July 24, 1962 J. C. DAVIS 3,045,740

WIRE BENDING MACHINE

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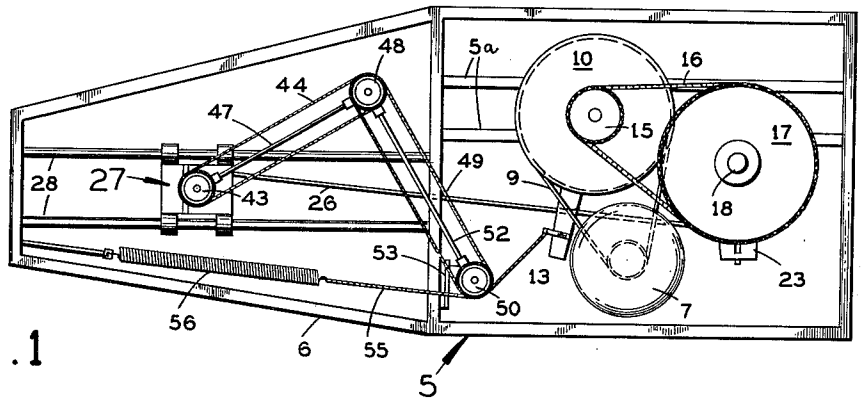


FIG. 1

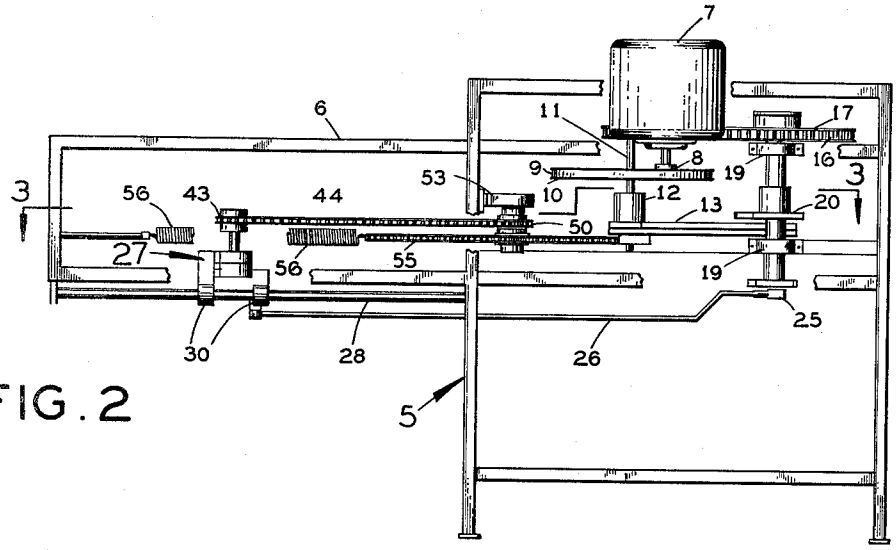


FIG. 2

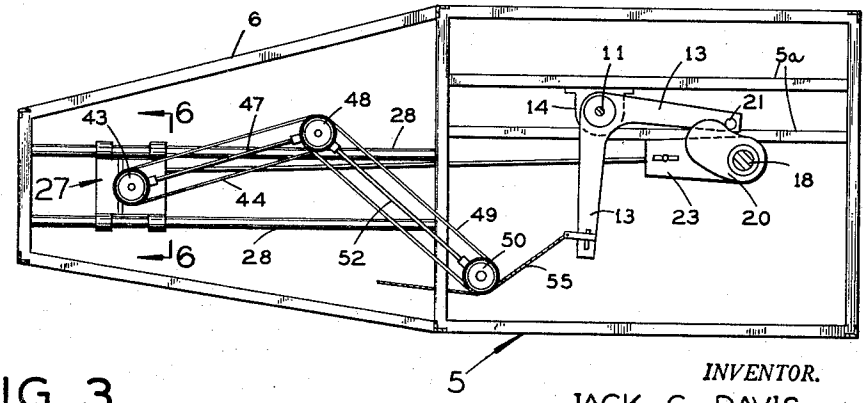


FIG. 3

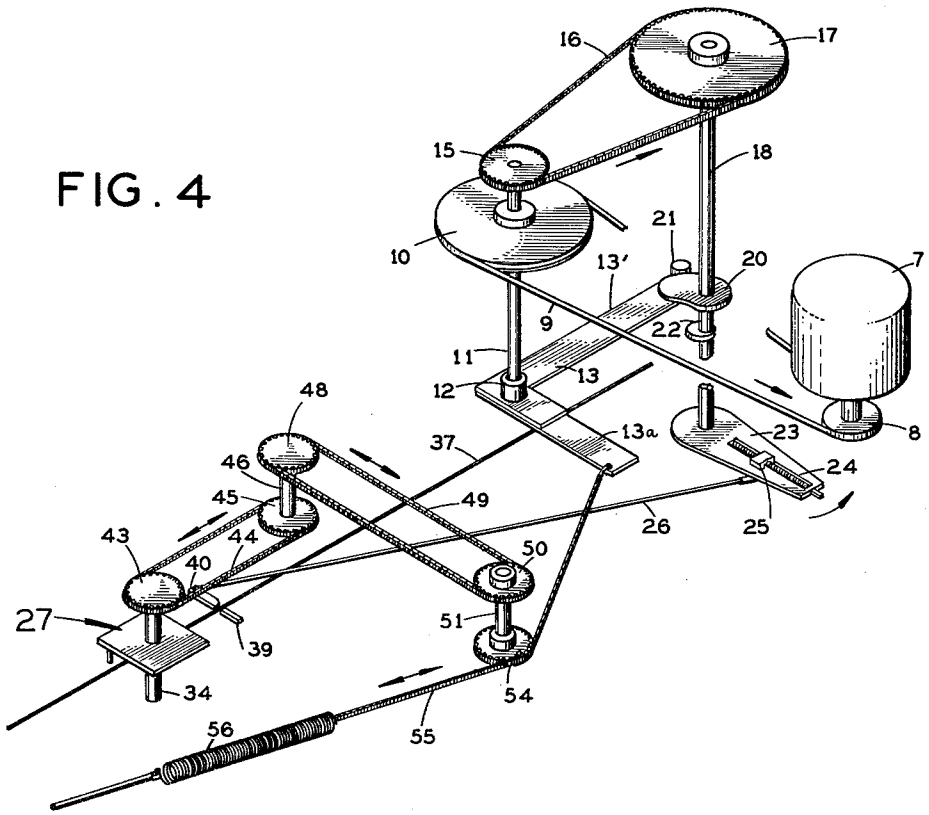
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WIRE BENDING MACHINE

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FIG. 4



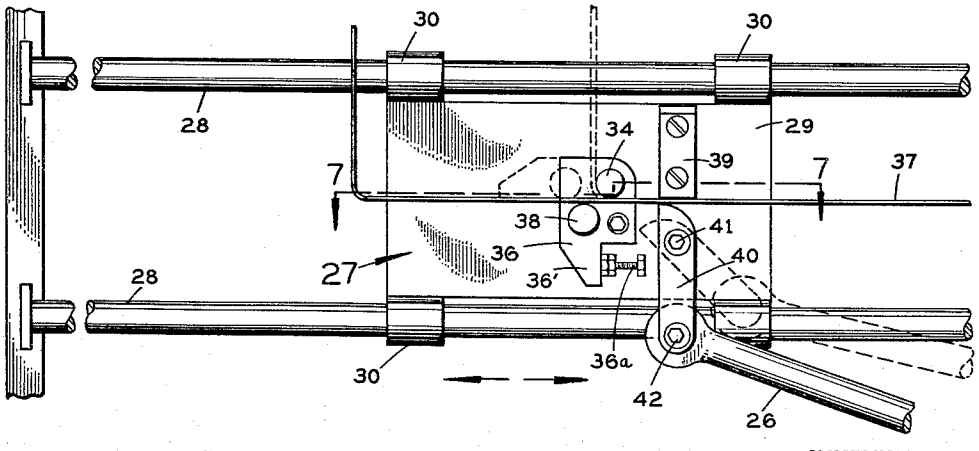


FIG. 5

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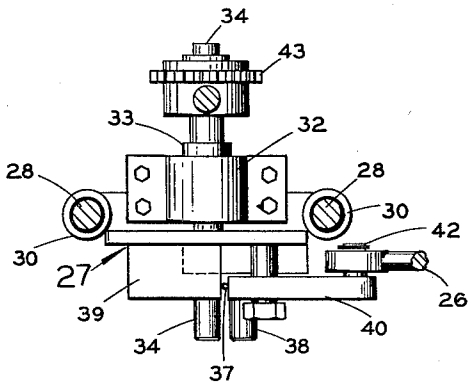
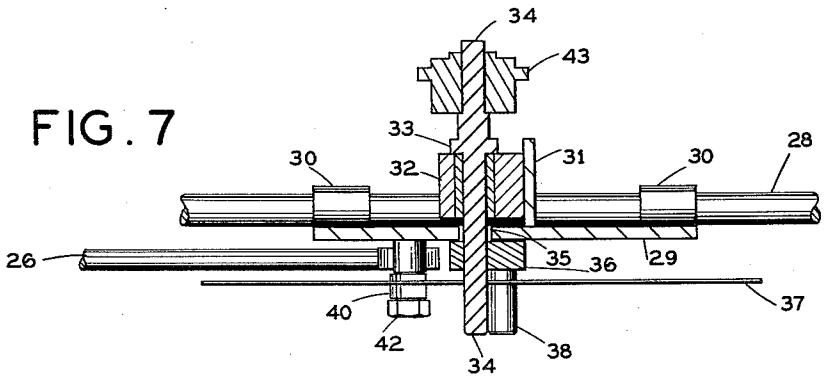


FIG. 6

FIG. 7



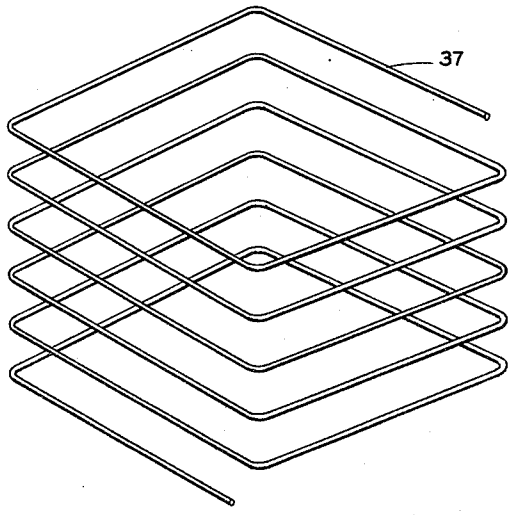


FIG. 8

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3,045,740

WIRE BENDING MACHINE

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8 Claims. (Cl. 153—64)

This invention relates to improvements in wire bending machines and has particular reference to a machine adapted to bend a continuous section of wire into a substantially square coil.

The invention contemplates mechanism that is adapted to be actuated by a prime mover in a manner whereby mechanism is controlled to feed wire forwardly from a coil or other source of supply and at predetermined intervals, to bend the wire at a right angle to form the substantially square coil commonly employed in reinforcing for concrete piers or similar concrete structures that normally have required coils of wire that may be extended along the forms to be embedded into the concrete.

Novel features of construction and operation of the device will be more clearly apparent during the course of the following description, reference being had to the accompanying drawings wherein has been illustrated a preferred form of the device and wherein like characters of reference are employed to denote like parts throughout the several figures.

In the drawings:

FIGURE 1 is a top plan view of a machine constructed in accordance with the invention,

FIGURE 2 is a side elevation thereof, parts being broken away for purpose of illustration,

FIGURE 3 is a horizontal section taken substantially on line 3—3 of FIGURE 2,

FIGURE 4 is a perspective view of the several actuating elements employed to feed and bend the wire at predetermined intervals,

FIGURE 5 is a bottom plan view of a wire feeding and bending carriage,

FIGURE 6 is a transverse section taken substantially on line 6—6 of FIGURE 3,

FIGURE 7 is a section taken substantially on line 7—7 of FIGURE 5, and

FIGURE 8 is a perspective view of a partial section of a square coil formed by the machine.

Referring specifically to the drawings, the numeral 5 designates a supporting framework, formed of angle irons, channel irons or similar elements. The frame 5 is adapted to be supported in resting engagement upon a floor area whereby the coil, adapted to be formed by the machine may be fed downwardly by gravity. The frame 5 is provided with a forward extension 6, to support mechanism, to be presently described.

Fixedly mounted upon the upper portion of the frame 5, is a prime mover 7, here illustrated as an electric motor. The motor 7 is provided with a relatively small groove pulley 8, that drives a flexible belt 9 to a relatively large pulley 10. The pulley 10 is fixed upon a vertically arranged shaft 11 that is journaled in suitable bearings carried by the frame 5 and with the bearings preferably being supported by frame members 5a. The shaft 11 is journaled at its upper and lower ends and its lower end has rotative movement in a sleeve 12, carried upon a bell crank lever 13. The shaft 11 extends below the sleeve and bell crank lever for rotative movement in a journal bearing 14.

The upper end of the shaft 11 carries a relatively small sprocket 15, that engages a sprocket chain 16, that has sprocket engagement with a relatively large sprocket 17 that is fixed upon a vertical shaft 18, that is journaled in suitable bearings 19 carried by the frame member. Fixed upon the shaft 18 intermediate its height, is a cam element 20. The cam element 20 is adapted to engage a

cam roller 21, carried upon one arm 13' of the bell crank lever 13 and whereby to rock the bell crank lever 13 upon each complete rotation of the shaft 18. It will thus be apparent, that the motor 7 driving the pulley 10, will rotate the shaft 11, the sprocket 15 and the sprocket 17 through the medium of the sprocket chain 16 to drive the shaft 18 and upon each complete revolution the cam 20 rocks the lever 13 laterally, for a purpose to be presently described.

The shaft 18 is also provided with a smaller cam 22 that is employed to actuate a suitable counter mechanism, not shown.

Fixedly connected to the lower end of the shaft 18 is a preferably flat actuating crank arm 23, that is slotted at 24, to receive an adjustable pivot block 25, having pivotal connection with a rod 26 that has operative engagement with a combined feed carriage and bending mechanism, illustrated as a whole by the numeral 27.

Fixed upon the forward frame extension 6 to lie in horizontal spaced apart and parallel relation, are a pair of cylindrical tracks 28. The carriage device 27 is adapted to traverse the tracks 28 in the normal feeding of the wire and the subsequent bending to the predetermined angularity. The carriage 27 comprises a flat plate 29, having tubular sleeves 30 at each of its corners, that have riding engagement with the tracks 28. The plate 29 is provided with an upstanding transversely extending flange 31, that carries a journal bearing 32. Rotatably supported in the journal bearing 32 and held against downward movement by a collar 33, is a shaft 34. The shaft 34 extends through a suitable opening 35 in the plate 29 and fixedly carries a bending plate 36. The shaft 34, see particularly FIGURES 4, 6 and 7, projects below the plate 36 to constitute a peg around which the wire, indicated 37 is bent. The plate 36 also carries a downwardly extending stud 38 that is offset from the lower extension of the shaft 34 substantially 45 degrees. Fixed upon the underside of the plate 29 is a block 39 that constitutes one-half of a clamping device for the wire 37, that includes a pivoted clamping lever 40, that is pivoted at 41 upon the underside of the plate 29 and with the lever 40 having pivotal connection at its outer end as at 42, with the rod 26. The lever 40 is actuated in a rocking motion by the rod 26 that is moved under the influence of the crank arm 23. The plate 36 is provided with a lateral extension 36', having an adjusting screw 36a, whereby the plate 36 is accurately adjusted to receive a section of the wire 37 for a subsequent 90 degree bending motion.

The shaft 34 at its upper end is provided with a sprocket 43, that engages a sprocket chain 44, that is driven by a sprocket 45, carried upon a shaft section 46. The shafts 34 and 46 are rotatable in journal bearings carried upon the opposite ends of a rigid arm 47 and whereby the shaft 46 may be shifted in a longitudinal direction while maintaining a driving connection with the sprocket 43 and the shaft 34. The driving connection as illustrated, is an oscillatory drive and is not a complete rotation. The shaft 46 at its upper end carries a sprocket 48 that is driven through the medium of sprocket chains 49, driven by a sprocket 50, fast upon a shaft 51. The shaft 51 and the shaft 46 also are held in spaced relation by bearing supporting arm 52. The shaft 51 is journaled in a suitable bearing 53 carried by the main frame 5. The shaft 51 is also provided at its lower end with a sprocket 54 that is driven by an oscillatory sprocket chain 55. The chain 55 overrides the sprocket 54 and at one end is connected to an arm 13a of the bell crank lever 13 and at its opposite end is connected to a retractile coil spring 56, that is connected at its opposite end with the frame extension 6. It will thus be apparent, that when the lever 13 is actuated in a rocking motion by the cam 20, the arm 13 will alternately pull upon and release the chain 55, im-

parting an oscillatory movement to the sprocket chains 49 and 44, which motion is substantially one quarter of a revolution, causing the shaft 34 to be rotated a corresponding degree for rotating the plate 36 for shifting the bending stud 38 against the wire 37, to bend it around the lower shaft extension 34 at substantially a right angle.

The operation of the device is as follows:

With a section of wire 37, fed from a suitable coil or roll at a remote point into the machine, the free end of the wire is initially clamped between the lever 40 and the block 39. As the shaft 18 rotates, the crank arm 23 swings in an arc and functions to shift the rod 26, in a direction to swing the lever 40 into biting engagement with the wire 37 and, in such biting engagement, a continued movement of the crank arm 23 shifts the carriage 29 along the trackways 28, feeding an additional section of wire from the roll in accordance with the particular adjustment between the rod 26 and the crank arm 23 and such adjustment will determine the dimensions of the coil to be formed. As the carriage is moved to its forward maximum position, the cam 20 engages the roller 21 and rocks the bell crank lever upon the shaft 11, swinging the arm 13*a* and pulling upon the chain 55, such action causing a rotation of the sprockets 54, 50, 48, 45 and 43 through the medium of their chains 49 and 44, imparting a rotation to the shaft 34 and the plate 36. The rotation of the shaft 34 and the plate 36 is at the end of the travel of the carriage 27. Due to the lobe of the cam 20, the bell crank 13 is rocked beyond a 90 degree travel and imparting to the shaft 34 a rotation slightly greater than the required 90 degree bend for the wire, such perhaps being rotated to approximately 105 degrees more or less depending upon the type of wire being shaped and such additional bending permits the wire to spring back and assume a full 90 degree bend for forming the coil 37. As the shaft 34 rotates to bend the wire held by the clamping arm 40, the entire coil that is suspended below the head 27 will be bodily rotated. The rotative movement of the plate 36 has been indicated as being shown in dotted lines on a 90 degree motion but it will be apparent to others skilled in the art that it becomes necessary that the wire be slightly bent beyond the 90 degree bend since it will spring back and assume the proper bend, such being customary in wire bending devices. The bending action functions when the carriage has moved to approximately its forward travel on the trackways. The arrangement of the shafts 46 and 34 in a pantographic assembly permits the carriage 29 to be shifted upon the trackways 23, moving the shaft 46 and its sprockets 45 and 48 and to constantly maintain a driving connection with the shaft 34. After the shaft 34 has been rotated slightly beyond ¼ turn, the lever 13 is released from the cam 20 and the spring 56 returns the lever 13 to its initial starting position and also pulls upon the chain 55, to return the chains 49 and 44 to their initial positions, such action reversing the movement of the shaft 34 and the plate 36. Since the prime mover is continuously driving the shaft 18, through the medium of the belt 9, pulley 10, pulley 15, chain 16 and sprocket 17, it follows that the crank arm 23 at the lower end of the shaft is being constantly rotated in a horizontal plane, such action causing the carriage 29 to reciprocate upon the tracks 28. When the arm 23 moves to a position where it pulls upon the rod 26, it automatically shifts the clamping lever 40 to the dotted line position and a continued movement of the crank 23, pulls the carriage 27 inwardly upon the tracks 28 and, when the crank moves substantially 180 degrees, the action upon the rod 26 will be reversed, causing the lever 40 to then move to the full line position, shown in FIGURE 5, causing its end to clamp upon the wire 37 at a point calculated to be the dimension for one side of the coil to be formed and a continued movement of the crank arm forces the carriage forwardly for repeating the operation previously described. The adjustment of the block 25 obviously will vary the shifting movement of the rod 26 and vary the traverse of the carriage 29 to increase or decrease the length of coil section to be bent. The coil formed by this machine has been illustrated in FIGURE 8 and comprises a multiplicity of wire flights of equal length, to form substantially a square cage that may be stretched axially in accordance with the area of the concrete beam or the like to be reinforced.

It will be apparent from the foregoing that a very novel form of wire bending machine has been employed to quickly and easily bend a continuous section of wire into substantially square convolutions. The mechanism is such that a section of wire is clamped at the inner position of the carriage and fed forwardly by the movement of the carriage to be subsequently bent to form the square coils. The movement of the carriage is such that one motion of the carriage feeds the wire forwardly and bends it in one stroke of the machine. The bending mechanism is such that the wire is bent to a degree slightly greater than 90 degrees so that when the bending mechanism is released, the wire section that has been bent will spring backward and assume a true 90 degree bend. The mechanism is adjustable to vary the size of the convolutions and the driving connections for the bending head automatically adjusts themselves in accordance with the size of coil to be formed, depending upon the traverse of the carriage upon the trackways as will be determined by the adjustment of the block 25 within the slot 24 formed within the crank 23. The device is relatively simple in construction, is strong, durable and most effective as a wire bending device with one forward motion of the bending head, such including the feeding of the wire and the bending in a single stroke of the carriage.

It is to be understood that the invention is not limited to the precise construction shown, but that changes are contemplated as readily fall within the spirit of the invention as shall be determined by the scope of the subjoined claims.

Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. A wire bending machine of the character described for progressively forming square convolutions into an elongated coil that comprises a main supporting frame and an auxiliary frame, a prime mover supported in the main frame, a pair of trackways carried by the auxiliary frame, a carriage device shiftable in a reciprocatory manner upon the trackways, means actuated under the influence of the prime mover for reciprocating the carriage, means operated by the prime mover for engaging and shifting a predetermined length of wire to be bent, a bending head carried by the carriage and that is actuatable when the carriage has been moved to a predetermined point to bend the wire laterally to assume a ninety degree angle.

2. A wire bending machine of the character described for bending square convolutions of wire to form an elongated coil and with each side of the coil being substantially identical, a main supporting frame and a forwardly extending axuiliary frame, the auxiliary frame carrying a pair of spaced apart and parallel guide rails, a carriage shiftable upon the rails, a prime mover carried by the main frame, a crank arm and reduction driving means between the prime mover and the crank arm and means for coupling the crank arm to the carriage whereby the crank arm is actuated to shift the carriage in a back and forth manner upon the rails, a bending head rotatably supported upon the carriage, a clamping lever pivotally supported upon the carriage, said coupling means including a pitman connecting the crank arm with the lever, the said pitman shifting the carriage in one direction to engage a predetermined length of a wire to be bent and actuating the clamping lever and being operative to move the carriage in the opposite direction in a manner to clamp the lever against the wire to shift the wire forwardly a predetermined length and while shifting the carriage forwardly, a bell crank lever that is actuatable by a cam

driven from the prime mover, flexible drive means between the bell crank lever and the bending head whereby to rotate the bending head for bending the wire to assume a right angle when the carriage has been shifted to a maximum forward position.

3. A wire bending machine of the character described that comprises a main frame and a forwardly extending auxiliary frame, a pair of spaced apart track rails mounted in and disposed in horizontal relation to the auxiliary frame, a prime mover supported by the main frame, a vertical shaft driven by the prime mover and a second vertical shaft driven by the first named shaft, the second named shaft having a horizontally rotatable crank arm upon its lower end, a bell crank lever freely rotatably supported upon the first named shaft, a cam device carried by the second named shaft and whereby to shift the bell crank lever intermittently, a wire feeding and bending carriage having traverse engagement with the rails, a clamping lever pivotally supported upon the underneath surface of the carriage, a pitman device connected with the first named crank and the clamping lever and which functions to simultaneously actuate the clamping lever and to shift the carriage along the rails, the said clamping lever being movable in a horizontal plane to freely move along a strand of wire when the first named crank is rotated in one direction to move the carriage rearwardly, the said pitman device being actuated upon a further rotation of the crank to shift the lever into clamping engagement with the strand of wire and to move the carriage forwardly upon the rails to extend a predetermined length of the wire to be bent, a bending head carried by the carriage and rotatably journaled in the carriage, the said bending head including a fulcrum pin around which the wire is to be bent and a pin for bending the wire around the fulcrum pin and means actuatable under the influence of the bell crank lever for rotating the bending head throughout to a degree slightly greater than 90 degrees.

4. The structure according to claim 3 wherein the said pitman is adjustable with respect to the crank to determine the traverse of the carriage upon the rails and to determine the length of wire to be bent into the square coil.

5. The structure according to claim 3 wherein one arm of the bell crank lever is connected to a chain drive, the said chain drive having its opposite end connected with the auxiliary frame through the medium of a retractile coil spring, the said chain drive actuating a chain of sprocket devices that are connected to the bending head, the said bending head being actuatable under the influence of the cam to be rotated after the carriage has been shifted forwardly by the pitman to present a length of wire corresponding to the size of coil to be formed.

6. A wire bending machine for progressively forming substantially square convolutions, comprising a supporting frame, a prime mover carried by the frame, an auxiliary frame connected to the supporting frame, a pair of spaced apart horizontally arranged track rails carried by the auxiliary frame, a carriage device reciprocated upon the rails, means operable by the prime mover for reciprocating the carriage, means connected with the carriage and caused to grip upon a section of wire to be bent at a predetermined point so that upon movement of the carriage a section of wire will be moved forwardly from a source of supply for a distance in accordance with the dimension of the convolutions to be formed, a rotatable bending head supported upon the carriage and with the head having bending pins disposed in a plane to engage the section of wire fed forwardly by the carriage, and means operable by the prime mover for rotating the bending head when the carriage has been shifted to the distance according to the convolution to be formed, the said bending head being rotatable in an arc of substantially ninety degrees to bend the wire to a degree that subsequently assumes a true ninety degrees.

7. The structure according to claim 5, wherein the chain and sprocket drive connection to the bending head is uninterrupted throughout the movement of the carriage upon the rails, the said bending head being rotated only at the maximum forward position of the carriage and under the influence of the said cam.

8. A wire bending machine of the character described having a pair of trackways, a carriage device shiftable along the trackways, means for moving the carriage back and forth upon the trackways, a wire bending head supported upon and movable with the carriage, a wire clamping device supported upon and movable with the carriage, means actuatable to simultaneously move the carriage in one direction and to release the clamping means whereby the clamping means on subsequent engagement with a wire is caused to engage a predetermined length of the wire from a wire roll, means actuatable to move the carriage in the opposite direction causing the clamping means to bite upon and feed the engaged section of wire forwardly, means embodied in the machine for intermittently actuating the bending head, the said bending head being actuatable when the carriage has reached its outer position of travel and the section of wire to be bent has been fed forward, the said means for actuating the bending head functioning to rotate the bending head in an arc somewhat greater than 90 degrees so that when the bending head is reversed, the wire will spring back and assume a true 90 degree angle.

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