

July 29, 1930.

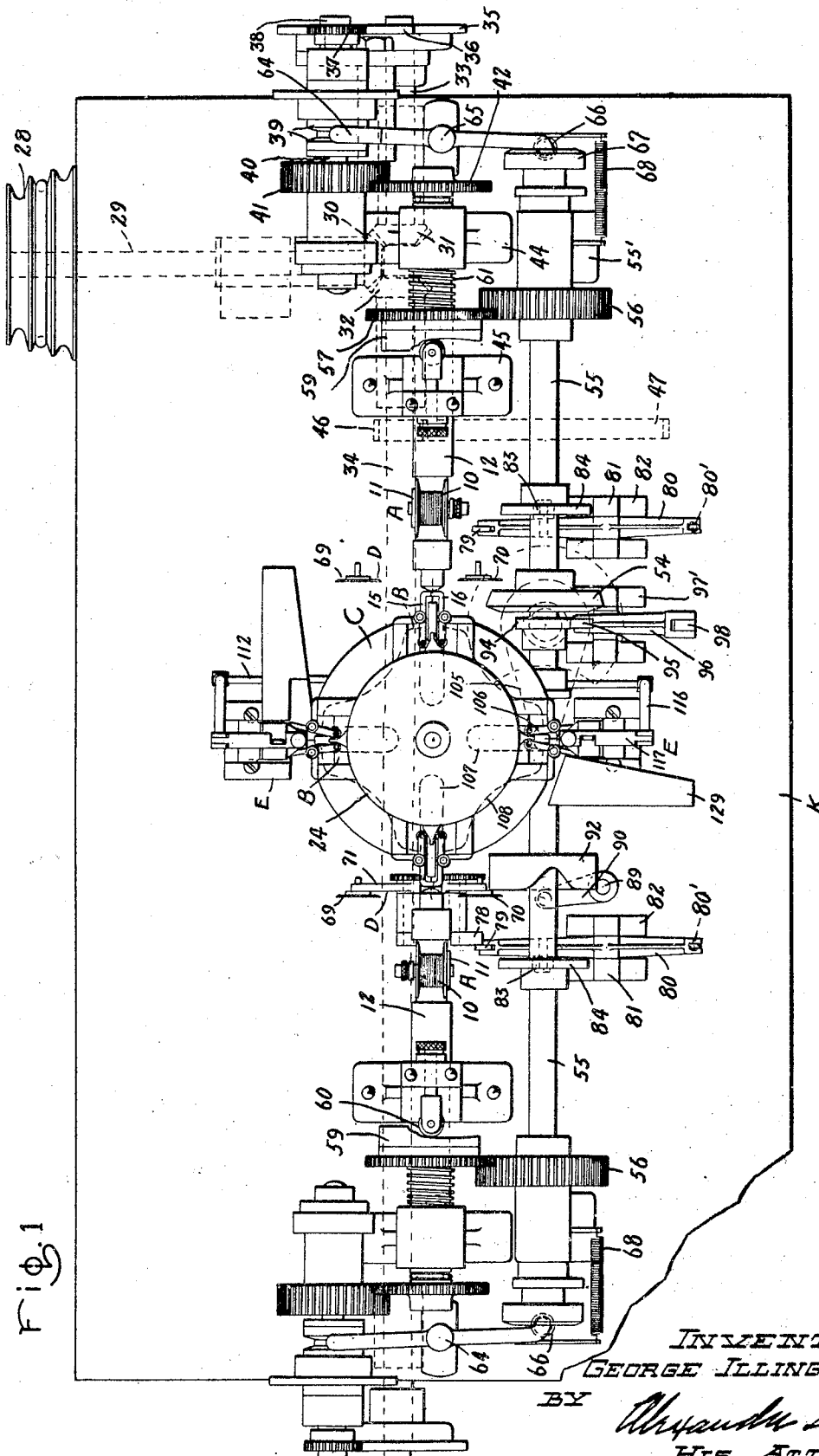
G. ILLINGWORTH

1,771,927

COILING MACHINE FOR FINE WIRE

Filed July 6, 1923

4 Sheets-Sheet 1



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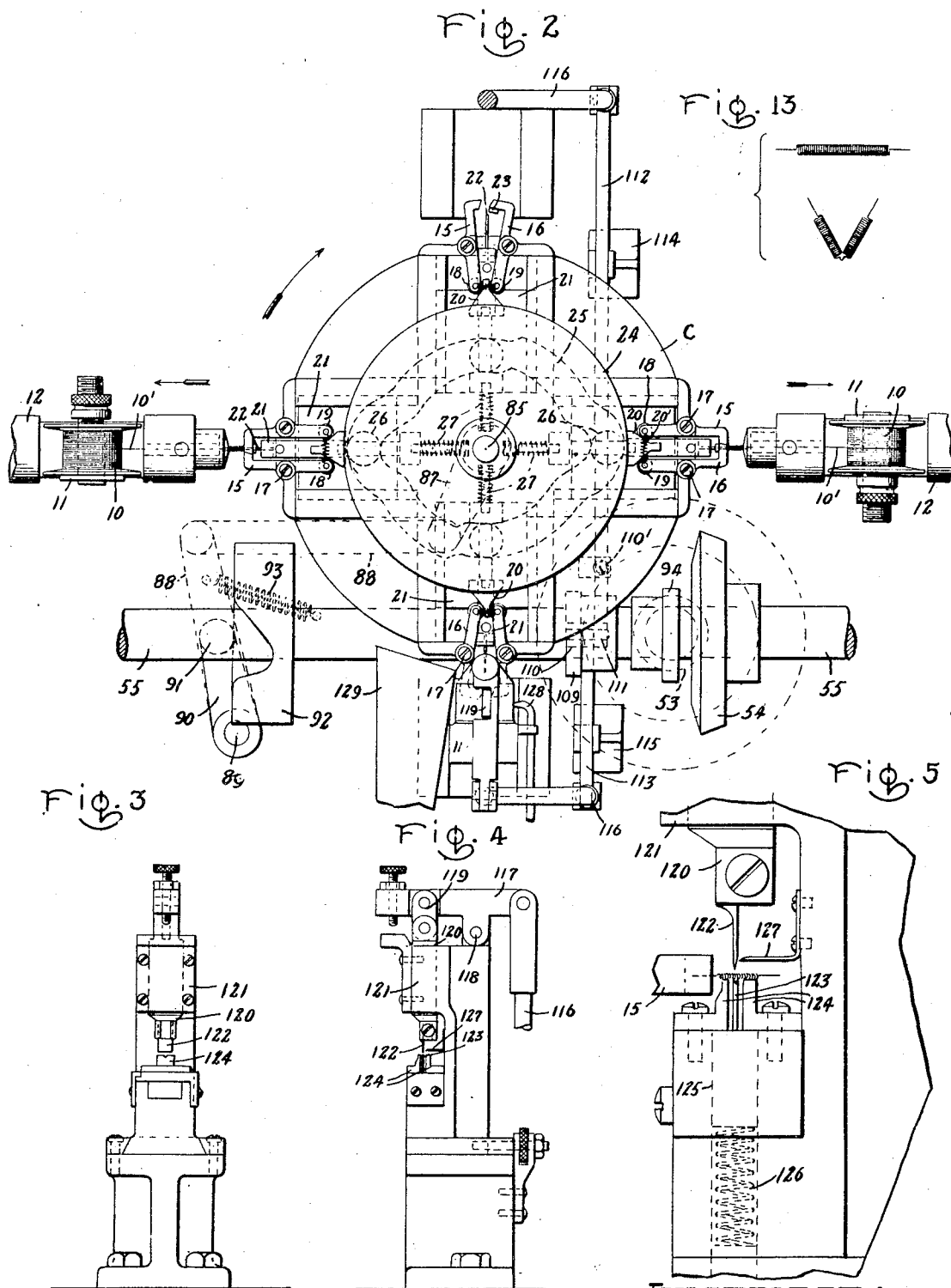
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4 Sheets-Sheet 2



INVENTOR:
GEORGE ILLINGWORTH,
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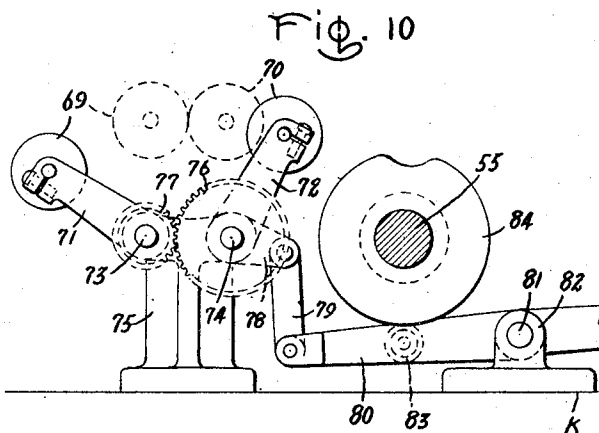
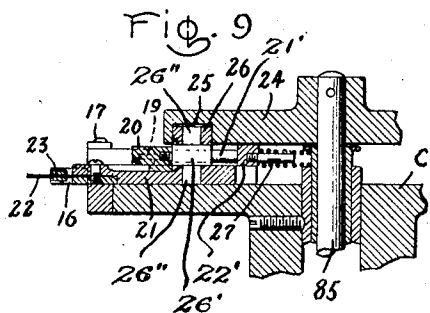
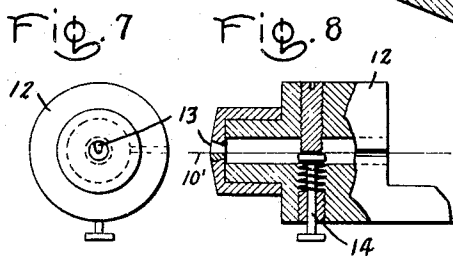
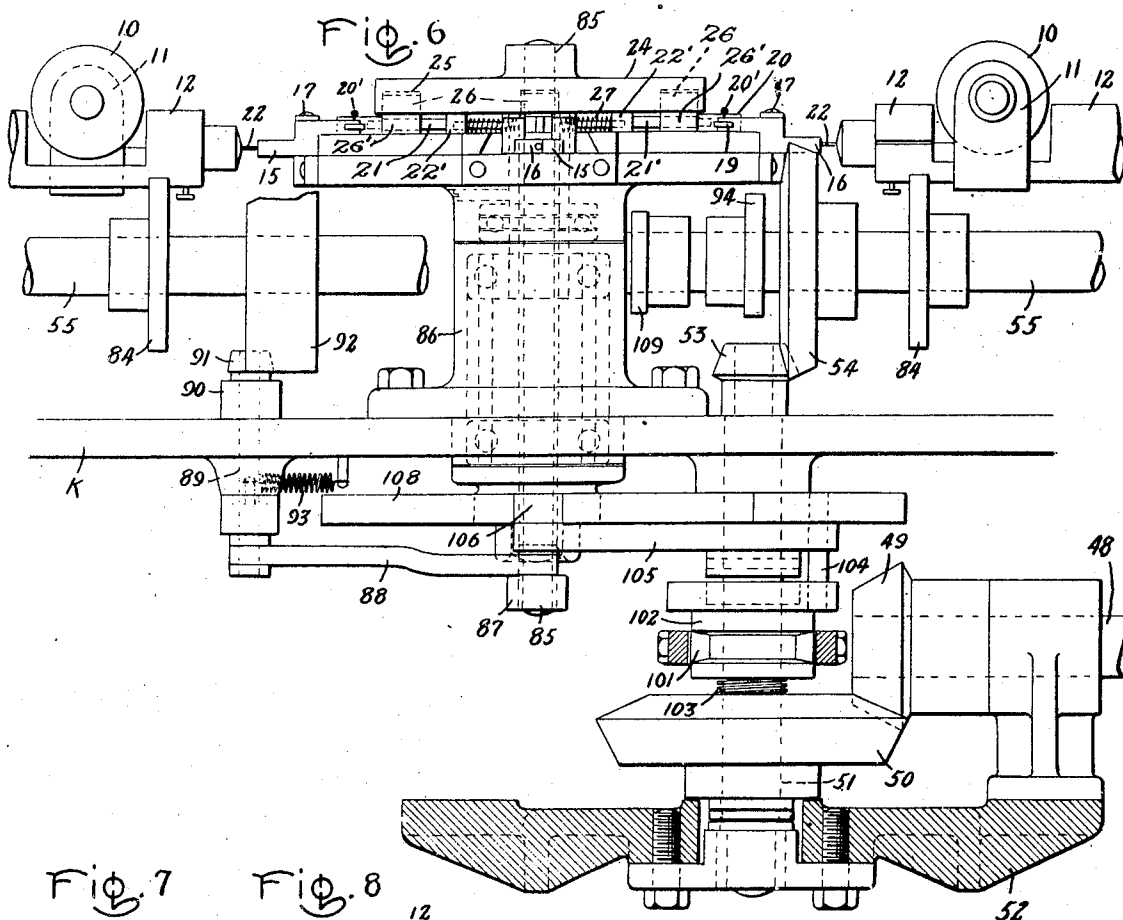
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4 Sheets-Sheet 3



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FIG. 11

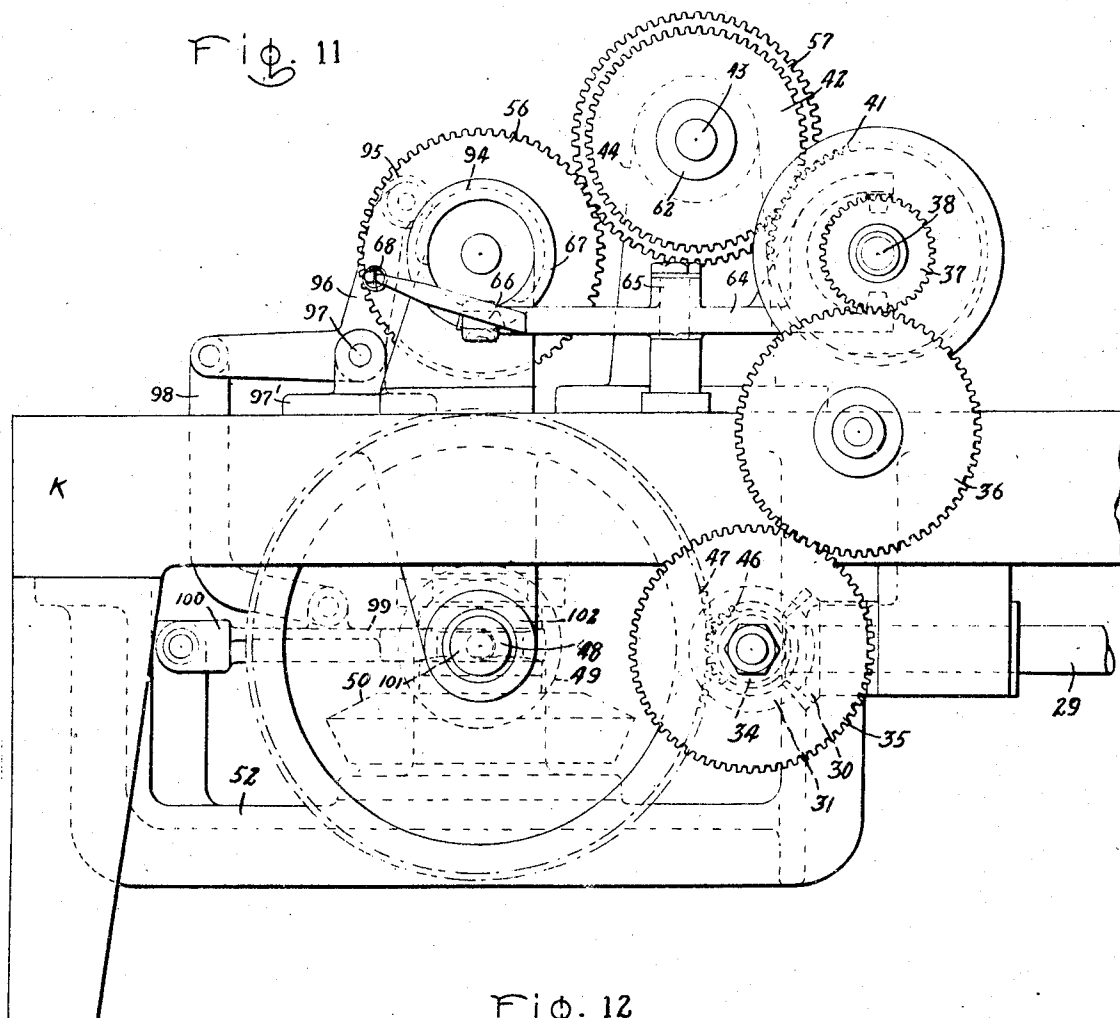
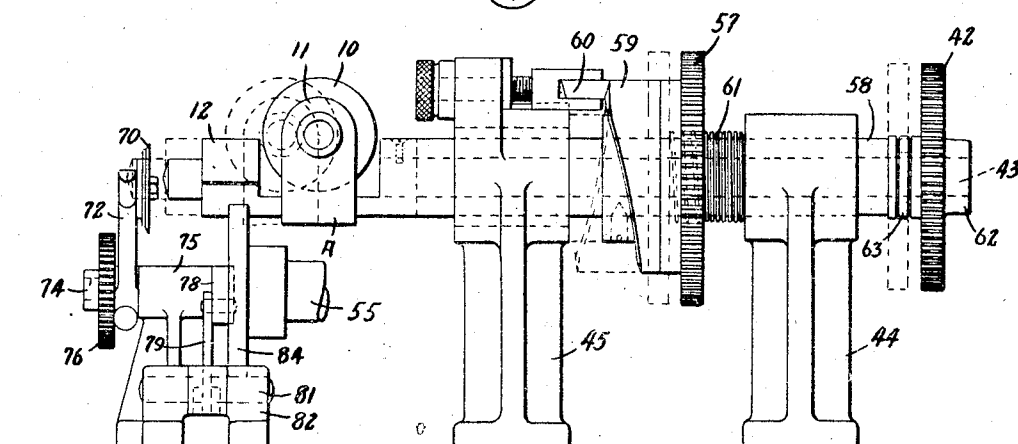


FIG. 12



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UNITED STATES PATENT OFFICE

GEORGE ILLINGWORTH, OF CLEVELAND, OHIO, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

COILING MACHINE FOR FINE WIRE

Application filed July 6, 1923. Serial No. 649,784.

My invention relates to apparatus for shaping fine wires into coils such as are used for filaments for incandescent electric lamps and parts of other similar electrical devices. It is the practice in the manufacture of coiled incandescent electric lamp filaments to shape the same from fine wire, ordinarily tungsten, by coiling around a mandrel wire. This is a continuous operation and results in the production of a reel of the composite mandrel and coiled filament wire. This is cut up into the requisite lengths and the mandrel wire is dissolved by a suitable chemical leaving the coiled filaments, after cleaning, ready for use. According to my invention, as distinguished from that procedure, the mandrel wire is withdrawn from the coil after the formation thereof, thus eliminating the necessity for dissolving the mandrel and obviating the disadvantages of handling disagreeable chemicals and the expense of the additional operations. Further features of my invention are the provision of filament shaping means in the same machine as the coiling means so that a filament is produced which is ready for mounting. Moreover, I have provided means whereby the shaping of one filament takes place during the coiling of another, thus increasing the speed of the machine. My machine is completely automatic, requiring simply the placing therein of reels of filament wire and the machine accomplishes the rest of the necessary operations, including the final discharge of the finished filament. Various other features and advantages of my invention will appear from the description which follows of a species thereof and from the accompanying drawings.

In the drawing Fig. 1 is a plan view of my improved coiling machine; Fig. 2 is an enlarged plan view of the more important parts; Fig. 3 is a front elevation of the bending or shaping means; Fig. 4 is a side elevation thereof; Fig. 5 is a fragmentary elevation thereof on an enlarged scale; Fig. 6 is a side elevation of a portion of the machine; Fig. 7 is a front view of the filament wire head; Fig. 8 is a vertical longitudinal section; Fig. 9 is a longitudinal vertical section of a portion of a turret showing the mandrel

and its support; Fig. 10 is an elevation of the filament cutting means; Fig. 11 is an end elevation of the machine; Fig. 12 is a side elevation showing mechanism operating on the filament wire head; and Fig. 13 comprises enlarged elevations of the coil before and after shaping.

In the drawing I have illustrated a machine which is provided with two oppositely disposed holding means A for the filament wire reels 10. The two holders A form part of a filament wire coiling means which cooperate with the mandrel advancing and retracting means B of which there are four spaced at substantially 90° from each other on a turret C. For each holder A, a coil severing means D is provided. The machine further comprises oppositely disposed similar filament shaping means E to which the severed coil is carried by the rotation of the turret C. The arrangement is such that while the shaping mechanisms E are operating on filaments which have already been coiled, other mandrels have been moved into operative relation with the heads A and filaments are being coiled. Inasmuch as there are a plurality of the mechanisms, A, B, D and E, a description will be made of one of each which will apply to the others.

Referring to Figs. 2, 6, 7 and 8 it will be seen that the filament wire reel 10 is removably mounted in the holder 11 which is carried by the head 12. The filament wire 10' passes through an aperture 13 (Fig. 8) in the closed end of the head and projects beyond the same a short distance, being retained in position by a spring pressed gripping means 14. The corresponding end of the mandrel operating mechanism B comprises a pair of jaws 15, 16 which are pivoted at 17 on a framework supported on the turret C and carry at the rear rollers 18, 19 which engage a wedge 20. A spring 20' holds the said rollers against the wedge 20.

As shown in Fig. 9 the wedge 20 is mounted upon the clamp plate 21 which removably holds the mandrel 22. The said mandrel is reciprocated back and forth through an aperture 23 in the end of jaw 16 when in closed position. The mandrel is reciprocated by

the cam plate 24 which has a slot 25 into which the roller 26 extends. The clamp plate 21 which carries the mandrel 22 is connected to the roller 26 through the sliding bearing 26' by means of pins 26'' and is operated independently of the wedge 20 during certain stages of operation. The wedge 20 is carried by a rod 21' which extends through the bearing 26' and has attached to its opposite end thereof a block 22'. The wedge 20 is retracted only when the bearing 26' strikes against the block 22' which forces the wedge back against the spring 27, said wedge being advanced against the action of said spring.

For one set of mechanisms, the following is the cycle of movements for the various parts. When the turret C assumes a position so that jaws 15 and 16 are lined up with the aperture 13 of the head 12 which carries the filament wire, the latter advances toward the said jaws bringing an end of the filament wire between them and they are immediately closed by the advance of the wedge 20. The portion of the wire thus clamped between the jaws 15-16 forms one leg or plain section of the filament. The continuation of this advance movement causes the mandrel to pass through the aperture 23. The wire head then rotates to coil the filament on the mandrel being at the same time retracted until the proper length of coiled filament has been formed. When a certain point has been reached the rotation of the head stops, thus stopping the coiling, but the head is retracted a certain length, thus forming the other leg or plain section of the filament. The retraction of the wire head then stops and the cutters are brought together to sever the completed filament. Upon the separation of the cutter knives the turret is turned. For the first portion of its travel, which is approximately one-third, the cam plate 24 travels therewith. The cam plate then stops, but the turret continues its movement, and during this period the retraction of the mandrel takes place so that it is entirely retracted by the time the turret has moved 90°. The turret then stops. During this time the wire head has been advancing another wire end. A reverse or counter-clockwise movement of the cam plate 24 then begins thus bringing the rollers 26 to the position shown in Fig. 2. At this point the jaws are closed upon the wire end and the mandrel is advanced to start a cycle resulting in the production of another filament. At the same time the jaws at the bending position are opened, the shaper is actuated and compresses the first coil. After the shaping operation, the filament is blown into a discharge chute. During this time a new filament is being coiled in the first position. This coiling is completed, the wire head retracted, the cutters actuated, another movement of the turret and cam plate follows, and thus the

operation of the machine goes on continuously.

The driving means for the various mechanisms will now be described. The main drive comprises a pulley 28 on shaft 29 which carries at its inner end a bevel gear 30. The latter engages two bevel gears 31 and 32 on aligned shafts 33 and 34 respectively. Shaft 33 revolves the coiling head at one side of the machine while shaft 34 accomplishes a similar function at the other side. I will describe one side only. At the outer end of shaft 33 is a pinion 35 which meshes with pinion 36. This in turn meshes with pinion 37 mounted on shaft 38 which is connected through clutch 39 to a shaft 40 keyed to which is the wide gear wheel 41. The latter engages the narrow gear 42 keyed to the shaft 43 (Fig. 12) carried in bearings in standards 44 and 45, said shaft carrying at its inner end the head 12.

The reciprocation of the head 12 and the starting and stopping of its rotation are secured by the following mechanism. The shaft 34 carries a small pinion 46 (Fig. 1) which meshes with a large gear 47 carried on shaft 48 (Fig. 11). Shaft 48 carries at its inner end a bevel gear 49 (Fig. 6) which meshes with bevel gear 50 on vertical shaft 51 supported in bracket 52 and extending up through the bed K of the machine and has a bevel gear 53 at its upper end. The latter engages a bevel gear 54 mounted on the shaft 55. The shaft 55 may be termed the main actuating shaft since it operates the coil reciprocating mechanisms, the mandrel and gripper jaw mechanisms, the shaping mechanism, the severing mechanism and turret revolving mechanism. It rotates continuously and extends entirely across the machine and is carried in bearings in standards 55'. It also carries cams which actuate the clutches in the coil head revolving mechanism.

The reciprocation of the wire head 12 is accomplished as follows: As shown in Fig. 1 the said head is in its extreme position to the left, which is the position it occupies when the jaws 15 and 16 have closed upon the end of the filament wire. Shaft 55 carries a wide gear 56 which meshes with gear 57. The latter is keyed on a hollow shaft 58 (Fig. 12) carried in the standards 44 and 45 and surrounding shaft 43. Shaft 58 also carries cam 59 which engages a roller 60 adjustably mounted on standard 45. A spring 61 surrounds shaft 58 and extends between standard 44 and gear 57 so that the said shaft and attached parts are moved against and by reason of said spring by the action of roller 60 on cam 59.

The inner shaft 43 reciprocates with outer shaft 58 but rotates at intervals within the same. It carries the head 12 at one end and, at the opposite end, a collar 62 upon which is mounted gear 42. An anti-friction bear-

ing 63 is provided between said collar and end of hollow shaft 58. The clutch 39 is actuated through a forked arm 64 pivoted at 65 and having a roller 66 at one end engaging cam 67 on shaft 55. A spring 68 holds the said roller against the cam surface.

The severing means comprises two cutter discs 69 and 70 mounted on arms 71 and 72 respectively carried on shafts 73 and 74 supported in standard 75. Shaft 74 carries pinion 76 meshing with pinion 77 on shaft 73. The opposite end of shaft 74 carries crank 78 to which is pivoted link 79 pivoted to arm 80 which is in turn pivoted at 81 to bracket 82 on the bed K of the machine. Arm 80 has a roller 83 which engages a cam 84 on shaft 55. A spring 80' attached to arm 80 and to the bed K of the machine serves to keep said roller against said cam and the cam causes the cutters to be brought together and separated in synchronism with the other operations of the machine.

The rotation of cam plate 24 to advance and retract the mandrel 22 is secured as follows. Said cam plate is mounted on shaft 85 (Fig. 6) extending through standard 86 and the bed K of the machine and carries at its lower end a crank 87 to which is pivoted bell crank 88, the other end of which is secured on a shaft 89 extending up through the bed K and having arm 90 at its upper end carrying roller 91 which engages the cam 92 on shaft 55. A spring 93 serves to hold said roller against said cam.

The turret C is actuated as follows: Fastened to shaft 55 is cam 94 bearing against roller 95 (Fig. 11) on bell crank 96 pivoted at 97 to bracket 97' on the bed K and having pivoted to its outer end the link 98 pivoted to arm 99, one end of which, 100, is pivoted to the bracket 52 and the other end of which, 101, is forked to engage collars 102 surrounding shaft 51 and working against spring 103. The upper collar has a pin 104 which, when the collar is raised, enters an aperture in an arm 105 loosely mounted on shaft 51. The opposite end of arm 105 carries a roller 106 which is adapted to enter slots 107 in a disc 108 thus constituting an intermittent Geneva drive.

The shaping mechanism is operated as follows: The cam 109 on shaft 55 engages a roller 110 on a short shaft 111, said roller being held against said cam by spring 110'. The arms 112 and 113 are pivotally connected by shaft 111 and are pivoted in standards 114 and 115 respectively and operate similar shaping mechanisms on opposite sides of the machine. I will describe one of these similar mechanisms only. The arm 113 has pivoted to its outer end a vertical rod 116, the upper end of which is pivoted to a rocker arm 117 pivoted at 118 and having arm 119 pivoted to its other end. The latter is pivoted to a vertically reciprocating

member 120 working in standard 121 and carrying at its lower end a blade 122. The coil is deposited upon release from the jaws 15 and 16 upon an anvil 123 and supports 124. The anvil is mounted on a block 125 slidably held in standard 121 and resting on spring 126. The blade 122 is first forced downwardly to shape the coil as shown in Fig. 13 and then raised to the position shown in Figs. 3 to 5. A stripper 127 is provided to prevent the coil from following the blade. A jet of air is directed through nozzle 128 to direct the shaped coil into the chute 129.

It will be understood that the foregoing is merely a description of a species of my invention, the scope of which is indicated in the following claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. An automatic machine for forming coils from fine wire, which comprises a mandrel, means for advancing said mandrel, means for advancing a wire toward said mandrel and substantially in line therewith, means for gripping an end of said wire, means for coiling said wire around said mandrel, means for retracting said mandrel after the formation of a coil, and means for releasing said gripping means to allow the removal of the completed coil.

2. An automatic machine for forming coils from fine wire, which comprises a mandrel, means for advancing said mandrel, a holding means for a supply of wire, means for advancing said wire and holding means toward said mandrel and substantially in line therewith, means for gripping an end of said wire, means for coiling said wire around said mandrel, means for retracting said mandrel after the formation of a coil, and means for releasing said gripping means to allow the removal of the completed coil.

3. An automatic machine for forming coils from fine wire, which comprises a mandrel, means for advancing said mandrel, a holding means for a supply of wire, means for advancing said wire and holding means toward said mandrel and substantially in line therewith, means for gripping an end of said wire, means for coiling said wire around said mandrel, means for retracting said wire holding means with respect to said gripping means during the coiling operation, means for retracting said mandrel after the formation of a coil, and means for releasing said gripping means to allow the removal of the completed coil.

4. An automatic machine for forming coils from fine wire, which comprises a mandrel, means for advancing said mandrel, a holding means for a supply of wire, means for advancing said wire and holding means toward said mandrel and substantially in line therewith, means for gripping an end of said wire, means for coiling said wire around said mandrel, means for retracting said wire holding

means with respect to said gripping means during the coiling operation, a coil cutting means and means for causing the same to operate after the retraction of the wire holding means, means for retracting said mandrel after the formation of a coil, and means for releasing said gripping means to allow the removal of the completed coil.

5. An automatic machine for forming coils from fine wire which comprises a pair of gripping jaws, a mandrel and means for advancing the same in a line adjacent to and in the direction of the meeting plane of said jaws, a wire feeding means comprising means for bringing a wire end of said jaws, means for causing said jaws to grip said wire end, means for coiling said wire around said mandrel when in advanced position, means for retracting said mandrel from the coil so formed and means for releasing said jaws to allow the removal of said coil.

6. An automatic machine for forming coils from fine wire which comprises a pair of gripping jaws, a mandrel and means for advancing the same in a line adjacent to and in the direction of the meeting plane of said jaws, a holding means for a supply of wire, means for causing said jaws to grip a wire end, means for withdrawing wire from said holding means and coiling it around said mandrel when in advanced position, means for retracting said mandrel from the coil so formed and means for releasing said jaws to allow the removal of said coil.

7. An automatic machine for forming coils from fine wire, which comprises a mandrel, means for advancing said mandrel, holding means for a supply of wire, means for rotating said wire holding means, means for advancing said wire and holding means toward said mandrel and substantially in line therewith, means for gripping an end of said wire, means for coiling said wire around said mandrel, means for retracting said mandrel after the formation of a coil, and means for releasing said gripping means to allow the removal of the completed coil.

8. An automatic machine for forming coils from fine wire, which comprises a mandrel, means for advancing said mandrel, holding means for a supply of wire, means for advancing said wire and holding means toward said mandrel and substantially in line therewith, means for gripping an end of said wire, means for coiling said wire around said mandrel, means for simultaneously rotating and retracting said wire holding means during the coiling operation, means for retracting said mandrel after the formation of a coil, and means for releasing said gripping means to allow the removal of the completed coil.

9. An automatic machine for forming coils suitable for use as filaments for electric incandescent lamps and similar devices, which comprises a mandrel, means for holding a

supply of wire means for rotating said wire holding means with relation to said mandrel so as to coil the filamentary wire upon said mandrel, means for withdrawing said mandrel from the completed coil, and means whereby all of said means are caused to operate in a predetermined sequence.

10. An automatic machine for forming coils suitable for use as filaments for electric incandescent lamps and similar devices, which comprises means for holding a supply of wire, means for rotating said wire holding means, a mandrel, means for withdrawing wire from said holding means and coiling it upon said mandrel, means for cutting off the completed coil, means for shaping the completed coil, means for withdrawing said mandrel from said coil, and means whereby all of said means are caused to operate in a predetermined sequence.

11. An automatic machine for forming coils suitable for use as filaments for electric incandescent lamps and similar devices which comprises means for holding a supply of wire, a mandrel, means for withdrawing wire from said holding means and coiling it upon said mandrel, means for holding said mandrel stationary during the coiling operation, means for cutting off a completed coil, means for withdrawing said mandrel from said coil, and means whereby all of said means are caused to operate in a predetermined sequence.

12. An automatic machine for forming coils suitable for use as filaments for electric incandescent lamps and similar devices, which comprises a mandrel, means for coiling the filamentary wire upon said mandrel, means for holding said mandrel stationary during the coiling operation, means for shaping the completed coil, and means whereby all of said means are caused to operate in a predetermined sequence.

13. An automatic machine for forming coils suitable for use as filaments for electric incandescent lamps and similar devices, which comprises a mandrel, means for coiling the filamentary wire upon said mandrel, means for holding said mandrel stationary during the coiling operation, means for withdrawing said mandrel from the completed coil, means for shaping the completed coil, and means whereby all of said means are caused to operate in a predetermined sequence.

14. An automatic machine for forming coils suitable for use as filaments for electrical incandescent lamps and similar devices, which comprises means for holding a supply of wire, a mandrel, means for withdrawing wire from said holding means and coiling it upon said mandrel, means for holding said mandrel stationary during the coiling operation, means for cutting off a completed coil, means for shaping the completed coil, means

for withdrawing said mandrel from said coil, and means whereby all of said means are caused to operate in a predetermined sequence.

- 5 15. An automatic machine for forming coils suitable for use as filaments for electric incandescent lamps and similar devices, which comprises means for holding a supply of wire, a mandrel, means for advancing
10 said wire and holding means toward said mandrel, means for gripping an end of said wire, means for simultaneously retracting and rotating said wire holding means during the coiling operation, means for cutting off a
15 completed coil, means for withdrawing said mandrel from said coil, means for shaping the completed coil, and means whereby all of said means are caused to operate in a predetermined sequence.

20 In witness whereof, I have hereunto set my hand this 2nd day of July, 1923.

GEORGE ILLINGWORTH.

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