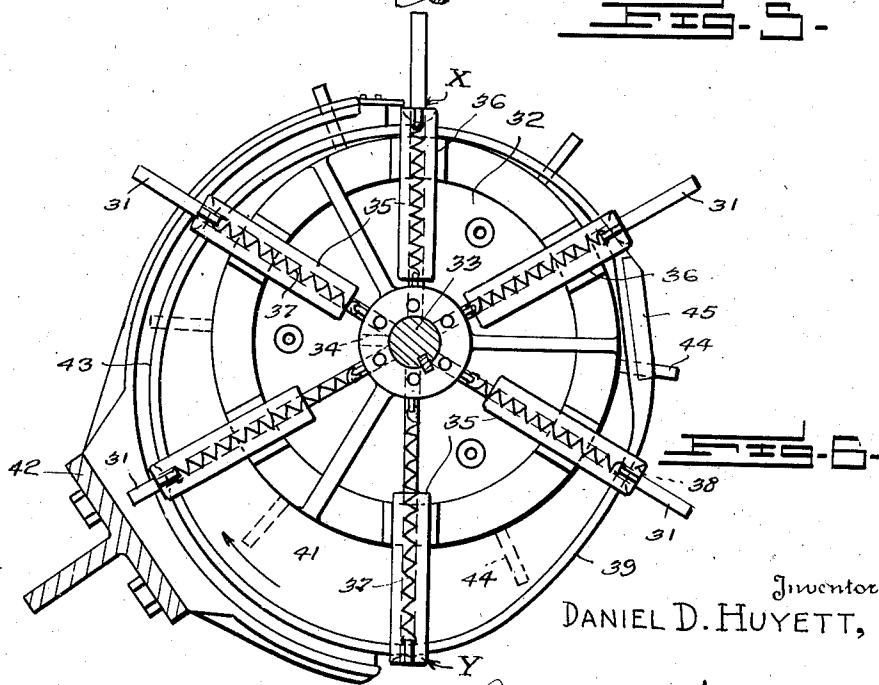


FIG. 6.

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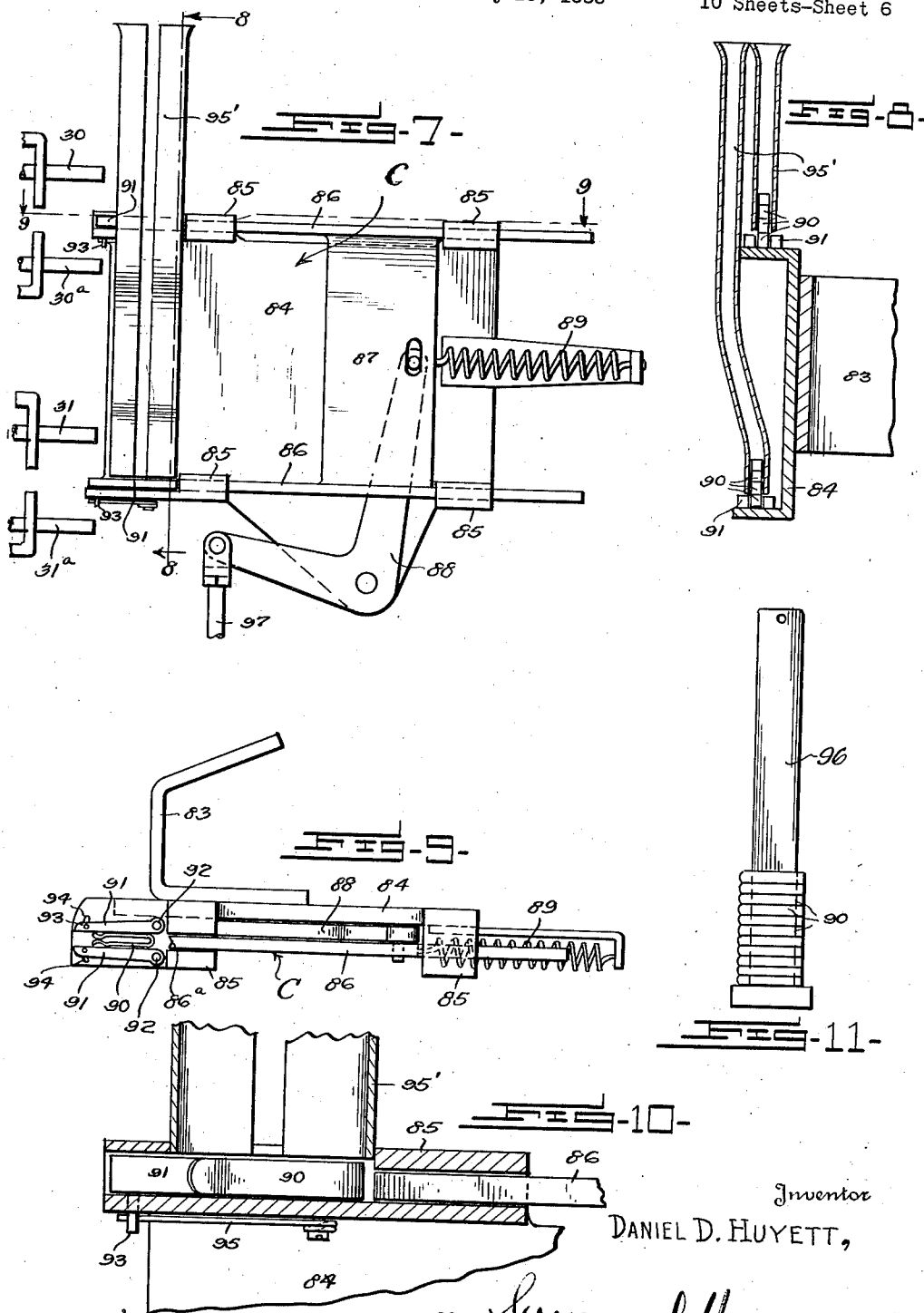
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WIRE FOLDING, CUTTING, AND HANDLING MACHINE

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10 Sheets-Sheet 6



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WIRE FOLDING, CUTTING, AND HANDLING MACHINE

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10 Sheets-Sheet 7

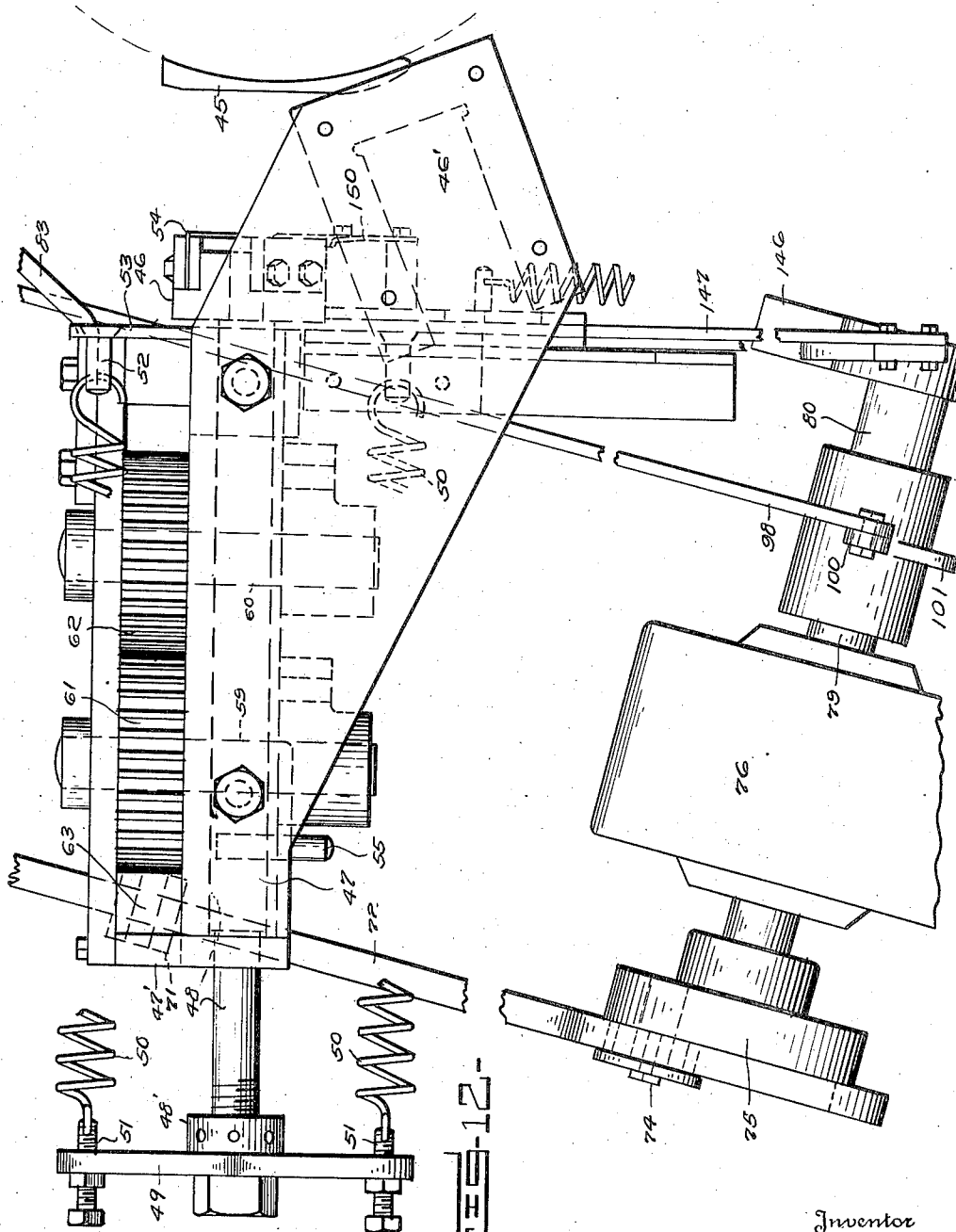


FIG. 12-

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WIRE FOLDING, CUTTING, AND HANDLING MACHINE

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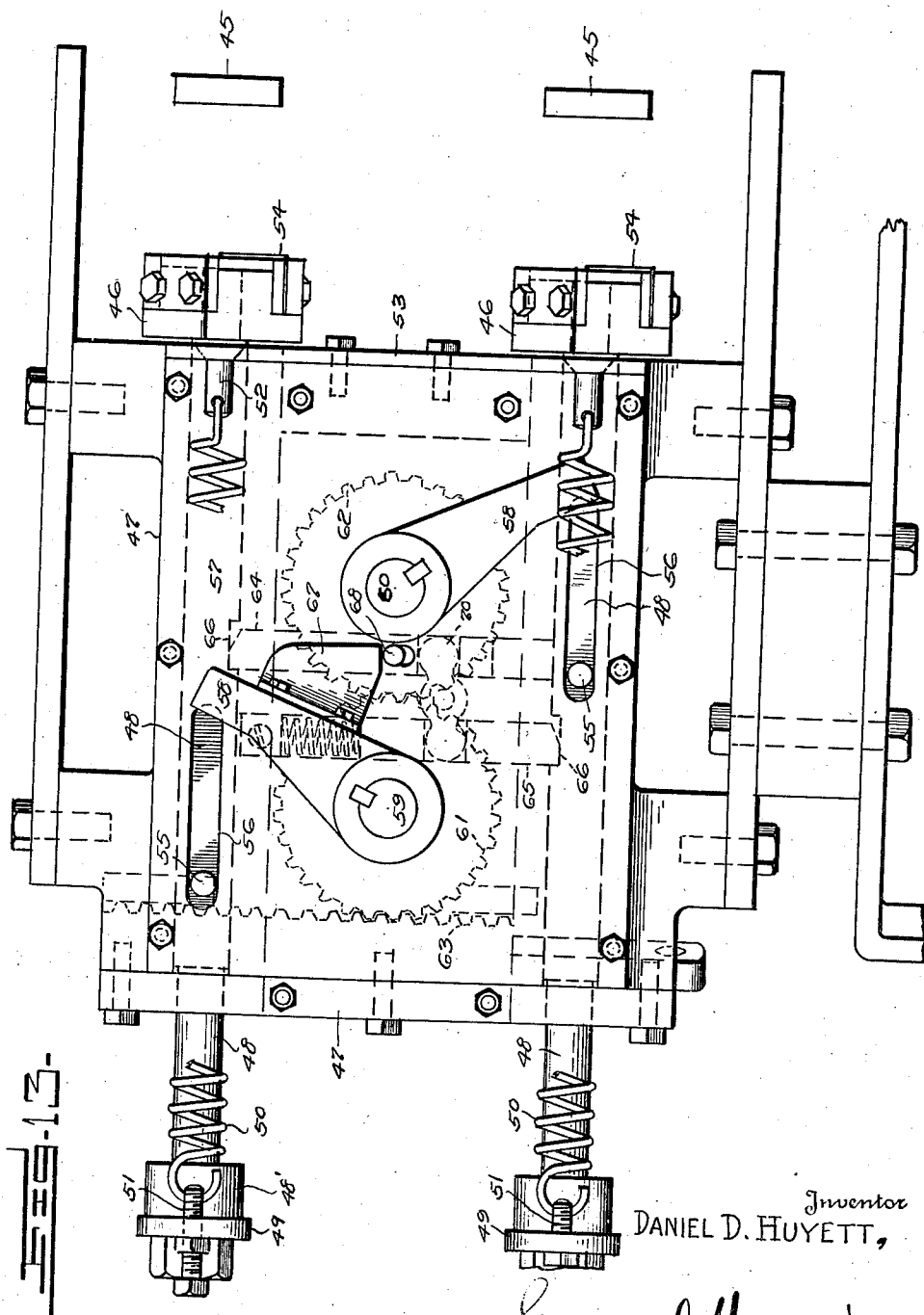


Fig. 13-

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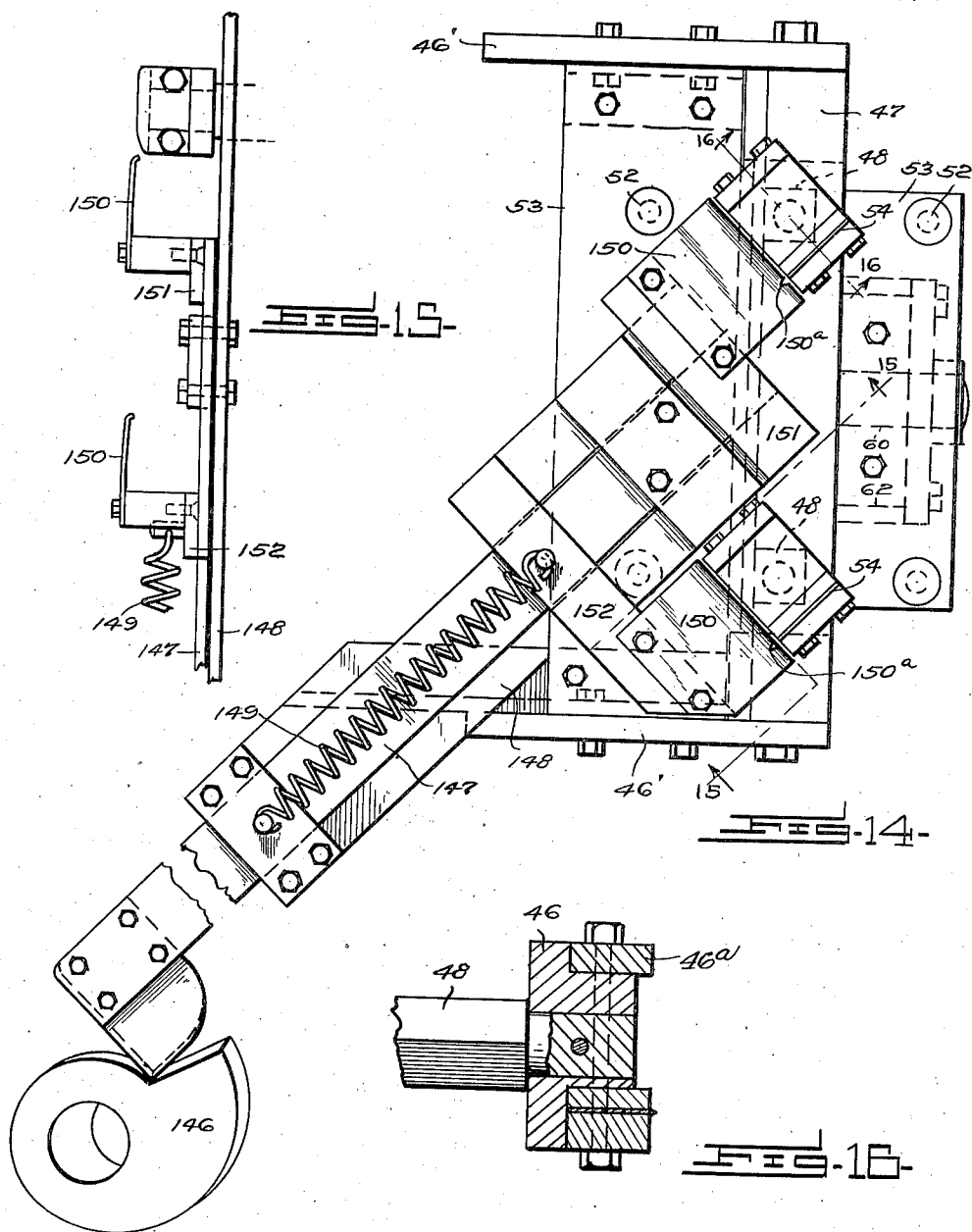
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WIRE FOLDING, CUTTING, AND HANDLING MACHINE

Filed May 16, 1935

10 Sheets-Sheet 9



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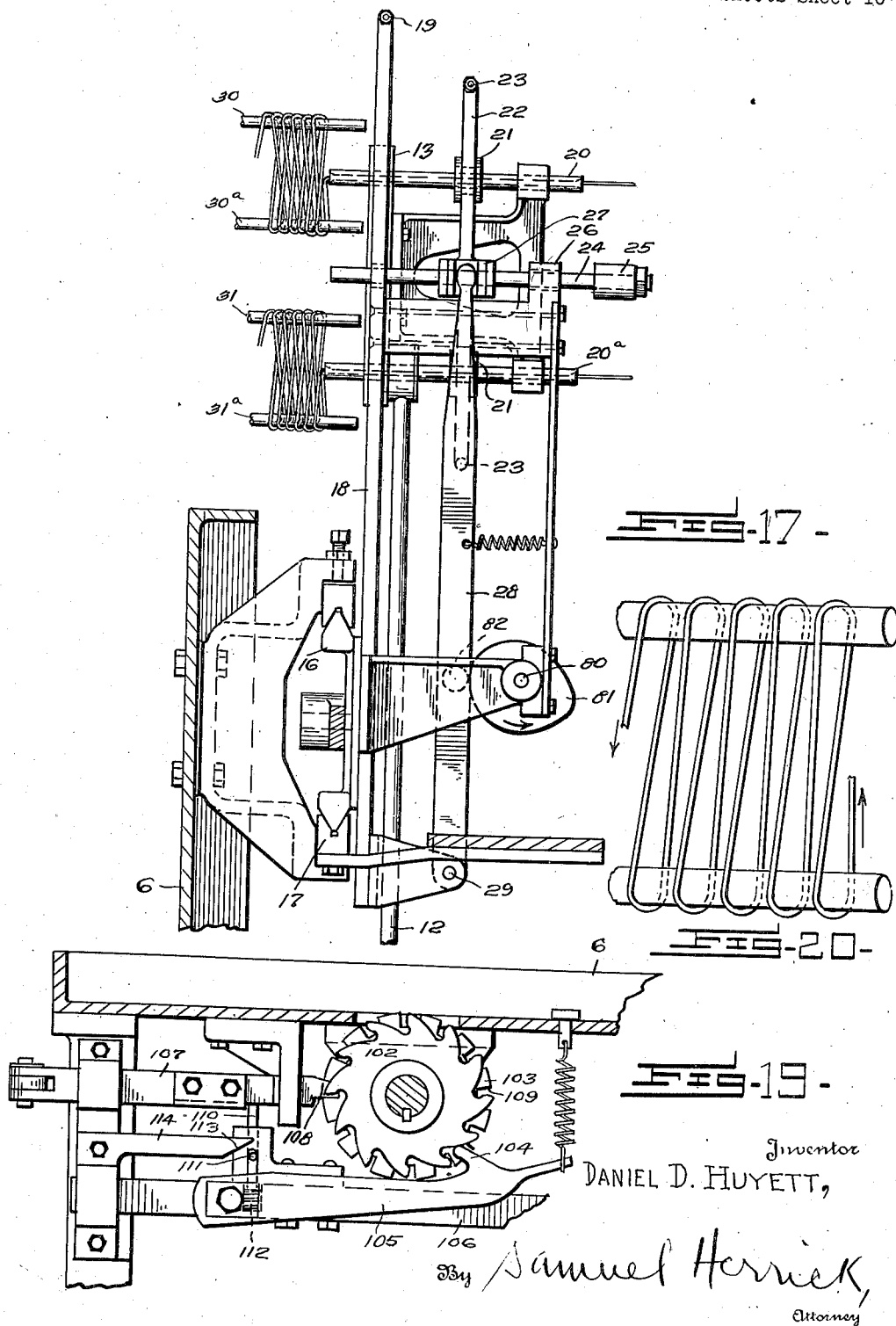
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WIRE FOLDING, CUTTING, AND HANDLING MACHINE

Filed May 16, 1935

10 Sheets-Sheet 10



UNITED STATES PATENT OFFICE

2,061,579

WIRE FOLDING, CUTTING, AND HANDLING
MACHINEDaniel D. Huyett, Wilmington, Del., assignor to
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Application May 16, 1935, Serial No. 21,859

36 Claims. (Cl. 140—71)

This invention relates to an improved wire folding, cutting and handling machine. The primary object of the invention is to provide an improved machine of the character indicated adapted to fold the lead wires of electric detonators in such manner as to facilitate the production of the detonator package which constitutes the subject matter of United States Patent 1,983,141, issued to D. M. McFarland on December 4, 1934.

The machine of the present invention is of the general character of the machines disclosed in my prior Patents 1,696,121 of December 18, 1928 and 1,928,786 of October 3, 1933, and the machine of the present application aims to improve the machines of the patents above referred to in such respects that the new machine will fold the leg wires of detonators into a group of figure-8 loops with each loop lying in a plane in advance of the plane of the loop preceding it, so that the wire may be drawn out into a single straight strand when the time of use arrives, without any intertangling or kinking of the wire.

A further feature of novelty inherent in the new machine is the provision of means for applying retaining clips to the bundles of wire after they have been wound but before they are removed from the pins upon which they were wound, said clips serving to retain the various loops of the bundle in proper relation to each other during the succeeding operations of attaching the wires to the detonators and applying the shunts to said wires. After the wires have been placed in the packaging tubes as shown in the McFarland patent above referred to, the tubes themselves hold the wires in their established relation. The clips applied by the machine of this invention serve to hold the various loops of the wound bundle in their proper relation, as stated, between the time at which the bundle is wound and the time of application of the tube to the bundle.

A further object of the invention is to provide a machine of such construction that a plurality of bundles may be wound simultaneously and through the instrumentality of a single shuttle actuating mechanism. To this end the machine employs a plurality of shuttles mounted upon a traverse mechanism, common to all of said shuttles, said traverse mechanism being of a nature to wind the wire in a figure-8 path after the manner disclosed in my prior patents aforesaid.

In addition to these improved functional differences, the machine of the present application

comprises various refinements in construction by virtue of which the desired results are accomplished in a facile and efficient way. For example, the new machine embodies a greatly simplified ejecting mechanism by which the wound bundles are ejected from the pins upon which they were wound; improved insulation removing and wire cutting means, and scraping means by which the insulation pounders are kept free of particles of insulating material.

Further objects and advantages of the invention will be set forth in the detailed description which follows.

In the accompanying drawings:

Fig. 1 is a front elevation of a machine constructed in accordance with the invention, with the turret head omitted,

Fig. 2 is a side elevation with the turret head in place,

Fig. 3 is a rear elevation,

Fig. 4 is a plan view,

Fig. 5 is a detailed vertical sectional view of the turret head and bundle ejecting mechanism,

Fig. 6 is a horizontal sectional view upon line 6—6 of Figure 5.

Fig. 7 is a detailed side view of the clip applying mechanism.

Fig. 8 is a vertical sectional view through the clip applying mechanism upon line 8—8 of Fig. 7.

Fig. 9 is a horizontal sectional view upon line 9—9 of Figure 7.

Fig. 10 is an enlarged fragmentary vertical sectional view through the lower portion of the clip applying mechanism.

Fig. 11 is a detailed view of a carrier by which the clips may be transported to the clip applying mechanism.

Fig. 12 is an enlarged plan view of the insulation pounding and wire cutting mechanism hereinafter described,

Fig. 13 is a side elevation of the insulation pounding and wire cutting mechanism;

Fig. 14 is a front elevation of the insulation pounding and wire cutting mechanism illustrating the scrapers for removing particles of insulation from the pounders;

Fig. 15 is a sectional view upon line 15—15 of Fig. 14;

Fig. 16 is a detailed sectional view upon line 16—16 of Figure 14;

Fig. 17 is a detailed transverse sectional view illustrating the shuttle actuating mechanism and cross head by which it is carried;

Fig. 18 is a sectional view of a slide coupling hereinafter described;

Fig. 19 is a plan view illustrating the turret indexing ratchet mechanism; and

Fig. 20 is a diagrammatic view illustrating the manner of winding the wires upon the pins as hereinafter set forth.

Like numbers designate corresponding parts in all of the figures of the drawings.

Power for actuating the machine is derived from any suitable source such for example as the motor 5, supported in the main frame 6 and driving through pinion 7, gear 8, countershaft 9, and pinion 10, to a large gear wheel 11. This gear wheel actuates a connecting rod 12 through which vertical reciprocation is imparted to a shuttle carrying slide 13, as hereinafter set forth.

The gear wheel 11 meshes with and drives a second gear wheel 14, and this gear wheel in turn meshes with and drives gear wheel 15. The gear wheels 11 and 14 have an equal number of teeth, while the gear wheel 15 has only half as many teeth as the gear wheel 14, and thus makes two revolutions to each revolution of the gear wheel 11. The gear 15 imparts horizontal reciprocation to a cross head 16 that is slidably mounted in ways 17 of the main frame.

Spaced vertical standards 18 are rigidly affixed to the cross head 16 to partake of the horizontal reciprocation of said cross head. These standards are tied together at the top, as indicated at 19, and it is between these standards that the shuttle actuating slide 13 is mounted for vertical reciprocation. For purposes of explanation, I have illustrated two shuttles 20 and 20a, these shuttles being caused to describe identical paths with respect to associated winding pins, as presently set forth. I wish to make it clear, however, that more than two shuttles may be actuated simultaneously from a single shuttle carrying and actuating mechanism, if desired.

Spool like members 21 upon the shuttles receive the edges of a pair of spaced bars 22 between them. These bars are tied together at their upper and lower ends as indicated at 23. Rods 24, which are tied together by a cross bar 25 and are slidably supported in bracket 26, and standards 18 carry the bars 22, through block like extensions 27 of said bars 22. The upper ends of actuating levers 28 are rounded for engaging in end recesses of said blocks. The lower ends of these levers are pivoted at 29 to a bracket extension of the spaced standards 18, and said levers are actuated by cams hereinafter described.

Since the cross head 16 makes two horizontal strokes to each vertical stroke of the shuttles, it follows that each shuttle will describe a figure-8 path to bring about the laying of the wire to be wound in figure-8 form upon the pairs of winding pins 30, 30a, 31, 31a. At the beginning of the winding of the wire upon any given set of pins, these shuttles are projected to their limit of movement inwardly, or toward said pins, so that the winding of the wire is from the inner portions of the pins outwardly toward their ends, and as the winding proceeds, a lateral traverse is imparted to the shuttles through the medium of the arms 28, so that the wire is laid upon the pins in progressive, non-intersecting, and non-tangled loop formation, as illustrated in Fig. 17.

The winding pins 30, 30a, 31, 31a, are fixed in disks 32 said disks being splined upon the turret shaft 33 to turn therewith but being capable of being adjusted toward and from each other upon said shaft through the medium of set screws of conventional form, indicated in dotted lines at 34. The length of the bundles may be increased

or diminished by adjusting the pairs of disks 32 away from or toward each other as the case may be, and, to adjust the stroke of the connecting rod 12, when adjusting the length of the bundle, the gear wheel 11 is provided with a plurality of openings 12a for the reception of the crank pin 12b by which the connecting rod is actuated, said openings 12a being varying distances from the center of the gear 11. The number of wraps per bundle may be varied by changing the ratio of the chain drive to the high speed shaft of the reducing mechanism hereinafter described.

For ejecting the wound bundles from the pins, strippers 35, of inverted U-shape, have their legs 35a, 35b slidably mounted upon said pins and have their intermediate portions guided in recesses 36 of said disks 32. Springs 37 tend to retract the strippers and to cause wear plates 38, carried by the leg members 35b of said strippers, to bear against the cam faces 39 of fixed disks 40, 41.

The fixed disks are in turn carried by the turret cap 42. These fixed disks comprise cam ways 43 and the shape of the several cam surfaces is such that, guiding the ejectors during the rotation of the disks 32 with respect to the fixed disks 40, the ejectors are fully retracted at the winding position, as indicated at X in Fig. 6. These ejectors are fully projected against the tension of their springs 37 by the time that they reach the discharge position of the bundles, as indicated at Y in Fig. 6, and are gradually returned to fully retracted position during the time of their travel from position Y to position X.

The lowermost disks 32 carry guide pins 44, there being one of these guide pins between each of the pairs of winding pins. After one bundle has been wound, the turret constituted by shaft 33, disks 34, and associated parts, is indexed or stepped forward to bring the next set of winding pins into juxtaposition to the traveling shuttles. In its initial movement, the wire is first looped over a guide pin 44 of the lowermost disk 32 of a pair of said disks, and is next carried over the upper winding pin 30. This causes the wire to lie obliquely across the face of the anvil 45 and in position to have the insulation crushed therefrom by the insulation pounding heads 46.

The insulation pounding and wire cutting mechanism is best illustrated in Figs. 4, 12, and 13. By reference to these figures, it will be seen that a supporting bracket 46' projects from the turret cap 42 and constitutes a carrier for a block 47. Since there are two winding mechanisms, upper and lower, it follows that there are two pounders. Each pounder comprises a shank 48, angular in cross section to cause the pounder head, and the cutter carried by said pounder head, to maintain the proper oblique position to insure that the cutter will engage the wire substantially at right angles to its length; it being remembered that the wire extends obliquely across the face of the anvil because of the fact that it extends from a lower guide pin 44 to an upper winding pin 30 or 31 as the case may be. The shanks 48 are slidable in block 47, and the pounder heads comprise steel pounding blocks 46a (Fig. 16) which perform the actual work of crushing the insulation.

The shanks 48 carry transverse bars 49 at their outer ends, and pairs of springs 50 are connected to these bars through the medium of adjusting screws 51, the opposite ends of said springs being connected to studs 52 that are carried by plates 53. It will be seen that the springs 50 tend to thrust

the pounder heads 36 forcibly toward the anvil 45. Cutting plates 54, carried by the pounder heads, serve the function of actually severing the wires, while the pounder heads themselves serve merely to crush the insulation from the wires and leave the terminal ends of said wires free of insulation, it being understood that one end of the wires of each bundle is to be attached to an electric detonator, while the other end receives a safety shunt and serves as the attaching means by which the detonator is to be connected to the firing cable of a blasting machine, when the time of use arrives.

The shanks 48 of the pounders and cutters carry pins 55 which project outwardly through slots 56 of a side plate 57. These pins are thrust outwardly to place the springs 50 under tension, by swinging arms 58 which are connected to oscillatory shafts 59 and 60. Gear wheels 61 and 62 upon these shafts mesh with each other and the gear wheel 61 is engaged by a rack bar 63.

When the rack bar is drawn downwardly (Fig. 13) the pins 55 are thrust outwardly until detent latches 64 and 65 snap into notches 66 of the shank 48, said latches then holding the pounder heads in retracted position during the return or upward movement of the rack bar 63 and until a trip bracket 67 carried by one of the arms 58 engages a pin 68 on one of the latches 64 to retract said latch. The movement of this latch is imparted to the other latch 65 through a pivoted rock lever 70, and thus both pounder heads are released at the same time, and the springs 50 act to thrust said pounder heads and cutters forcibly toward the anvil for the purpose of crushing the insulation and cutting the wire, as aforesaid. This movement is limited by contact of bosses 48' with cap plate 47'.

The rack bar is connected by a suitable link mechanism 71 to a lever 72. (See Fig. 2.) This lever is pivoted at 73 to the frame of the machine and its free end is slotted and engaged by a wrist pin 74 of a crank disk 75, that is actuated from the slow speed shaft of a conventional reducing mechanism 76.

The details of this reducing mechanism have not been illustrated, because these are common mechanical units which may be purchased on the open market having driving and driven shafts of varying speed ratios with respect to each other. The ratio employed in the present machine is preferably about 12:1, but this ratio may be varied if desired. The high speed shaft of the reducing mechanism is driven through a silent chain or sprocket mechanism 77 from the shaft of gear wheel 14, said high speed shaft being indicated at 78. The low speed shaft of the reducing mechanism is indicated at 79, and this shaft is suitably coupled to a corresponding low speed shaft 80 (Fig. 1) which carries cams 81 by which the arms 28 are actuated to impart the desired traverse to the shuttles 21. These cams engage a suitable roller 82 carried by said arms. (See Fig. 17.)

After the bundles have been wound and after they pass beyond the anvil, the winding pins by which they are carried come to rest in front of the clip applying mechanism, indicated generally at C, Figs. 2, 3, and 4, and illustrated in detail in Figs. 7-10. This clip applying mechanism is carried by a bracket 83 which projects from the pounder body. (See Figs. 4 and 12.)

By referring to Fig. 9, it will be seen that this bracket 83 supports a plate 84, said plate carrying forwardly projecting bearing extensions 85

through which pusher bars 86 slide. These bars are connected to move in unison by a cross head 87 and this cross head is projected forwardly by the actuation of a bell crank lever 88 and retracted by the action of a spring 89.

The forward ends of the pusher bars are notched as indicated at 86a to adapt them to securely engage the rear ends of the clips 90 and to thrust said clips forwardly to engage the bundles at about their central portions. Fingers 91 are pivoted at 92 and carry pins 93 at their forward end portions. The pins 93 project through slots 94 and are engaged by springs 95. (See Fig. 10.) The fingers hold the clips in proper position until the pusher bars eject the lowermost clip of a pile, the piles of clips being received in magazines 95'. A carrier bar 96 (see Fig. 11) provides means for holding the clips in assembled relation during the time that they are being carried to and deposited in the magazines 95'.

The bell crank lever 88 of Fig. 7 is actuated by link 97, and this link is, in turn, actuated by a rocking lever 98, to one end of which link 97 is pivoted. Lever 98 is in turn pivoted at 99 and carries a roller 100 at its free end, said roller being actuated by a cam 101, driven from the slow speed shaft of the reducer in a manner hereinafter set forth.

The mechanism for imparting the desired step by step movement to the turret constituted by the disks 32 and associated parts, is substantially identical with the like parts shown in my prior patents aforesaid. It is sufficient to say that the shaft 33 of the turret carries ratchet disk 102 and locking disk 103. Ratchet disk 102 is engaged by the nose 104 of a pawl 105 that is pivoted to a horizontally sliding bar 106. A locking plunger 107 has a nose 108 adapted to engage in the locking notches 109 of the locking disk. When the bar 106 is moved toward the left in Fig. 19 a pin 110, which engages a shoulder on the locking plunger, moves said plunger out of engagement with the locking disk, and then the nose 104 of pawl 105 engages a tooth of the ratchet disk to impart one step of rotation to the turret.

The pin 110 carries a lateral extension 111, and said pin is held in an elevated position by spring 112. When the pin 111 rides beneath the cam surface 113 of a bracket 114, the pin is depressed and the locking plunger is released and shoots forward preparatory to again engaging the locking disk when the next notch of said disk comes into alignment with the nose 108 of said plunger.

The construction of this part of the machine differs from that of my prior patents only in the means for actuating the locking plunger, which means, in the present instance, comprises a lever 115. This lever is pivoted at its lower end as indicated at 116 and is pivotally connected to the outer end of the locking plunger at 117. A spring 118 tends to project the locking plunger 107 toward the locking disk. The bar 106, as in my patents aforesaid, is actuated by a swinging lever 119, the upper end of which is hung upon a pivot 120. This lever passes through the bar as indicated at 121 in Fig. 3 and its lower end is disposed to be engaged by a cam 122 of a sleeve 123 that is splined upon and rotates with the shaft 124 of the intermediate gear wheel 14.

The sleeve 123 is urged toward the right by a spring 125 which bears between said sleeve and a collar 126. However, movement of the sleeve toward the right is resisted by the engagement

of bearing blocks 127, only one of which is shown, between collars 128 of said sleeve. These bearing blocks are carried by a lever 129 of yoke-like formation. Said lever is pivoted at its upper end, as indicated at 130, and its lower end is provided with a wear plate 131, adapted to be engaged by a wear plate 132 of a trip lever 133.

When the inner end of this trip lever is depressed to free yoke 129, and consequently to free the sleeve 123, said sleeve moves bodily toward the right; cam 122 is brought into alignment with lever 129, and as this cam rotates, the lever is swung upon its pivot to move the bar 106 endwise and consequently to index the turret one step.

It will be observed that there are 12 teeth to the ratchet disk, while there are only 6 sets of pins to each shuttle. However, it will also be observed that the additional guide pins 44, carried by each of the lowermost of the pairs of rotative disks, make the total number of pins, considered circumferentially with respect to the several disks, equal in number to the notches of the ratchet disk. Thus, two actuations of the ratchet disk take, in the advancement of the turret, a distance equal to the distance between the sets of winding pins, and during the first of these movements, the wire is looped under the guide pin 44.

Referring now to Fig. 18, it will be seen that the controlling means for the several mechanisms hereinbefore described are concentrated in and about the reducing mechanism. In this figure, I have illustrated the connection between the slow speed shaft 79 of the reducing mechanism and the shaft 80 which actuates the cams 81 of the shuttle traverse mechanism. Since the reducing mechanism 76 is fixed to the frame of the machine, while the cams 81 reciprocate bodily, horizontally with the cross head 16, it follows that the connection between the slow speed shaft 79 and the shaft 80 must be a sliding one. To effect that result, I have provided a sleeve 134 that is keyed at 135 upon the shaft 79, said sleeve having a reduced internal bore 136 having splined engagement with a correspondingly shaped end 137 of shaft 80.

A flange 138 upon the sleeve, in conjunction with a disk 139, constitutes a recess 140 within which the arms of a yoke 141 are received. This yoke is provided upon one of its sides with a cam 142 adapted to be engaged by a roller 143 of a crank arm 144, said crank arm being mounted upon and turning with the sleeve 134. The function of the roller 143 is to engage beneath the cam 142 to elevate the yoke and a rod 145, said rod constituting the actuating means for the trip lever 133. This lever is pivoted intermediate its ends at 133a, and when the rod 145 is drawn upwardly by the cam roller acting upon cam 142 (Fig. 2), lever 129 will be released and, through the connections described, the turret will be indexed forward one step.

Further, the sleeve 134 carries a cam 146 for operating the scraper mechanism by which the pounder heads are kept free of accumulations from the crushed insulation. The scraping means comprises a reciprocatory bar 147 that is slidably mounted in a guide 148, supported from the pounder mechanism. A spring 149 tends to keep this bar and the parts carried thereby in engagement with the cam 146. The cam and spring act to reciprocate this bar and move spring steel scraper plates 150 carried thereby across the face of the pounder heads and across the cutters. To permit the scraping plates to contact with the

pounder heads without interference by the cutters or blades 54, said scraper plates are notched, as indicated at 150a, so that the plates may pass therethrough. The scraper plates are secured to the transverse blocks 151, 152, of bar 147. The sleeve 134 carries the cam 101, which constitutes the actuating means for the clip applying mechanism, said cam engaging the roller 100 upon the rock lever 98, for the purpose of actuating the bell crank lever 88 of the clip mechanism, as hereinbefore set forth.

It is common practice in wire winding machines of various kinds to apply tensioning devices to the wires to take up undesirable slack, and to keep the wire taut during the winding operation. I contemplate the use of any such tension device, the particular form of which may vary widely without affecting the proper and efficient operation of this machine. The machine of the present invention is intended to handle wire, which, while flexible, still has such inherent stability and resistance to change of form that when it has been wound to figure-8 form it will retain that shape to constitute permanently formed, progressively disposed loops; until the wire is positively drawn out by the operator. In this respect the invention differs from mere thread winding devices which wind threads of such a low degree of stability that they would tend to fall into many different shapes as soon as released from the pins upon which they are wound.

It is of course apparent that many ways will readily suggest themselves to the skilled engineer for accomplishing the results at which this invention aims, while employing means different from those shown and described. I therefore wish it to be understood that the invention is not limited to the construction herein disclosed, but that it includes within its purview any structure fairly falling within either the terms or the spirit of the appended claims.

Having described my invention, what I claim is:

1. The herein described method of winding the leg wires of detonators upon a pair of spaced supports, which consists of passing said wire through a shuttle moving in a figure-8 path with respect to said supports, and simultaneously imparting lateral traverse to said shuttle with respect to said supports to thereby lay the wire upon said supports in a plurality of permanently formed progressively disposed, non-intersecting loops.

2. The herein described method of winding detonator leg wires upon a pair of spaced supports which consists of passing said wire through a shuttle moving in a figure-8 path with respect to said supports, simultaneously imparting lateral traverse to said shuttle with respect to said supports to thereby lay the wire upon said supports in a plurality of permanently formed, progressively disposed, non-intersecting loops, and applying a retaining means to the bundle of loops prior to their removal from the said supports.

3. A machine of the character described, comprising in combination a turret, a pair of spaced supports carried by said turret, a shuttle-carrying slide and shuttle carried thereby, means for imparting such movement to the shuttle-carrying slide that the shuttle is caused to travel in a figure-8 path and to wind wire in figure-8 form upon said spaced supports, and means for imparting a lateral traverse to the shuttle during its movement in such fashion and to such an extent as to thereby lay the wire upon the spaced supports

in a plurality of progressively advancing and non-intersecting loops.

4. A machine of the character described comprising a turret carrying a plurality of pairs of spaced supports, a shuttle-carrying slide, means for imparting such movement to said slide as to cause it to describe a figure-8 path, and a plurality of shuttles carried by said slide and cooperating with the respective pairs of spaced supports of the turret.

5. A machine of the character described comprising a turret carrying a plurality of pairs of spaced supports, a shuttle-carrying slide, means for imparting such movement to said slides as to cause it to describe a figure-8 path, a plurality of shuttles carried by said slide and cooperating with the respective pairs of spaced supports of the turret, and means for imparting a lateral traverse to said shuttles with respect to the spaced supports, so that the said wires will be laid upon said supports in the form of a bundle of progressively advancing, and non-intersecting loops.

6. A structure as recited in claim 5, in combination with clips adapted to embrace the bundle of loops, a carrier for said clips, and means for projecting said clips from the carrier and into engagement with the bundle of loops, while said loops are upon the pair of spaced supports.

7. A structure as recited in claim 3, in combination with an anvil associated with the turret, and an insulation pounding and wire cutting mechanism cooperating with said anvil.

8. A structure as recited in claim 3 in combination with an anvil associated with the turret, an insulation pounding and wire cutting member associated with the anvil, a clip applying mechanism, and means for imparting step by step movement to the turret to carry the wound bundles from winding position to insulation pounding and cutting position and thence to clip applying position.

9. A structure as recited in claim 3 in combination with an insulation pounding and wire cutting mechanism disposed adjacent the turret, a clip applying mechanism disposed adjacent the turret, a bundle ejecting means associated with the turret, and means for imparting step by step movement to the turret to carry the wound bundles into position to be successively acted upon by the mechanisms aforesaid.

10. A machine of the character described comprising a shuttle actuating assembly consisting of a reciprocatory cross head, supports affixed thereto and moving therewith, a shuttle slide mounted in said supports, a shuttle mounted to move laterally through said slide, means for imparting uniform reciprocatory movement to the slide, and means for imparting such uniform lateral traverse to the shuttle with respect to the slide as to cause wire guided by said shuttle to be wound in the form of a plurality of uniformly progressing non-intersecting folds or loops.

11. The combination with a machine of the character described, of a shuttle actuating member comprising a reciprocatory cross head, a pair of supports constituting ways secured to and bodily movable with the cross head, a shuttle slide mounted in the ways constituted by said supports, means for imparting reciprocatory movement to the said shuttle slide, a plurality of shuttles movable laterally through the shuttle slide, and means for imparting movement in unison to said shuttles, laterally with respect to the slide through such portions of the travel of the

said slide as to cause the said shuttles to guide wire passing therethrough in such fashion as to wind the wire in the form of a bundle of progressively advancing, non-intersecting folds or loops.

12. A machine of the character described comprising a reciprocatory cross head, ways carried thereby, a shuttle slide vertically reciprocating in said ways, a plurality of shuttles movable laterally with respect to said slide, collars carried by said shuttles, a yoke-like member engaged with the collars of the respective shuttles, and a swinging lever actuating said yoke-like member.

13. In a machine of the character described, a turret comprising a pair of rotative disks, fixed winding pins carried by said disks, strippers slidably mounted for endwise movement upon said pins, and means for moving said strippers endwise upon said pins to eject bundles of wire therefrom.

14. In a machine of the character described, a turret comprising a pair of disks, fixed pins arranged complementally upon said disks to constitute pairs of pins, ejecting members slidable upon said pins, and means for moving said ejectors endwise to eject bundles of wire from said pins.

15. In a machine of the character described, a turret comprising a pair of rotative disks, pins carried by said disks, the pins of one disk being aligned with the pins of the other disk to constitute pairs of winding pins, a fixed cam, strippers upon said pins, and members upon said strippers for engaging said cams and moving the strippers to eject wound bundles of wire therefrom.

16. In a machine of the character described, a turret comprising a pair of rotative disks, a fixed disk between the rotative disks, cam trackways carried by the fixed disk, pins carried by the rotative disks and arranged in pairs, ejectors slidably mounted upon said pins, and member carried by the ejectors and engaging the cam trackways.

17. A structure as recited in claim 16, in combination with means for adjusting the rotative disks toward and from each other to thereby vary the length of the bundles of wire wound upon said pins.

18. The combination with a machine of the character described, of a turret comprising a shaft, means for imparting step by step movement to said shaft, a pair of disks rotating with the shaft, means for adjusting the disks toward and from each other upon the shaft, fixed winding pins projecting radially from the disks, strippers of inverted U-shape, the legs of which slidably engage said pins, and a fixed member between said disks carrying cam trackways with which one of the legs of each of the strippers engages.

19. A structure as recited in claim 18, in combination with an anvil carried by said fixed member.

20. A structure as recited in claim 18, in combination with a set of guide pins upon the lowermost of said disks, between the winding pins of said lowermost disk.

21. A machine of the character described comprising a turret including a plurality of pairs of rotative disks, winding pins carried by said disks and arranged in superposed pairs, a shuttle operative with respect to each of the pairs of pins, and means for causing said shuttles to describe a figure-8 path in unison.

22. In a machine of the character described, 75

the combination with a plurality of winding mechanisms, a plurality of pairs of winding pins associated with the plurality of winding mechanisms, anvil surfaces over which wire is drawn, an insulation crushing pounder, and wire cutter for each of the winding mechanisms, and a common actuating means for said pounders.

23. An insulation pounding and wire cutting mechanism, comprising a pair of pounder heads, wire cutting elements carried by said pounder heads and projecting slightly in advance thereof, springs tending to project said pounder heads, a common actuating member, a pair of movable members operated by the common actuating member and serving to retract the pounder heads against the tension of their springs, detent mechanisms for holding the pounder heads in retracted position and against the tension of their springs, and means for moving the detent mechanisms to release the pounder heads at the completion of movement of the pair of movable members in one direction.

24. In a machine of the character described, the combination with a supporting block, of a pair of pounder heads, shanks by which said heads are carried, supported in said block, springs tending to urge said shanks in one direction, a rack, a pair of meshing gears one of which is engaged by said rack, arms movable with said gears, members carried by said shanks and adapted to be engaged by said arms for retracting the shanks against the tension of their springs, a pair of latches, springs actuated to engage said shanks and hold the pounder heads in retracted position against the tension of said springs, means engaging said latches to move them in unison, and means carried by one of said arms for moving said latches to release the shanks as described.

25. A structure as recited in claim 24, in combination with a wire cutting blade carried by each of said pounder heads and projecting beyond the face of the pounder head a distance approximately equal to the thickness of the insulation upon the wire to be cut.

26. In a machine of the character described, the combination with a pounder head for pounding the insulation from the firing cable of electric detonators, of a scraper and means for moving said scraper over the face of said pounder head for the purpose of keeping the same free of accumulations of insulating material.

27. A machine of the character described comprising a pair of pounder heads, a pair of scrapers for the faces of said pounder heads, a common shank by which said scrapers are carried, a spring for moving said shank in one direction, and means for actuating the shank in the other direction.

28. In a device of the character described, the combination with a pair of pounder heads having wire cutting blades projecting beyond the face thereof, of scrapers movable over the pounder heads and having notched portions for the reception of said blades.

29. A structure as recited in claim 28, in combination with a common shank for said scraper blades, a guide through which said shank moves, a spring engaging the guide and the shank, and a cam for moving the shank and blades against the tension of said spring.

30. In a machine of the character described, the combination with a pair of spaced winding pins and means for winding wire in bundle formation thereon, of a clip applying mechanism

disposed in juxtaposition to said pins and comprising a holding means for bifurcated clips and an ejector for thrusting said clips endwise into engagement with the wires constituting the wound bundle.

31. In a machine of the character described, the combination with a pair of spaced winding pins, of a clip carrying mechanism, comprising a chute adapted to receive a plurality of bifurcated clips with their open ends disposed toward the wound bundles upon said pins, a push bar in alignment with the lowermost clip of a pile, a yieldable holding means for the clip by which the clip is held and guided in a straight line and into engagement with the wires of the wound bundle, and means for actuating the pusher bar to thrust the clip into engagement with the wound bundle.

32. In a machine of the character described, the combination with a turret comprising two pairs of winding pins disposed in superposed relation to each other, in combination with a clip applying mechanism comprising two clip holding elements adapted to engage elongated bifurcated clips having their open ends disposed toward wound bundles upon said pins, pusher bars movable toward said bundles, and a common actuating means for the pusher bars.

33. A clip applying mechanism for a machine of the character described, comprising a support, a pair of magazines adapted to receive elongated and bifurcated clips with their open ends disposed outwardly, spring actuated fingers having straight parallel confronting faces which engage and guide the lowermost of said clips in a straight line, pusher bars adapted to engage the lowermost clips of each magazine, and a common actuating member for the pusher bars.

34. A machine of the character described, comprising a source of power, a train of gearing driven by said source of power, a shuttle, a shuttle actuating connecting rod connected to one of the gears of said train, a reducing mechanism comprising a high speed shaft driven from said train of gearing and a low speed shaft, a turret, means for imparting step by step movement to the turret, said means comprising a trip lever, a clip applying mechanism, an insulation pounding and wire cutting mechanism, and means for imparting transverse traverse to the shuttle, the slow speed shaft of the said reducer being provided with means for controlling the lateral traverse of the shuttle, the movement of the pounder, the movement of the clip applying mechanism, and the said trip.

35. A machine of the character described, comprising a source of power, a train of gearing driven thereby, a horizontally reciprocatory cross head, a connecting rod connected to said cross head and to one of the gears of said train, a shuttle-carrying slide, a connecting rod connected to said shuttle-carrying slide and to another of the gears of said train, the last named gear rotating only half as fast as the gear which actuates said cross head, guides carried by said cross head in which the shuttle carrying slide moves, a plurality of shuttles, and means for imparting lateral traverse to said shuttles with respect to the shuttle carrying slide, said means comprising a pair of swinging arms, rotative cams for moving said arms, a shaft by which said cams are carried, a reducing gearing comprising a high speed shaft and a low speed shaft, the high speed shaft of said reducing gearing being driven from the first named train of gearing, a slidable

coupling between the said cam-carrying shaft and the slow speed shaft of the reducing mechanism, said slidable connection permitting horizontal reciprocation of the cross head, while
5 maintaining driving connection between the reducing mechanism and the said cam carrying shaft.

36. A structure as recited in claim 35, in combination with an insulation pounding and wire

cutting mechanism, a clip applying mechanism, a turret carrying a plurality of pairs of winding pins, means for imparting step by step movement to said turret, a trip for controlling the last named means, and means actuated by the
5 slow speed shaft of the reducer and actuating said trip, pounder mechanism, and clip applying mechanism.

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