

Aug. 29, 1961

S. A. PLATT

2,998,032

WIRE SINUATOR

Filed Oct. 15, 1956

4 Sheets-Sheet 1

Aug. 29, 1961

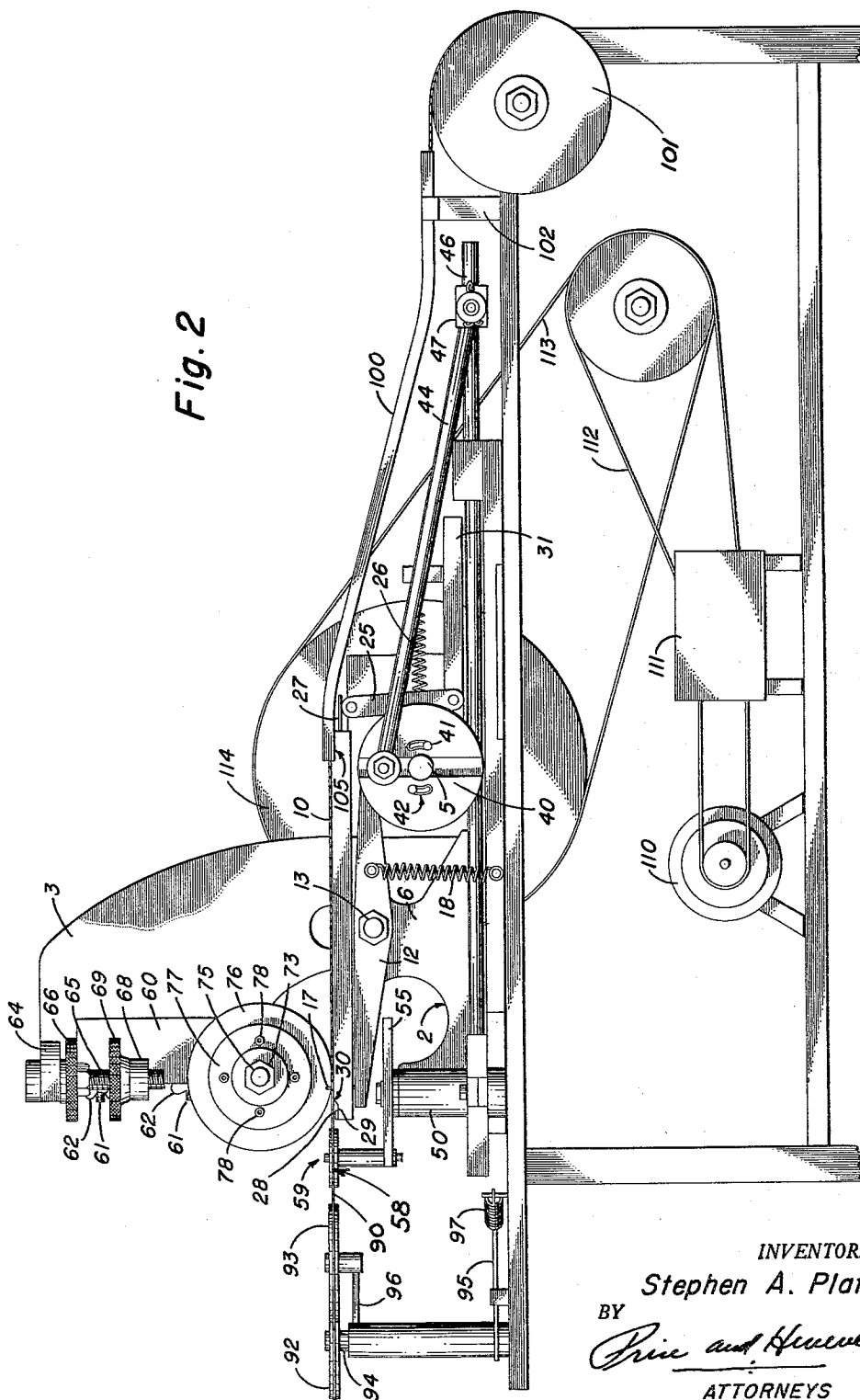
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WIRE SINUATOR

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4 Sheets-Sheet 2



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4 Sheets-Sheet 3

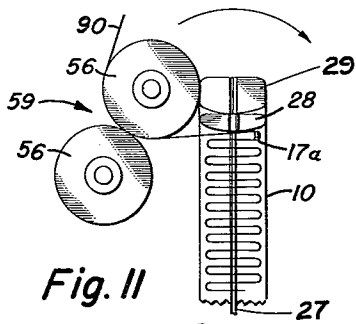


Fig. 11

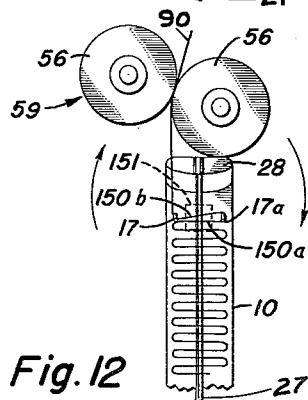


Fig. 12

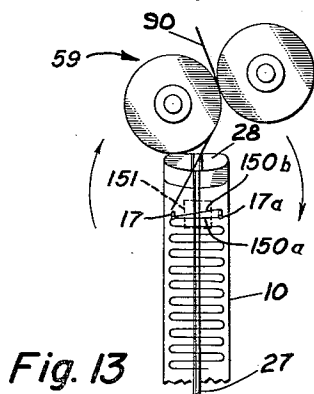


Fig. 13

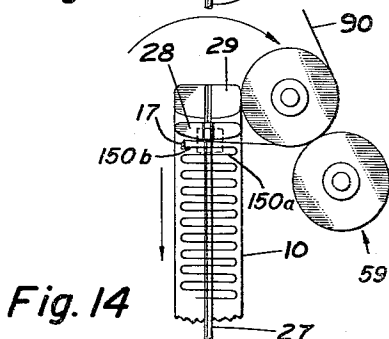


Fig. 14

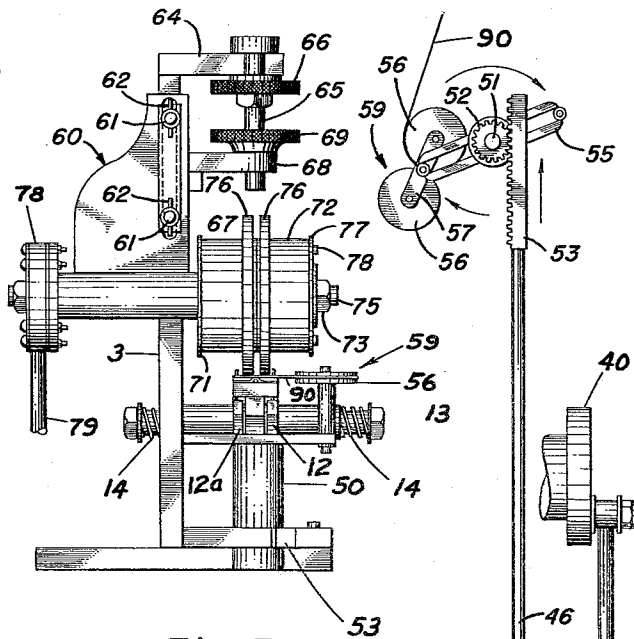


Fig. 3

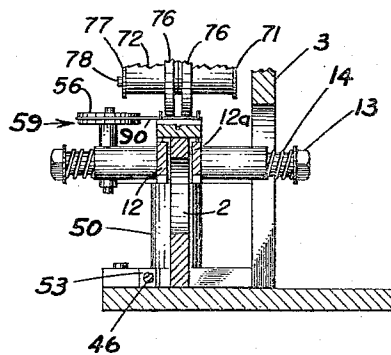


Fig. 7

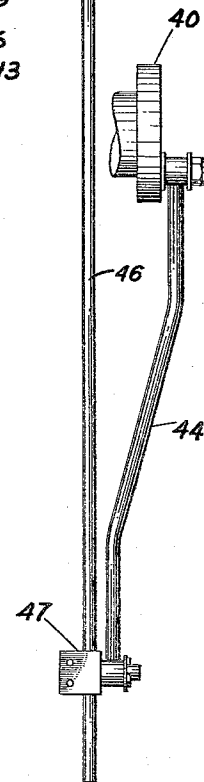


Fig. 4

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WIRE SINUATOR

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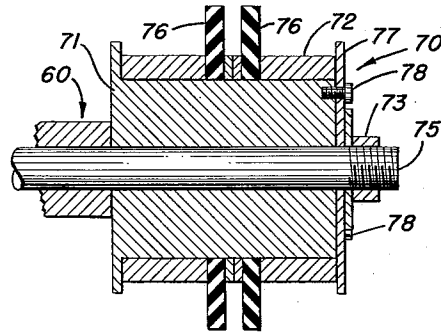


Fig. 15

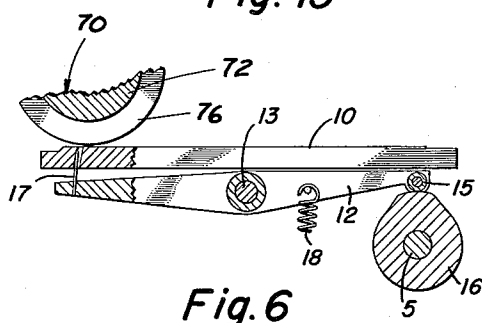


Fig. 6

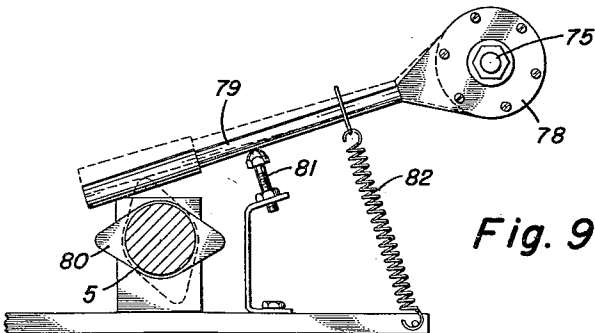


Fig. 9

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WIRE SINUATOR

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4 Claims. (Cl. 140-71)

This invention relates to machines for sinuating wire. It is particularly designed for forming resistance wire for electrical heaters into elongated, closely spaced loops.

This invention is designed to provide a machine of this type which is fast and accurate. It is so designed that it is capable of producing a wrapped or sinuated wire in which the spacing between the loops is accurate and the bends formed at each end of each loop are precisely shaped. This latter is important. It eliminates defects resulting from sharp bends, pinching or partial rupturing of the wire. These defects result from forming of the wire about a sharp angle or about a radius less than that for which the wire is rated. Any reduction in cross section such as is produced by partial rupture or pinching results in a point of high resistance. Such a wire used for a heater element will result in early failure due to excessive loading at the point of defect.

This invention provides a simple machine in which all of the operating parts are closely interrelated so that accurate timing and coordination can be maintained. It is also adaptable to various sizes of wires, with a minimum of delay in adjusting the machine from one size to another.

These and other objects and purposes of this invention will be understood by those acquainted with the problems of sinuating an electrical resistance wire upon reading the following specification and the accompanying drawings.

In the drawings:

FIG. 1 is a plan view of the machine.

FIG. 2 is a side elevation view of the machine.

FIG. 3 is a front elevation view of the machine, omitting the drive shaft and its related structure.

FIG. 4 is a fragmentary plan view of the crank and rack mechanism operating the wire wrapping assembly.

FIG. 5 is a partially fragmentary side elevation view of one of the rocker arms controlling the wire holding mechanism, showing the pin in extended position.

FIG. 6 is a partially fragmentary side elevation view of the rocker arm for the wire holding assembly showing the pin in retracted position.

FIG. 7 is a sectional elevation view taken along the plane VII-VII of FIG. 8 showing the rocker arms with one pin raised and one lowered.

FIG. 8 is a partially fragmentary, sectional elevation view of the wire holding assembly.

FIG. 9 is a side elevation view of the driving mechanism for the wire progression assembly.

FIG. 10 is a somewhat schematic side elevation view of the cam organization coordinating and driving the various parts of the machine, including the cams shown in FIGS. 5, 6, 8 and 9.

FIGS. 11 through 14 are somewhat schematic views showing in progressive order a half cycle of the wire wrapping assembly.

FIG. 15 is a fragmentary central sectional view of the wire progression mechanism.

In carrying out the objects of this invention there is provided a machine into which wire in a continuous length is fed through a head which, as the machine is illustrated, is adapted to swing from side to side through an arc of slightly more than 180 degrees. At one limit of the swing of the head the wire fed through the head is carried behind a pin which, as the wire passes it in rearward motion, is retracted. As the head reaches its maximum rearward travel, the pin is extended restraining

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the wire while the feeding head moves to the opposite limit of its travel. At the opposite limit of the travel, a second pin is provided which is retracted as the wire moves rearwardly across it and is extended to engage the wire when the head once again starts forward swinging motion. Means in the form of a sliding head or bar is brought into engagement with the wire to snug it about each of the pins to assure a bend of identical radius at the end of each loop. This operation is repeated continuously, producing a progression of loops in the wire. After each loop has been completely formed and the radius of the loop has been accurately set by the sliding head, it is released by the pin and a resilient wheel in contact with the wire inches it rearwardly in the machine, thus, intermittently progressing the work past the pins.

Referring specifically to FIG. 2, the machine is illustrated as mounted on any suitable means such as the support assembly 1. The machine itself is supported by a base frame 2 having a vertical arm 3, a support element 4 and a center post 6. Journaled in the support element 4 and the vertical arm 3 (FIG. 1) by suitable bearings, is a main driving shaft 5. The base frame 2 is designed to be completely rigid.

(1) Wire holding assembly

Extending through the center of the machine is a flat guideway 10 having a central, longitudinal slot 11 at its upper surface (FIGS. 1 and 7). The guideway 10 is supported by the center post 6. Beneath the guideway 10 and mounted on each side of the upstanding leg of the base frame 2 are rocker arms 12 and 12a (FIGS. 2, 5, 6 and 7). The rocker arms are mounted, at approximately their centers, on a common pivot bolt 13 (FIGS. 1 and 7) and resiliently pressed against spacers on their inner faces by springs 14 on each end of the pivot bolt 13. The springs 14 bear against collars 21 surrounding the bolt 13. The springs hold the rockers tightly against the spacers, thus, accurately locating them with relation to each other. At their rearward ends, each of the rocker arms 12 and 12a is equipped with a cam follower 15 (FIGS. 5, 6 and 8). The cam followers 15 each ride on cams 16 and 16a, respectively (FIGS. 8 and 10). The cams 16 and 16a are separated by the cam 24 which will be described subsequently.

At its forward end, each of the rocker arms 12 and 12a has an upstanding pin 17 and 17a respectively. Each of the pins extends through a separate opening in the guideway 10, one on each side of the central slot 11. The pivoting of the rocker arms 12 and 12a under the influence of the cams 16 and 16a causes the pins 17 and 17a each to be alternately extended above and retracted into the guideway 10. The purpose of this will be explained more fully hereinafter. Each of the rocker arms is urged downwardly on its rearward end by a spring 18 to maintain constant, positive engagement with the cams 16 and 16a.

The cams 16 and 16a are mounted on and keyed to the drive shaft 5. Each of the cams 16 and 16a has a single crown for activating its associated rocker arm. The crowns of the cams 16 and 16a are spaced 180 degrees apart, resulting in alternate operation of the rocker arms 12 and 12a.

Mounted on the shaft 5, between the cams 16 and 16a, is a double acting cam 24. This double acting cam 24 is keyed to the drive shaft 5 for positive coordination with the cams 16 and 16a.

The double acting cam 24 has a pair of crowns arranged 180 degrees apart, effecting two actuations of its associated structure in each operating cycle. The machine is so designed that each revolution of the shaft 5 effects one operating cycle of the machine.

As best seen in FIG. 8, a rocking lever 25 is pivotally

mounted to the base structure 2 rearwardly of the cam 24. The rocking lever is urged against the cam 24 by a spring 26. Thus, during each revolution of the shaft 5, the rocking lever 25 is forced rearwardly twice. Pivotaly secured to the upper end of the rocking lever 25 is a rod 27. The rod 27 lies in the slot 11 in the guideway 10 and extends the full length of the guideway. At its forward end, the rod 27 has a cinching head 28. The cinching head extends laterally from each side of the rod to a point beyond the pins 17 and 17a. The thickness of the cinching head 28 is slightly less than that of the wire formed in the machine. The purpose of this will be brought out under "Operation."

In its forward position the cinching head seats in a retraction pocket 29 in the forward end of the guideway 10 (FIGS. 2 and 8). The depth of the pocket 29 is such that the top surface of the cinching head 28 is flush with or below that of the top surface of the guideway 10 when seated in the pocket. The rearward end of the pocket is defined by a sloping wall 30. The sloping wall 30 causes the cinching head 28 to rise onto the top surface of the guideway 10 when the cinching head is drawn rearwardly. The function of this wall will be explained more fully under "Operation."

The rocking lever 25 and the spring 26 are both mounted on a plate 31 (FIG. 8) which may be adjusted longitudinally of the machine to correctly position the cinching head 28 with relation to the rest of the structure. The plate 31 is secured by bolts 32 passing through slots in the plate 31 whereby the longitudinal adjustment may be effected.

(2) Wire wrapping assembly

Mounted at one end of the drive shaft 5 is a crank head 40 (FIGS. 1 and 2). The crank head 40 is secured to a hub 49 which, in turn, is secured to the shaft 5. The crank head is attached to the hub by the retaining bolts 41, each of which is mounted in an arcuate slot 42. This arrangement permits adjustment of the crank head 40 circumferentially of the shaft 5. This permits its adjustment with respect to the cams 16, 16a, 24 and 80. The crank head 40 has a radially extending guide slot 43. A slide 48 (FIG. 1) is seated in the slot 43 to which is pivotally attached a crank arm 44 by means of the threaded pin and nut assembly 45. After the slide 48 has been properly spaced radially from the shaft 5, its position is locked by tightening the bolts 41.

At its rearward end, the crank arm 44 is pivotally secured to the connecting rod 46 through an adjusting block 47 (FIGS. 1 and 2). The adjustment block 47 is movable along the connecting rod 46 and may be locked in any selected position by suitable means such as set screws.

At the front of the machine a bearing post 50 is secured to the base frame 2. Extending vertically through the bearing post is a shaft 51 (FIGS. 2 and 4) having a pinion gear 52 at its lower end. The pinion gear 52 meshes with a rack 53 on the front end of the connecting rod 46. The base of the post 50 has suitable structure for holding the rack 53 in engagement with the pinion gear 52. Secured to the upper end of the shaft 51 is a reciprocating beam 55. Pivotaly secured to one end of the reciprocating beam 55 is a tie bar 57 having a pair of guide rollers 56 mounted thereon. The point of attachment between the tie bar and the reciprocating beam 55 is at the center of the tie bar.

The rollers 56 each have a peripheral groove 58. The rollers are so mounted that their peripheral grooves co-operatively form a wire discharge passage just large enough for movement of the wire between them. The point of tangency or near tangency of the rollers 56 is at the axis of rotation of the tie bar 57 about its pivotal attachment to the reciprocating beam 55. The guide rollers 56 are so located vertically that the peripheral grooves 58 are flush with the top surface of the guide-

way 10. The length of the reciprocating beam 55 is such that as the beam rotates with the shaft 51, the rollers are carried around the end of the guideway 10 and travel some distance along the sides of the guideway.

This arc of movement is great enough to carry the wire discharge passage rearwardly of the pins on each side of the guideway 10 (FIGS. 11 and 14). The shaft 51 is located on the longitudinal centerline of the guideway 10.

The rollers 56 together with the tie bar 57 and reciprocating beam 55 collectively constitute a feeding head 59. It will be recognized that various modifications of the feeding head may be made which will operate satisfactorily with this machine.

Where the axis of rotation of the feeding head 59 is forward of the pins 17 and 17a the arc of travel of the head will exceed 180 degrees. However, should this axis be located rearwardly of the pins 17 and 17a this arc may be reduced to 180 degrees or less. The reciprocating beam 55 will have to be correspondingly lengthened to provide clearance for the rollers 56 around the forward end of the guideway 10.

(3) Wire progression assembly

Secured to the forward portion of the vertical arm 3 is an adjustable head 60 (FIGS. 1, 2 and 3). The adjustable head 60 is secured to the vertical arm 3 by studs 61 and wing nuts 62. The studs extend through a slot 67 in the adjustable head 60, permitting vertical movement of the adjustment head with relation to the top surface of the guideway 10. A rigid bracket 64 extends laterally from the vertical arm 3 over the guideway 10. A second rigid bracket 68 extends laterally from the head 60 over the guideway 10. A vertical shaft 65 passes through the brackets 64 and 68. It is stationary with respect to them. A portion of the shaft is threaded and has mounted on it an adjustment nut 66 and a locking ring 69. The lower end of the shaft is secured to the bracket 68 on the adjustment head 60. By rotation of the nut 66, the adjustment head 60 and the assemblies secured thereto may be adjusted accurately with respect to the guideway 10.

A shaft 75 is journaled in the lower portion of the adjustment head 60. Mounted above the forward end of and centered over the guideway 10 is a wheel assembly 70 (FIG. 15) having a pair of spaced resilient, contact disks 76. The contact disks 76 are spaced apart at least the width of the slot 11. Both are seated between the pins 17 and 17a. The contact disks 76 are of any suitable material such as natural rubber, synthetic rubber or a synthetic resin. The disks must have substantial rigidity yet be characterized by a peripheral surface capable of a small degree of yield and a high coefficient of friction. The contact disks 76 are mounted on the flanged hub 71 which is secured to the shaft 75. The contact disks 76 are held in spaced relation both from each other and from the ends of the hub 71 by suitable spacers 72. The disks and spacers are clamped by the header plate 77 secured by bolts 78. The end of the shaft 75 is threaded and the hub 71 is secured by the washer and nut assembly 73. The center line of the shaft 75 is slightly rearwardly of the pins 17 and 17a. The purpose of this will appear more fully under "Operation."

The shaft 75, on the end opposite from the contact disks 76, is equipped with an inching clutch 78 driven through the arm 79 by the cam 80 (FIGS. 1 and 9). The cam 80 is mounted on the shaft 5. The cam 80 has two diametrically positioned crowns. Thus, the inching clutch is operated twice in each revolution of the shaft 5. The progression of the shaft 75 is controlled by the length of the stroke of the arm 79. This may be varied by means of the adjustable stop 81. The arm 79 is returned positively against the stop 81 by the spring 82.

The structure of the inching clutch 78 is not described in detail since it is conventional equipment and its structural details form no part of this invention.

(4) Wire feed assembly

The wire is supplied to this machine as a continuous strand 90 (FIG. 1). The wire may come from any suitable source such as a spool 91. The spool may be mounted on any suitable support and this support need not be associated with the machine. Since the machine's demand for wire is intermittent, it is necessary to provide means to effect a substantially constant quantum of tension on the strand 90. This is accomplished by passing the wire over two feed rollers 92 and 93. The feed roller 92 is rotatably mounted upon a fixed shaft 94, and its position with relation to the machine is fixed. The shaft 94 is surrounded by a tube having a pair of radially projecting arms 95 and 96. The roller 93 is rotatably mounted on the end of the arm 96. Tension is obtained from a spring 97 secured to the arm 95 and urging the arm 96 to pull against the wire away from the feeding head 59. Suitable means are provided to restrict the free rotation of the spool 91 while the force exerted by the spring 97 is such that it is just capable of withdrawing wire from the drum when the machine is not demanding wire in its operating cycle. Thus, the rapid demand of wire by the machine will cause the roller 93 to move toward the drum during a peak wire demand. When the machine's wire demand decreases, the spring 97 overcomes the resistance of the drum and withdraws sufficient wire from the drum to permit the roller 93 to return to its normal position. Overtravel of the roller 93 away from the drum is prevented by any suitable mechanical expedient such as a stop 98.

Like the spool 91, the feed rollers 92 and 93 and their associated structure need not be mounted on a support or other equipment associated with the machine. Further, the particular wire feeding mechanism is not a part of this invention as various other arrangements can be used with equal facility with this machine. For this reason, the wire feeding mechanism is neither illustrated in detail nor is its particular structure considered a limitation of this invention.

The wire, after it has been sinuated by the machine, moves along the guideway 10 and through the chute 100 to a take-up spool 101. The chute 100 is merely a shallow, U-shaped trough supported at its rearward end by a standard 102. Its front end seats in a shallow pocket 103 in the rearward end of the guideway 10. The take-up spool 101 need not be part of the machine although it is preferable that it be driven from the machine to assure coordination of its operation.

(5) Drive assembly

The machine is driven by a prime mover 110 through a speed reducer 111 (FIG. 2). By means of the belts 112 and 113, power is transmitted from the speed reducer to the large fly wheel 114 mounted on the end of the drive shaft 5. The take-up spool 101 is driven from the shaft 5 by means of belts 116 and 117 through a speed reducer 118 (FIG. 1). The speed reducer 118 reduces the angular velocity of the spool 101 to that which will conveniently take up the sinuated wire as it is fabricated without placing it under such tension as will cause separation of the loops. It will be recognized that any suitable prime mover may be used for driving this machine. Further, the particular arrangement of belts and related equipment is merely illustrative and is not to be considered a limitation upon the invention. Various other arrangements may be used with equal facility.

Operation

The object of the machine is to form a straight strand of wire into a plurality of parallel, elongated narrow loops having their closed ends alternately arranged on opposite sides of the resulting wire. The machine is designed to form loops of equal length and of equal radius at the bends.

The wire is fed to the machine as a single strand 90.

It enters the machine by passing between the pair of guide rollers 56 (FIG. 1). To initiate the operation of the machine, the wire, after passing through the guide rollers, is passed about one of the pins 17 or 17a extending above the surface of the guideway 10. The particular pin will be selected away from which the reciprocating beam 55 is going to swing as the machine initiates its operation. The machine is then operated through several cycles to create a length of wire sufficient to initiate automatic operation. The contact disks 76 are then lowered until they have sufficient bearing on the wire that as they are rotated they will slide the formed wire along the surface of the guideway 10.

To start automatic operation of the machine, it is considered to be in the position illustrated in FIG. 11, with the feeding head 59 swung to its extreme position on one side of the guideway 10. In the position illustrated in FIG. 11, the feeding head 59 is adjacent the pin 17. When the feeding head 59 reaches its maximum rearward travel, there is a momentary dwell period. In this position, the feeding head positions the strand of wire rearward of the pin 17. During the dwell period, the pin 17 is caused to rise above the surface of the guideway 10. The wire, at this time, is bent about the other pin 17a on the opposite side of the guideway 10. The cinching head 28 is moved up firmly against the front portion of the wire wrapped about the pin 17a.

As the feeding head 59 initiates its forward movement, the cinching head 28 moves forwardly and lowers into the pocket 29 below the plane of the wire 90 (FIG. 12). As the feeding head 59 moves forwardly and swings about the forward end of the guideway 10, the wire is drawn tightly about the pin 17 (FIG. 13). Just before the feeding head 59 brings the wire into contact with the pin 17a, this pin is retracted. This permits the feeding head 59 to carry the wire behind the pin 17a (FIG. 14). Simultaneously, the cinching head 28 moves up onto the surface of the guideway 10 and firmly presses against the wire but this time against the wire as it passes about the pin 17 (FIG. 14).

The contacting disks 76 of the wire progression assembly contact that portion 150b (FIG. 12) of the wire extending laterally between the pins 17 and 17a and the next adjacent portion 150a, one end of which has been released by one of the pins. The area of contact with the contact disks 76 is indicated by the phantom rectangle 151. During the interval between the withdrawal of the pin 17a and the movement of the wire strand 90 rearward of the pin 17a by the rollers 56, the contact disks 76 rotate to move the last loop of wire formed about the pin 17a rearwardly a distance equal to the width of a loop longitudinally of the guideway 10. The movement of the wire is indicated by the displacement of the portions 150a and 150b in FIG. 14. This permits the feeding head to move the wire behind the pin 17a without interference. As the feeding head 59 reaches the momentary dwell point representing its maximum rearward travel adjacent the pin 17a, the pin 17a is again raised, trapping the wire strand 90 behind it. The feeding head then reverses its travel and moves around the front end of the guideway toward the pin 17.

Since the wire passes from the front of one pin to the back of the other pin as it is sinuated, the sides of the loops are not parallel as initially formed. However, the progression of the formed wire under the influence of the contact disks 76 corrects this situation since it bends the wire slightly rearwardly as the loop is moved past the retracted pin.

It will be seen from this description that, as the machine is illustrated, the forming of the wire consists of carrying the wire back and forth through an arc of slightly more than 180 degrees with the wire, at each limit of its travel, being caught behind a pin. The pin serves as a die, accurately controlling the radius of the bend. The sinuated wire is intermittently inched rear-

wardly on the guideway 10 twice in each operating cycle. This inching movement occurs in each cycle once when the pin 17 is withdrawn and once when the pin 17a is withdrawn. The function of the cinching head 28 is to assure a tight wrapping of the wire around each of the pins and to prevent the wire from moving away from the pin when the feeding head 59 initiates its return movement but before the wire contacts the pin that has in the meantime risen above the guideway 10 to intercept it. The minimum diameter of the pins 17 and 17a is limited by the minimum radius over which the wire may be bent.

It will be seen from this description that it is important in this machine that the intermittent operation of the various mechanisms be precisely coordinated. This is accomplished by driving all moving elements of the machine from a single drive shaft. The cams 16, 16a, 24 and 80, together with the crank head 40 are all locked to the shaft 5, their coordination, once established, is permanent. Since it is necessary to accurately adjust the quantum of motion of the contact disks 76, the reciprocating beam 55 and the cinching head 28, individual adjustments are provided for each. The distance the inching clutch 78 moves the contact disks 76 at each actuation is controlled by the adjustable stop 81 since that determines the length of stroke of the arm 79.

The length of the arc of travel of the feeding head 59 is adjusted by the radial spacing of the bolt 45 and its associated slide 48 from the shaft 5. The position of the feeding head 59 may be coordinated with the other parts by varying the position of the adjustable block 47 along the rod 46. This effects coordination of the feeding head 59 with the various cams mounted on and fixed to the shaft 5. The precise pressure exerted by the contact disks 76 upon the wire is selected through the adjustment nut 66. Once established, the position of the adjustable head 60 is locked by tightening the wing nuts 62.

It will be observed from the structure of the cams 16 and 16a, since they each have a single crown, that the rocker arms 12 and 12a will only be moved once in each operating cycle. Since the cams 16 and 16a have their crown set at a 180 degree spacing, the operation of the rocker arms 12 and 12a will alternate. It will also be observed from FIG. 9 that the crowns of the cam 80 are set for simultaneous operation with the crowns of the cams 16 and 16a. Since the cams 16 and 16a effect withdrawal of the pins, it will be observed from FIG. 9 that the intermittent rotation of the contact disks 76 and of the withdrawal of one or the other of the pins 17 and 17a is simultaneous. From this same view, it will be observed that the cam 24 also effects two movements of the cinching head 28 in each rotation of the shaft 5. These, however, are set to occur intermediate the operation of the cams 16, 16a and 80.

This machine provides a simple mechanism, capable of rapidly and accurately sinuating the wire. The bends formed in the wire will be to a precise radius and the length of each wire run between the bends will be identical. Once the operation of the machine is initiated, it will operate continuously without attention so long as a supply of wire is provided. The machine has no mechanism likely to result in a broken strand or cause damage to the wire. The nature of the machine is such that it will operate rapidly, thus having a high production capacity.

While I have described one particular embodiment of this invention, it will be recognized that various modifications may be made without departing from the principles thereof. Each of these modifications is to be considered as included in the hereinafter appended claims unless these claims by their language expressly state otherwise.

I claim:

1. In a machine for sinuating wire received under tension, said machine comprising: a flat surfaced support; a pair of rocker arms pivotally mounted beneath said support; a die pin on the forward end of each of said

rocker arms; said die pins extending upwardly through said support adjacent the forward end and one on each side thereof; a driven shaft; a feeding head having a pair of peripherally grooved rollers; means mounting said feeding head for reciprocating arcuate travel around said forward end of said support; said grooves together forming a passageway for the wire; said feeding head at each end of its travel positioning said passageway rearwardly of said pins; a contact member having a resilient peripheral surface bearing on said wire between said pins and adapted to move said wire rearwardly along said support; a crank on said shaft; a rack and pinion connected to said feeding head; means connecting said crank and said rack for actuating said feeding head; a pair of cams on said shaft for alternately pivoting said rocker arms for alternately withdrawing each of said pins into said support as said feeding head approaches the limit of its travel and to re-extend said pins when said feeding head reaches the limit of its travel; a third cam on said shaft adapted to activate said contact head each time one of said pins is withdrawn; a pocket in said support forward of said pins; a cinching head normally received in said pocket; a fourth cam on said shaft and means connecting said fourth cam to said cinching head for urging said cinching head against the wire wrapped around each of said pins while the other of said pins is withdrawn.

2. A wire sinuator comprising: a flat, stationary support surface; a pair of pins retractable into and extendable normally to said surface but otherwise stationary; a wire feeding head movable generally in the plane of said surface about said pins and through an arc of more than 180°, both extremities of said arc lying on the same side of a line joining the centers of said pins, the motion of said wire feeding head bending said wire alternately about said pins, said wire extending at all times during the motion of said wire feeding head in a straight line from said wire feeding means to the one of said stationary pins about which it is being bent, and means cooperating with said wire feeding head for retracting the other of said pins when said wire approaches a position parallel to said line joining the centers of the pins, and extending it again when said feeding head reaches the end of its arc adjacent said other pin.

3. A wire sinuator comprising: a flat, stationary support surface; a pair of pins retractable into and extendable normally to said surface but otherwise stationary; a wire feeding head movable generally in the plane of said surface about said pins and through an arc of more than 180°, both extremities of said arc lying on the same side of a line joining the centers of said pins, the motion of said wire feeding head bending said wire alternately about said pins, said wire extending at all times during the motion of said wire feeding head in a straight line from said wire feeding means to the one of said stationary pins about which it is being bent, means cooperating with said wire feeding head for retracting the other of said pins when said wire approaches a position parallel to said line joining the centers of the pins, and extending it again when said feeding head reaches the end of its arc adjacent said other pin, and advancing means engaging the sinuated portion of said wire and pulling it away from said pins each time one of said pins is retracted.

4. A wire sinuator comprising: a flat, stationary support surface; a pair of pins retractable into and extendable normally to said surface but otherwise stationary; a wire feeding head movable generally in the plane of said surface about said pins and through an arc of more than 180°, both extremities of said arc lying on the same side of a line joining the centers of said pins, the motion of said wire feeding head bending said wire alternately about said pins, said wire extending at all times during the motion of said wire feeding head in a straight line from said wire feeding means to the one of said stationary pins about which it is being bent, means cooperating with said wire feeding head for retracting the other of said pins

when said wire approaches a position parallel to said line joining the centers of the pins, and extending it again when said feeding head reaches the end of its arc adjacent said other pin, advancing means engaging the sinu-
 5 ated portion of said wire and pulling it away from said pins each time one of said pins is retracted, and cinching means for holding said wire clear of an extending one of said pins while it is in the process of being extended.

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