June 21, 1966

A. J. FISHER, JR., ETAL

3,256,915

WIRE FORMING MACHINES

Filed Dec. 11, 1959

5 Sheets~Sheet 2

FIG. 2

FIG. 12

FIG. 13

INVENTORS
ANDREW JAY FISHER JR.
RAYMOND D. STROUT

ATTORNEYS
This invention relates to wire forming machines and particularly to certain novel and useful improvements in wire bending machines of a type which form the supporting end sections of wire and back springs having small portions from which the end support sections are formed.

Wire springs of the type to which we refer are conventionally used in vehicles and furniture. The present invention relates to the forming of wire into various shapes and forms, particularly to the forming of long and slender shapes such as torsion bars. The invention includes transversely reciprocating slides arranged on opposite sides of a wire to be formed, rotatable slide dies for twisting torsion bar portions of the wire, and means for supporting the slides and rotatable dies in predetermined positions. The machine depicted, some rotatable die sections at the torsion bars are initially aligned with the wire but are rotated about an axis parallel to and out of alignment with the torsion bars of the wire.

Other objects and advantages of the invention will be pointed out specifically or will become apparent from the following description when it is considered in conjunction with the appended claims.

FIGURE 1 is a top plan view of the machine construction in accordance with the invention, including the wire to be formed shown held in position by the forwardly actuated holding and twisting slides in readiness for performance of the twisting operations; FIGURE 2 is an end elevation view illustrating the cam mechanism controlling the operation of the wire holding dies and the drive elements therefor; FIGURE 3 is an enlarged, transverse, sectional view taken on the line 3—3 of FIGURE 1, and depicting motion transmission elements for the wire holding dies which are both reciprocated and rotated, in some detail; FIGURE 4 is a fragmentary, top plan view thereof; FIGURE 5 is a fragmentary, sectional view taken on the line 5—5 of FIGURE 3; FIGURE 6 is an enlarged, transverse, sectional view taken on the line 6—6 of FIGURE 1 and showing a slide which is reciprocated but not rotated; FIGURE 7 is a top plan view thereof; FIGURE 8 is a view showing a typical formed wire which can be supplied to the machine; FIGURE 9 is an edge elevation of the wire shown in FIGURE 8, the diagrammatic lines illustrating the bending operations which are sequentially performed on the wire by the machine; FIGURE 10 is a top plan view of a wire spring which has been formed by the machine; FIGURE 11 is an edge elevation view thereof; FIGURE 12 is an enlarged, fragmentary, top plan view of wire holding die units shown at the right end of the machine in FIGURE 1; FIGURE 13 is a fragmentary, end elevation view thereof; FIGURE 14 is a fragmentary, sectional, elevation view taken on the line 14—14 of FIGURE 12; FIGURE 15 is an enlarged, fragmentary, side view of the bending dies which are adapted to perform a twisting operation at a torsion bar preformed in the wire; FIGURE 16 is a similar view illustrating the tilted position of the same die members after the twisting operation has been performed and prior to the time they are removed from the wire; and FIGURE 17 is a schematic view illustrating an electrical circuit which may be employed to operate a retractable wire supporting element.

Referring now more particularly to the drawings for a detailed description of the various elements of the machine, a letter generally indicates the frame of the machine, which includes cornerstone members 10 (FIGURE 2) connected by end wall rails 11 and side edge beams 12. End plate members 13 fixed on the beams 11 are provided to support pairs of rails 14 and 15 which are fixed to the end members 13 and aid in stabilizing the frame.

In order that the cross rails 12, 14, and 15 can be employed to support wire handling units in various longitudinal positions dependent on the shape of the preformed
wire W to be further formed, inversely disposed T slots 16 are provided therein. As shown particularly in FIGURES 1 and 7, inversely disposed, T-shaped nuts 17 received in the groove 16 are provided for bolt members 18 which secure various elements, to be presently described, in particular longitudinal positions. The machine bolts 18 may be provided with slotted heads so that they can be readily turned with a screwdriver or the like, and the heads are square in shape and will not turn in the grooves 16, although, as shown, there is sufficient clearance so that they can move freely longitudinally in the grooves 16 except, of course, when they are drawn up into clamping relation. The rails 14 and 15 support slide housing assemblies or means which are arranged on opposite sides of the wire to be twisted, in predetermined, longitudinal position, and will presently be described.

A typical wire W of the type to be formed, which will preferably be fed down automatically from an overhead hopper prior to the commencement of each forming operation, comprises (FIGURES 1 and 8–11) a substantially linear deck section 20 having rear deck torsion bars 21 and 22 which, with a spacer bar portion 23, form a single loop in the rear portion of the deck section 20. At the front end of the wire are torsion bars 24, 25, and 26 and diagonally disposed sections 27 and 28 connecting the torsion bars 24, 25, and 26, as shown.

The slide supporting housing assemblies are generally designated 25–29 on one side of the wire W in FIGURE 1 and 30–34, and 35 on the opposite side of the wire W. In addition, a block 35 having an elongated wire support bar 36 is secured in longitudinal position on one of the rails 15 opposite the slide housing assembly 30 and a support plate 37 mounting a fluid pressure operated cylinder 38 with a retractable piston rod 39 is supported on the rails 14 and 15 on one side of the machine. Connected to rod 39 is a retractable wire supporting plate 40 having magnets 41 thereon which will be disposed under the wire when it drops down from above. Both the block 35 and plate 37 are clamped in longitudinal position by bolt members 18 or the like extending down into grooves 16 in the particular members 14 and 15.

The slide housing assemblies 25, 26, 29, 30, and 34 are constructed differently than the slide housings 27, 28, 31, and 32, and attention is now directed to FIGURES 3–5 for a disclosure of the first mentioned group of housing assemblies and the reciprocable and rotatable slides which they carry. Since each of the assemblies 25, 26, 29, 30, and 34 is preferably identical in design, a description of the housing 29 and its associated rotatable slide 42 will suffice for all. The slide 42 comprises a cylindrical shaft which passes through a bore 43 in the housing 42a and is rotatable in bushings 44 provided therein as shown in FIGURE 3. Provided on shaft 42 are elongate pinion teeth 45 which mesh with the teeth 46 of a rack 46 carried in a vertically disposed groove 47 provided adjacent to and communicating with the horizontally extending bore 43. The rack 46 is vertically grooved as at 48 to receive a second rack bar 49 in mesh with a motion multiplying pinion 50 rotatably carried by a tappet 51. Provided in the lower end of housing 42a is a slide groove or guideway 52 receiving the tappet 51 and housing 42a is also horizontally recessed as at 53 to receive a third rack bar 54 in vertically fixed position therein with the machine, and the teeth 55, secured by screws 56, is provided for the rack 46, rack bar 49, tappet 51, and gear segment 54.

Mounted on the rack bar 46 at the upper end thereof is an angular plate 57 having an opening 58 (FIGURE 5) through which the threaded upper end 59 of bar 46 extends, the end 59 having a threaded opening 60 corresponding to the opening 61 which is employed to position the rack bar 49. The plate 57 (see FIGURE 5) is secured by a nut 62 on the threaded upper end 59 of rack member 46 and a nut 63 fixes the position of stud 61. Plate 57 also carries a bolt 64, secured by a nut 65, which functions as a stop in cooperation with a stop plate 65a provided on the housing 42a. Thus, downward movement of the rack 46 is arrested by the plate 57. Mounted on a retainer rod 66 threaded as at 67 in plate 57 and secured by nut 68 is a return spring 69. Rod 66 depends through a vertical bore 70 provided in the housing 42a on the opposite side of the piston 45 from the rod 46 and the lower end of bore 70 is countersunk as at 71 to provide an inner seat for the spring 69 which is restrained at its opposite end by a head portion 72 on the rod 66.

As will be seen from an inspection of FIGURES 1, 2, and 3, twin cam shafts 73 and 74 extend longitudinal along the frame F and are supported by bearings 74 provided in intermediate end connecting plate or wall members 74a. In the case of the slide housing assemblies 25, 26, 29, 30, and 34, which provide both reciprocable and rotatable die members, a pair of adjacent cams 75 and 76 are keyed as at 77 to the cam shafts 73 or 74a, as the case may be, under each housing 42a. Rotatably mounted on tappet 51 is a follower roller 78 on pin 79 and when tappet 51 is moved upwardly by a rise in the cam 75, pinion 50 is revolved counterclockwise in FIGURE 3, moving rack bar 49 and, accordingly, rack bar 46 upwardly. Slide rod 42 will be revolved in a counterclockwise direction responsive to upward rise of the slide bar 42 as viewed from the front or working holding end thereof, which is at the left in FIGURE 3. Because pinion 50 moves upwardly with tappet 51 at the same time it is revolved by stationary rack 54, the rise of cam 75 is multiplied and the desired degree of revolution of shaft 42 can be achieved.

Cam 76 controls the forward and rearward travel of slide 42 which has a working holding and supporting means, generally designated S, fixed thereon in the case of slide housing assembly 29, as by a key 78, and, as shown particularly in FIGURES 4 and 5, a lever 79 rotatably carries a cam follower roller 80 on a pin 81. A clevis member 82 secured in the T slot 16 in rail 12 pivotally supports the lever 79 on pin 83 and at its upper end, lever 79 mounts a clevis coupling member 84 which receives the block 86 on the rear end of slide 42. Trunnions 87 on the block 86 are received in slots 88 provided in the side walls of clevis member 84 as shown. Plainly in FIGURE 3 when a rise in cam 76 pivots the upper end of lever 79 in a counterclockwise direction about pin 83, the slide 42 is moved forwardly.

Provided on the rear end of slide rod 42 is a return spring 89 bearing on a washer 90 which freely passes the shaft 42 and spring 89 is, of course, compressed when the slide 42 is moved forwardly. Also, secured to block 82 is an arm 92 having a stop member 93 adapted to engage with a stop plate 94 fixed to rail 12 (FIGURE 3) and secured by nut 94. The plate 92 has an enlarged opening 95 for freely passing a rod member 96, coupled or linked to the lever 79 as at 97. Rod 96 is threaded at its outer end as at 96a to receive nut members 98 which retain a second return spring 99 which bears also against plate 92.
In FIGURES 6 and 7, the slide housing assembly generally designated 32 is shown, and since housing assembly 27, 28, and 31 are of identical design except for their work accommodating front end members, a description of housing assembly 32 will suffice for all. As shown in these views, the housing 32a is clamped in longitudinal position on rails 14 and 15 by means of clamp screws 18 in the manner described previously and is provided with transversely extending groove or recess 107 in which a slide 108 is reciprocably received. At its rear end, slide 108 is bored as at 109 (FIGURE 7) to receive a pin 110 which extends below the slide on both sides and is received within slotted openings 111 provided in a clevis 112 fixed on an actuating lever 113. The lever 113, through a rotatable follower roller 114 pinned to its lower end as at 115, transmits motion from a cam 116 keyed to camshaft 73 as at 117. Clevis block 118 clamped into the groove 16 in edge rail 12 by a clamping screw 18 is provided with a pin 119 which pivotally mounts the lever 113 for swinging movements in a vertical plane.

As in the case of lever 79, the pivot pin is disposed relative to the lever to effect a mechanical advantage. The lever return system for lever 113 is exactly the same as the return spring system for lever 79, as shown in FIGURE 3, and the like parts accordingly will not be described again but are given in numbers in the drawings.

At its front end, slide 108 has fixed thereto a wire holding unit S by means of a screw 120 and it will be seen that the unit S has a dependent portion 121 adapted to engage a stop screw 122 which is disposed within a recess portion 123 of the housing 32a to positively limit its forward movement. The wires holding 125 units generally designated S for slide housing assemblies 28, 31, and 32 are generally identified by the numerals 124, 125, and 126, respectively, and will now be described in detail. Each such unit S includes a generally clevis shaped jaw member 127 having a pin member 128 connecting its leg portions which embrace the front end of a block member 129. The jaw member 127 is provided with a wire receiving slot 130 horizontally aligned with the axis of reciprocation a of slide bar 108 and it will be seen that pin 128 is also normally located on this axis. The pin 128, however, received in a vertically slotted portion 131 of the block 129 is positioned in the slotted portion 131 by a set screw 132 so that the portion of jaw 127 could be vertically varied. When variation is desired, a set screw 132a can be adjusted at the same time.

However, where the members 36 and 41 receiving the wire initially are at a particular level, slot 130 will be arranged at the same level normally so that when slide 108 is moved forwardly it will receive the wire W within the slot 130.

The portion of block 129 which is cut away to receive the arms of the U-shaped jaw 127 is curved as at 133 so that plainly jaw 127 can be tilted upwardly slightly about pin 128. Each of the die assemblies 28, 31, and 32 are of this construction and include vertically pivotal jaws 127 having slots 130 centered in horizontal alignment with the upper surfaces of the initial wire supporting members 36 and 41. The purpose of providing tiltable jaw members 127 will be presently explained.

Referring now to the slide housing assembly 27 and FIGURE 1, it is to be understood that the assembly is identical with that shown in FIGURES 6 and 7 and just described, except that the front end of slide 108 is simply provided with a work supporting magnet portion 134 and has no unit S. A cover plate 135 is provided for the slide housing assembly 27, as well as for the slide housing assemblies 28, 31, and 32, and is secured by bolts 136 or the like, as shown in FIGURES 6 and 7.

In FIGURES 15 and 16 particularly illustrate, in addition to units of the type of unit 125, units S of the type generally designated 102, 103, and 106, and it will be observed that these units are constructed in the same manner as is the unit 129 shown in FIGURES 6 and 7 except that the wire holding slot 130 is offset a distance x axially relative to the axis of rotation of the slide 42 which is indicated by the line b in FIGURE 15 (unit 102). The axes of the shafts 42 of the die units 103 and 106 are similarly vertically offset from the axes of the other shafts 42 of the die assemblies 124, 125, and 126.

The reason for the offsetting of the die units S which revolve on shafts 42 will now be explained. If the wire holding units 102, 103, and 106 which accomplish twisting of the torsion bars 22, 24, and 25 are positioned so that the axis of rotation b of the rotary slide shaft 42 is in alignment with the slots 130, the torsion bars 22, 24, and 25 are horizontally tilted as a result of the twisting operation, rather than truly horizontal as they are shown in FIGURE 11. When a horizontally disposed torsion bar is held at one end and twisted or rotated about itself at its opposite end as in the present machine, the torsion bar will be bent either upwardly or downwardly as a beam, as well as twisted torsionally. The result is a drooping of the torsion bars of the end section, as this effect is known in the trade. By means of the wire holding slot 130 a predetermined distance x from the axis of rotation b in the vertical direction, the rotation proceeds about an axis aligned with the torsion bar in a vertical plane but offset from it horizontally in a manner to compensate for this bending of the torsion bar as a beam so that the torsion bars are not horizontally tilted in the finished product. The offset must be gauged, of course, for the normal "return" of the resilient wire. In FIGURE 16, the jaw assemblies 102 and 125 are shown in a position in which the shaft 42 of the assembly 102 has been revolved. This wire holding slot 130 of the units generally designated 127 of both die units 125 and 102 are free to tilt in the manner shown in FIGURE 16. In some instances the pins 128 of die units 124–126 and 102, 103, and 106 will be replaced by screws which fix the jaws 127 in position and prevent their tilting. The tilting of the torsion bars will still be avoided although slight bends are placed in the ends of the torsion bars because the jaws 127 cannot tilt. In many instances wires having these slight bends are acceptable.

FIGURES 12–14 indicate the manner in which a rotary slide shaft 42, as shown in FIGURES 3–5, can be employed to produce angular bends in the wire without twisting a torsion bar about its axis. The jaw assembly shown has been described in detail in FIGURE 3. While its slide shaft 42 is both reciprocable and rotatable about its axis, its slot 101 is vertically centered with respect to the axis of rotation of shaft 42 because die head 104 is not twisting at a torsion bar. The die head 105 also, as will be later explained, has its slot 101 in vertically centered alignment with the axis of its shaft 42 in the manner of die head 104.

Mounted on the fixed portion 129 of die head 106 is a bracket 137 (FIGURE 13) having a longitudinally offset portion 138 with a vertically disposed groove 139 therein. A vertically adjustable die 139 having a slot 140 therein so that it may be secured in vertically adjusted position by a screw 141 which threads into the bracket 137 mounts in the groove 139a. A set screw 143 threaded into a stop wall 144 above groove 139a braces the member 139 which functions as a bending die in a manner which will now be described. When the shaft 42 of slide housing assembly 29 is revolved to rotate head 104 through part of a revolution d, as indicated in FIGURES 9 and 14, the extending end of the wire is bent up to form a portion 23a and when portion 23a contacts die 139 a portion 23a is bent from portion 23a. Thus die 139 cooperates with a rotating die to form a bend in the wire, since die plate 139 is fixed on the die head 106 of adjacent slide housing assembly 134.

The cam shafts 73 and 73a on which the various cams 75, 76, and 116 are mounted controlling the operation...
of the machine may be driven in any suitable manner. As shown particularly in FIGURES 1 and 2, a platform 145 supported on the frame F may be provided to mount a motor 146 having an armature shaft 146a mounting a drive pulley 147 which, through the medium of drive belts 148, is connected to a conventional speed reducer 149, the belts 148 being trained around a pulley 150 keyed on the input shaft 151 of the reducer 149. The output shaft 152 of the speed reducer 149 is shown as provided with a sprocket 153 connected by a drive chain 154 with a sprocket 155 keyed on the extending end of shaft 157a. Gear 156 keyed on the shaft 173a drives a gear 157 keyed on shaft 173 through the medium of intermediate gears 158 and 159. The gears 158 and 159 are mounted on stub shafts 160 of the 161 which are journals by bearings 162 fixed on the end member 74a.

In the operation of the device, the wire W is dropped from an overhead hopper, preferably, to guides which lead down to the wire support member 36 and magnet support members 41 and 134 which are in forward position.

The wire will have been previously formed in a bending machine to the shape in which it is shown in FIGURE 8 in which all of its sections lie in a common plane. The die head members 102, 103, 104, 105, and 106, and 124, 125, and 126, will be in retracted position out of the path of descent of the wire W. Firstly, all of the die heads 102, 103, 124, 125, 104, 105, 125, 126, and 106 are moved forwardly so that the wire engages within their slots 101 or 130, as the case may be, to the position in which they are shown in FIGURE 1 and preferably at least the opposing slides in each case, such as 102 and 125, are moved simultaneously. The die members 104 and 105 do not have pivotal jaws 127 because they are not mounted opposite the torsion bars 21, 22, 24, or 25, to effect movement of the portion of the wire about one of the torsion bars as an axis.

The manner in which die head 104 swings through revolution d to form portions 23a and 23b of the wire has already been described and at the same time die head 105 moves through the revolution e (FIGURE 9) to form the offset portion 26a in the opposite end of the wire. As soon as these operations are completed, die heads 105 and 106 are withdrawn. The configuration of each pair of cams 75 and 76 is such that at the time the die heads 105 and 106 clear the wire, the die head 105is moved by means of the cam 79, 80 and 78 to accomplish return of the slide 42 and its associated mechanism to rearward position. Once heads 105 and 104 are withdrawn, head 102 is rotated through a revolution f and head 106 through a revolution g. In order that the torsion bars 25 and 27 will lie in a horizontal plane at the completion of the portion, the shafts 42 of heads 102 and 106 are offset below the opposite shafts of the heads 125 and 124, respectively. At the completion of these revolutions f and g, the opposing jaws 127 are tilted in the manner shown in FIGURE 16.

The next step is the withdrawal of die heads 102 and 106 and their non-rotary holding member 125 and 124, respectively. Then, die head 103 is rotated through the revolution h. In this instance the slot 130 of the jaw 127 for die head 103 is initially above the axis of rotation b of its rotatable slide 42, and at the end of revolution h the jaw 127 for head 103 has moved sufficiently about the offset axis to provide the compensating bend. Die heads 103 and 126 are then retracted and at the same time the slide 108 mounting magnet 134 is withdrawn. Also, fluid pressure cylinder 38 is operated to withdraw support plate 40 to retracted position. Fluid pressure cylinder 35 can be a conventional, solenoid operated, double acting cylinder with switches activated by a cam on the shaft 173 for moving the ram 39 forwardly and retracted position. FIGURE 17 diagrammatically illustrates the manner in which these conventional, double acting cylinders can be operated. Switch 163, operating in conjunction with a cam 164, can be employed to move the ram 39 forwardly and retain it in position, and switch 165 can be employed through cam 166 to retract the plunger 39. When support plate 40 and support head 134 are withdrawn, the wire is free to drop to a container or to a moving conveyor belt below the level of the rails 14 and 15. Once the wires have dropped, the magnets 134 and 41 are moved forwardly once again into position to receive the wire with the rod support 36 in receiving the next wire.

It should be clear that the machine disclosed is extremely versatile in operation and yet is of very simple and reliable design.

It is to be understood that the drawings and descriptive matter are in all cases to be interpreted as merely illustrative of the principle rather than limiting the same in any way since it is contemplated that various changes may be made in the various elements to achieve like results without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. In a wire bending machine; frame means; means having longitudinally disposed support surface thereon for supporting a generally longitudinally disposed wire having a portion with spacer bars joined angularly to a torsion bar; at least a pair of die members having means disposed in a longitudinal plane for receiving the wire arranged on said frame means on opposite sides of said torsion bar lying substantially in a common plane; means for tilting movement of said die members; and means for rotating one of said die members relative to the other about a transverse axis generally parallel to the torsion bar and the means for receiving the wire on the generally opposite die member but offset from the plane of the wire receiving means.

2. In a wire bending machine; frame means including longitudinally disposed support surface thereon for supporting a generally longitudinally disposed wire having a portion with spacer bars joined angularly to a torsion bar lying substantially in a common plane; members extending transversely to the support surface and generally opposite the ends of the torsion bar; generally opposate die members, including means for receiving the wire, disposed in a longitudinal plane, tiltable thereon into and out of the plane of the wire about a generally longitudinal axis for rotating at least one of said die members about a transverse axis offset from the plane of the wire receiving means of said one die member and generally parallel to the torsion bar and means for receiving the wire on the opposite die member.

3. In a wire bending machine; frame means; means having support surfaces thereon for supporting a wire disposed by said support means; die members on said slides having surfaces for accommodating the wire disposed in a longitudinal plane; said means having said support surfaces thereon disposing the torsion bars of the wire adjacent to said die members; a die member on one side of the wire and a die member on the opposite side thereof being in substantially opposing position at the ends of said torsion bars, each of said die members including means for holding the wire and being rockable out of the generally longitudinal plane of the wire; means for rotating one of said rockable die members for bending an end portion of said wire at one of said torsion bars out of the plane of an adjoining portion of said wire to form at least one end support section on said wire; said one of said rockable die members being rotated about a transverse axis offset with respect to the said longitudinal plane of the said surfaces on said die members and the wire; and means...
3,256,915

for operating said latter means and said slides in predetermined sequence.

4. The combination defined in claim 3 in which said last mentioned means comprises twin cam shafts; cams thereon; means transmitting the throw of said cams to said slides and latter means; and return spring means for said slides and latter means.

5. In a wire bending machine; frame means; means having support surfaces thereon for supporting a generally longitudinally extending wire with a portion of 10 generally sinuous design having torsion bars and spacer bars lying generally in a horizontal plane; transversely extending slide housing means supported on said frame means on opposite sides of said support surfaces and wire opposite at least one end of said wire; slides in said 15 housings movable transversely toward and away from a wire supported by said surfaces; certain of said slides being mounted for rotation; die members on said rotatable slides fixed thereon to rotate therewith and having slots in a longitudinal plane aligned with said plane for accommodating the wire; said means having support surfaces thereon disposing the torsion bars of the wire in horizontal alignment with the slots in said die members; means for rotating at least certain of said slides for bending end portions of said wire at said torsion bars 20 out of the plane of adjoining portions of said wire to form at least one end support section on said wire; cam shafts journaled by said frame means on opposite sides of the wire support surfaces; a pair of cams thereon for each rotatable slide; a single cam on a cam shaft for 30 the other slides; a lever connecting each slide with a cam for reciprocating the slide; means connecting other cams with the rotatable slides, permitting sliding of said slides relative thereto, for rotating said slides; said cams reciprocating and rotating said slides in predetermined sequence; and means for operating said latter means and said slides in predetermined sequence; said support surfaces comprising reciprocable magnet members movable in sequence with said slides.

References Cited by the Examiner

UNITED STATES PATENTS

2,450,876 10/1948 Blumensaadt et al. 140—71
2,645,268 7/1953 Blumensaadt 140—71
2,677,398 5/1954 Medendorp 140—71
2,744,546 5/1956 Williams 140—71
2,777,476 1/1957 Fante et al. 140—71
2,884,962 5/1959 Ott et al. 140—71
2,916,056 12/1959 O'Brien et al. 140—71.6
2,940,480 6/1960 Fante et al. 140—71
2,979,084 4/1961 Rober 140—71.6
3,004,584 10/1961 Fuchs et al. 155—44
3,104,685 9/1963 Gonia et al. 140—71
3,141,481 7/1964 Gonia et al. 140—71

CHARLES W. LANHAM, Primary Examiner.

NEDWIN BERGER, RICHARD A. WAHL, WILLIAM F. PURDY, Examiners.