

July 2, 1957

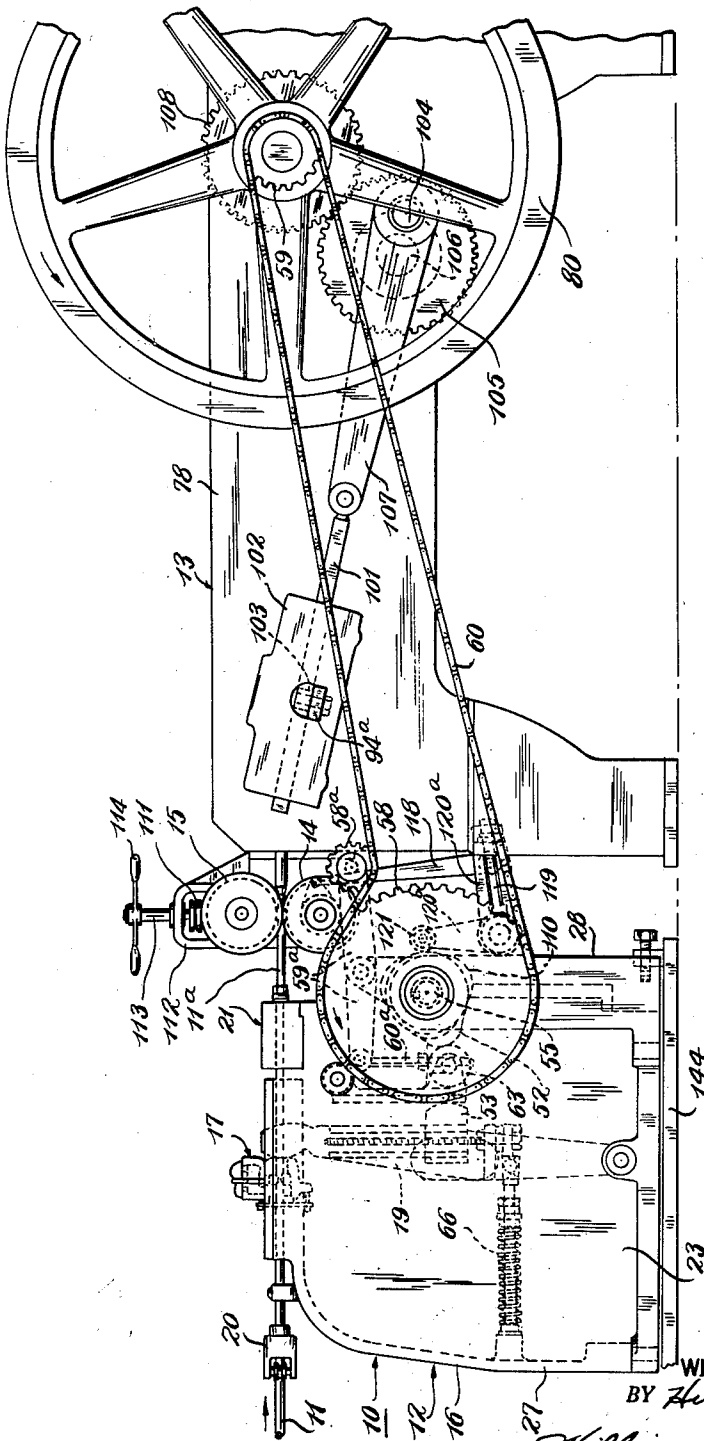
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2,797,799

APPARATUS FOR DRAWING WIRE AND OPERATING THEREON

Filed July 28, 1955

5 Sheets-Sheet 1



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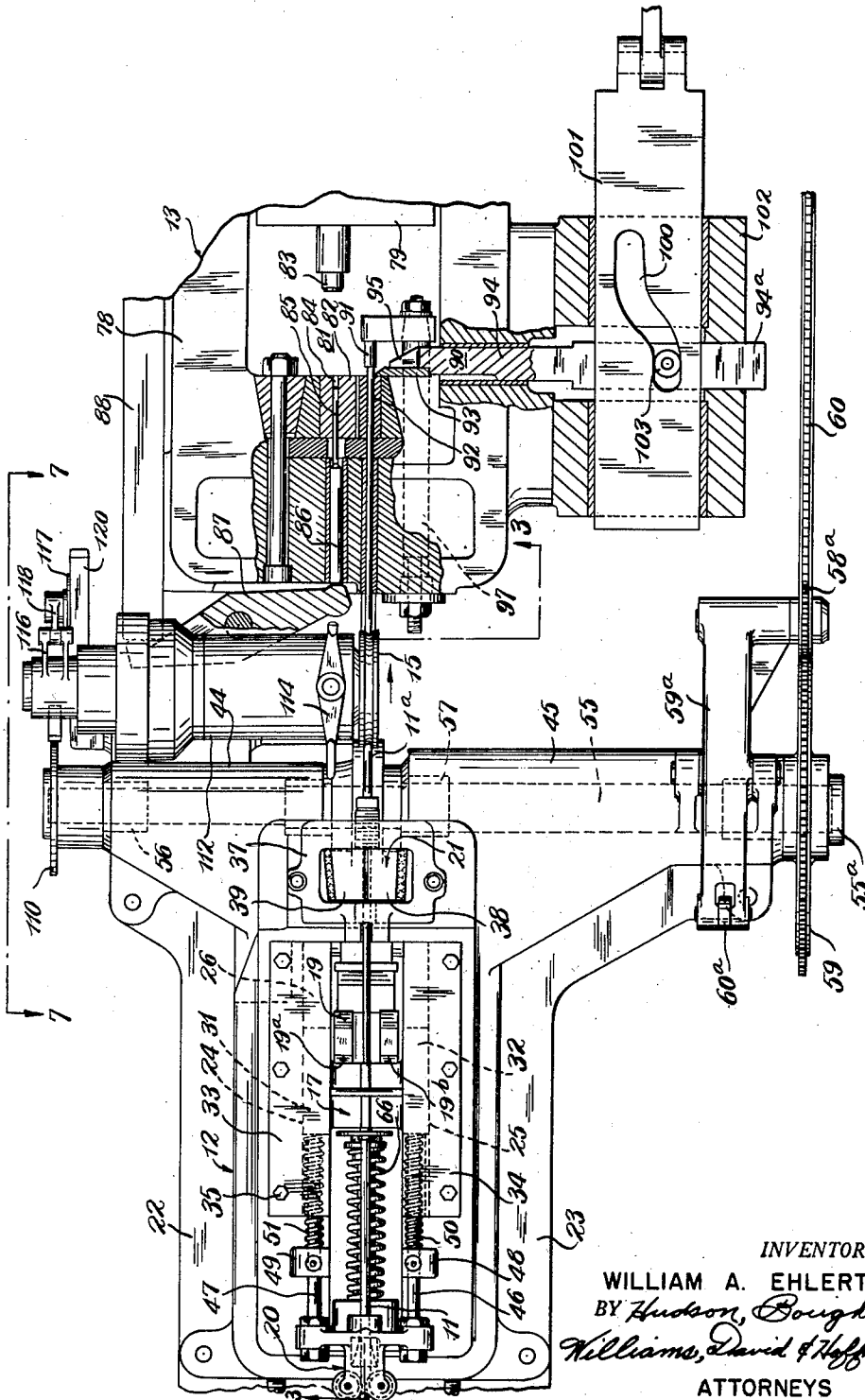
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APPARATUS FOR DRAWING WIRE AND OPERATING THEREON

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5 Sheets-Sheet 2



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APPARATUS FOR DRAWING WIRE AND OPERATING THEREON

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5 Sheets-Sheet 3

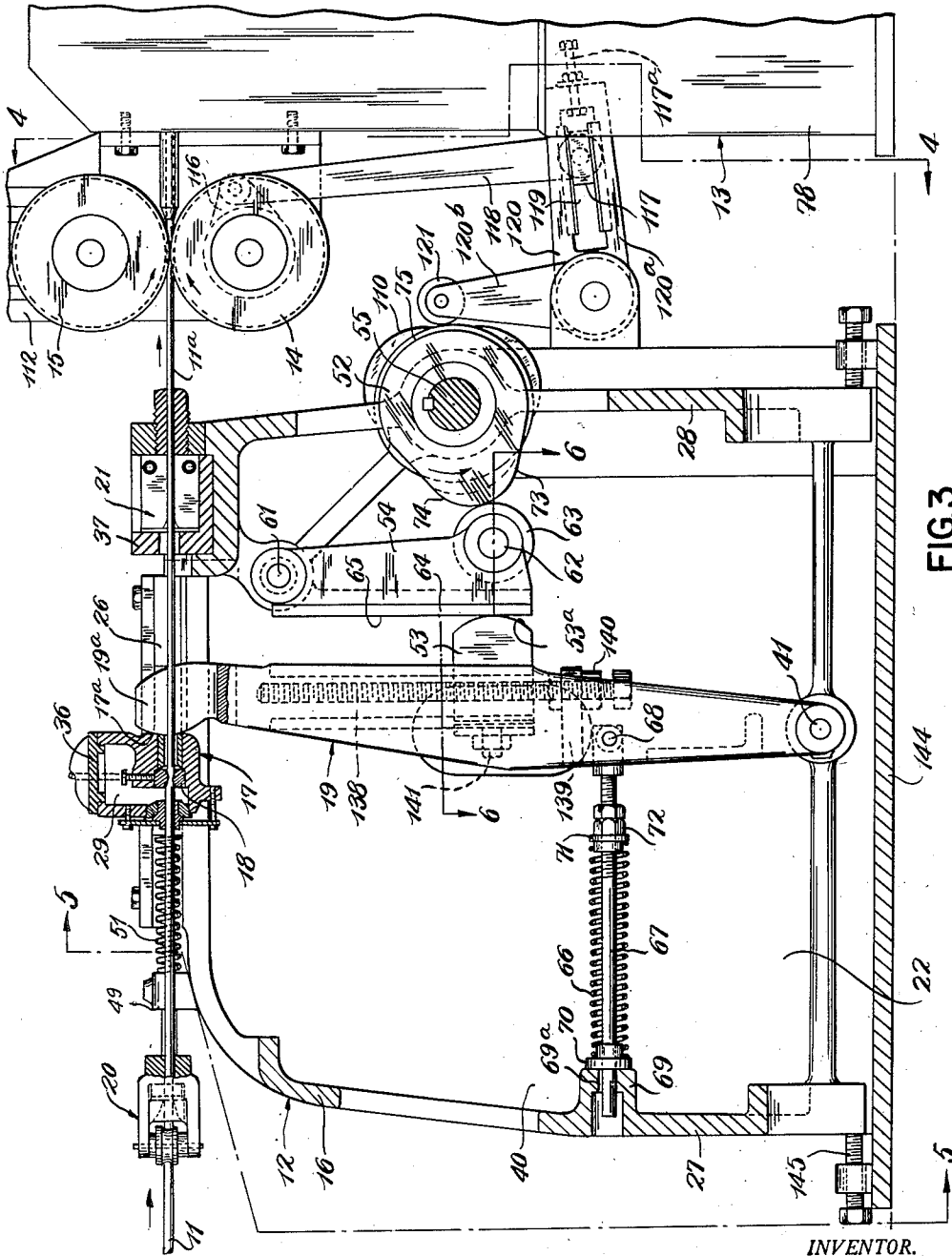


FIG. 3

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5 Sheets-Sheet 4

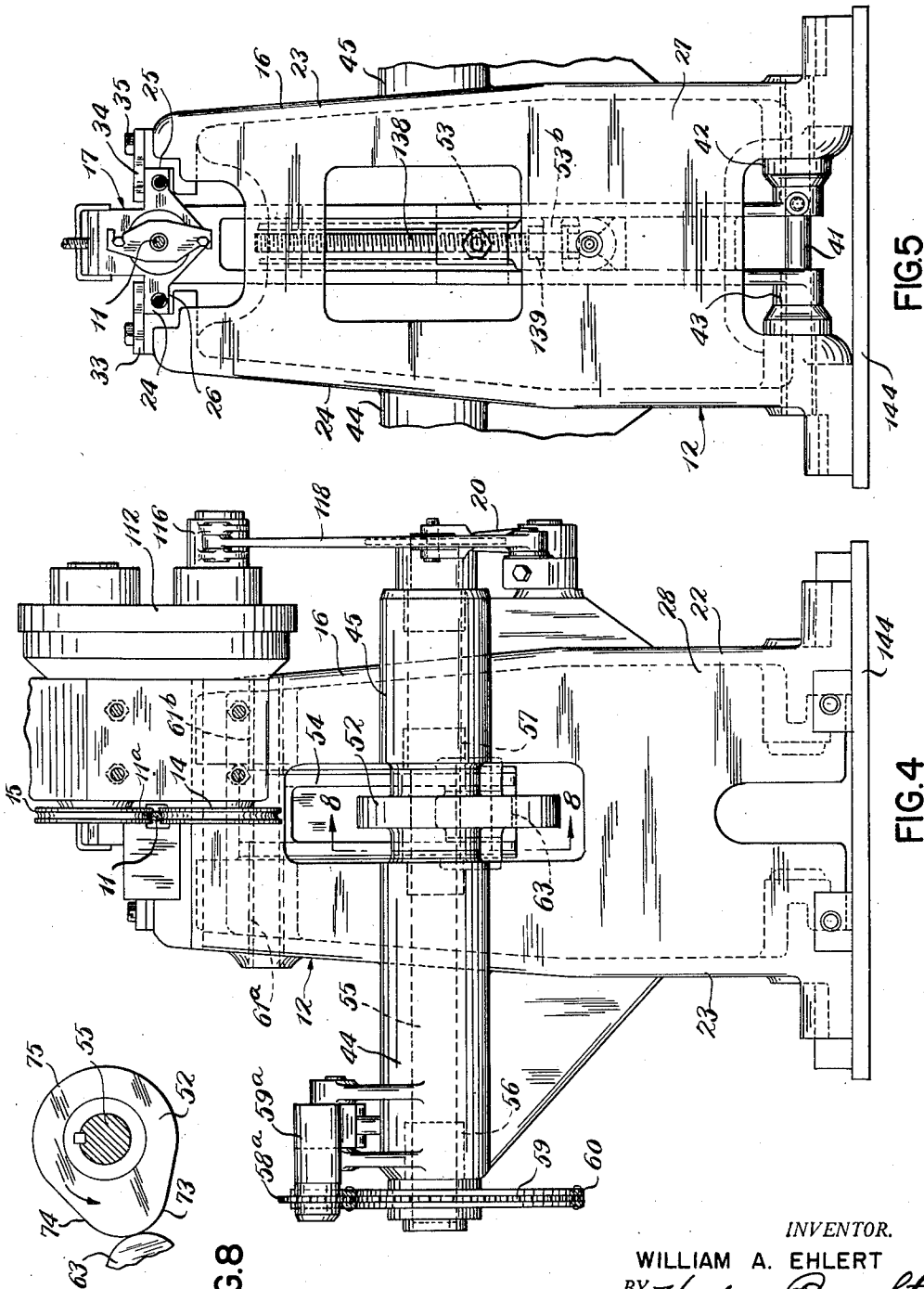


FIG. 8

FIG. 4

FIG. 5

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5 Sheets-Sheet 5

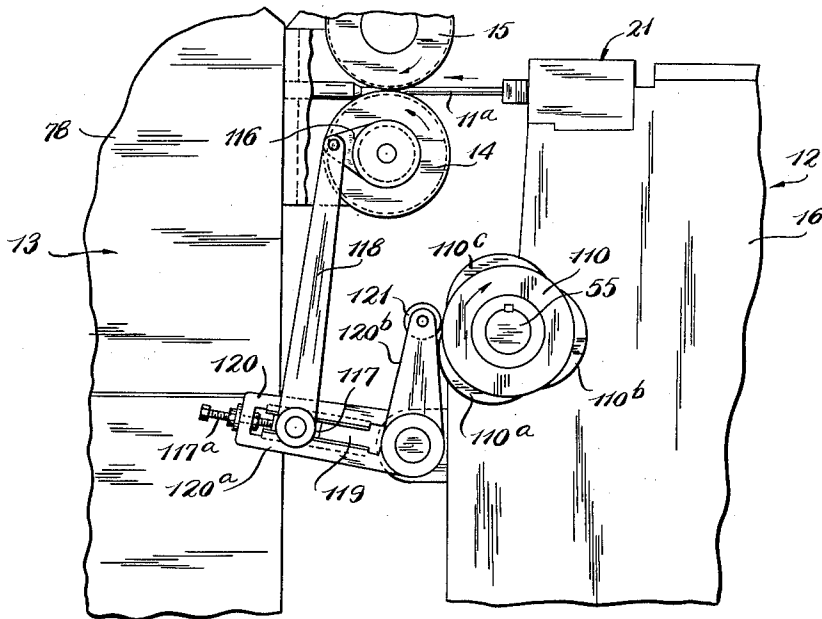


FIG. 7

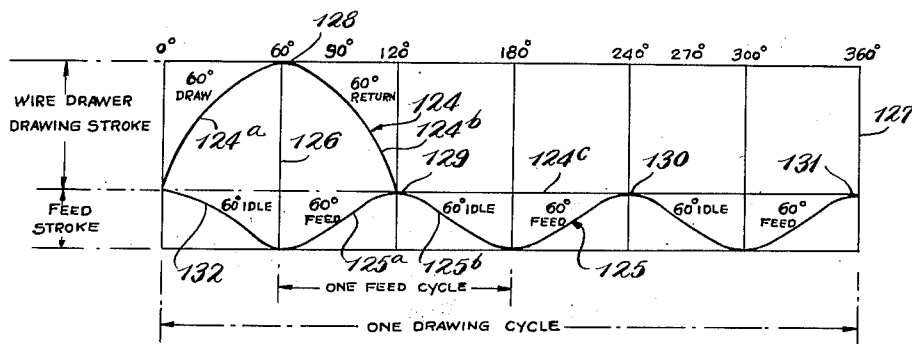


FIG. 9

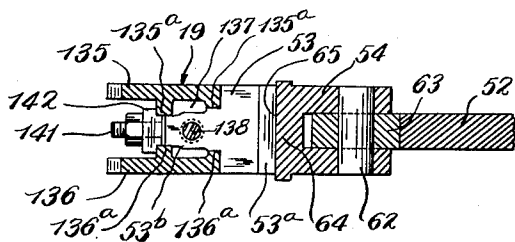


FIG. 6

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APPARATUS FOR DRAWING WIRE AND OPERATING THEREON

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Application July 28, 1955, Serial No. 524,986

6 Claims. (Cl. 205—4)

This invention relates to wire drawers of the lever-actuated reciprocating-die type intended for use in tandem relation to an associated machine or apparatus, such as a cold header or a stock cutter or other fabricating machine, to which the drawn wire is supplied directly and at substantially the rate of production operation of the associated machine.

This application is a continuation-in-part of application Serial No. 230,051 filed June 5, 1951 and now abandoned.

In the wire drawers of this character which have heretofore come to the attention of this applicant, the so-called draw lever which actuates the drawing die has been a swinging lever to which positive swinging movements in opposite directions are imparted by a crank or an eccentric with which the lever is connected. The swinging of the lever in one direction causes the drawing stroke of the die and the swinging of the lever in the opposite direction constitutes the return stroke of the lever.

In the operation of those previous wire drawers, the drawn wire was fed or supplied to the associated machine, which is hereinafter referred to merely as a header, intermittently between the successive drawing strokes of the die, that is to say, during the return movement of the swinging lever. Since the direct feed of the drawn wire to the cut-off and forming dies of the header necessarily had to be accomplished during the return movement of the swinging lever, the feeding interval was of very short duration and the range of usefulness of the header accordingly was limited by this operating characteristic.

The present invention overcomes this disadvantage and, as one of its objects, aims to provide a novel apparatus which can be conveniently referred to as a combination machine or drawer-header, and in which a period of materially longer duration is obtained in each drawing cycle during which additional feeding, or additional feedings and die operations, can be carried out on the drawn wire to thereby greatly increase the range of usefulness of apparatus of this kind.

Another object is to provide a combination machine of the kind above referred to in which a feeding period of increased duration is obtained, by the use of novel actuating means for the swinging draw lever which includes a cam having one portion adapted to produce the drawing stroke movement of the lever and a relief portion providing for a return movement and a rest interval for the lever, the time interval of the return movement and the rest interval constituting such feeding period or feeding and working period of increased duration.

A further object is to provide such a novel combination machine or drawer-header in which feed and cut-off mechanism operating on the drawn wire produces a plurality of severed stock sections, usually short-length stock sections, during each drawing cycle of the drawer, and in which the production of such a plurality of available stock sections per drawing cycle permits operation of the header at an increased rate of speed to use up the available stock sections, and hence, results in a greater output of fabricated articles.

Still another object is to provide such a novel combination machine in which the cam actuation of the draw lever of the wire drawer affords a feeding period of increased duration during the drawing cycle, and in which multiple feedings of the drawn stock to the associated machine are carried out during such period.

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Additionally this invention provides such a novel combination machine or drawer-header combination in which the multiple feedings of the drawn stock are accomplished by the use of a multiple-lobe feed cam.

The invention can be further briefly summarized as consisting in certain novel combinations and arrangements of parts hereinafter described and particularly set out in the claims hereof.

In the accompanying sheets of drawings forming a part of this specification:

Fig. 1 is a side elevation of apparatus embodying the present invention;

Fig. 2 is a partial top plan view of the apparatus with portions thereof shown in section;

Fig. 3 is a partial vertical longitudinal section taken through the apparatus substantially as indicated by section line 3—3 of Fig. 2;

Fig. 4 is a view representing mainly an end view of the delivery end of the wire drawer but also showing the feed mechanism, the view being taken substantially as indicated by the direction line 4—4 of Fig. 3;

Fig. 5 is an end elevation of the opposite end of the wire drawer, the view being taken as indicated by the direction line 5—5 of Fig. 3;

Fig. 6 is a partial horizontal section taken through the stroke adjusting means of the wire drawer, substantially as indicated by section line 6—6 of Fig. 3;

Fig. 7 is a partial side elevation further illustrating the feed mechanism, the view being taken as indicated by the direction line 7—7 of Fig. 2;

Fig. 8 is a fragmentary sectional view taken on section line 8—8 of Fig. 4 and further illustrating the contour of the draw cam; and

Fig. 9 is a diagram graphically illustrating the time relationship between the drawing function and the feeding function.

As one practical embodiment of this invention the drawings show novel apparatus 10 for drawing and operating on wire stock 11 and comprising a wire drawer 12 in tandem relation to an associated machine 13 to which the drawn wire 11^a is directly supplied by a pair of feed rolls 14 and 15.

The wire drawer 12 is of the reciprocating type and will be presently described in detail. The associated machine 13 will also be briefly described hereinafter but is here shown as being of the cold-header type. The drawer 12 and the associated machine 13 together represent one embodiment of the abovementioned combination machine or drawer-header.

The wire drawer 12 comprises in general a frame 16, a reciprocable die support or slide 17 carrying a wire drawing die 18, and a swinging draw lever 19 operable to cause drawing strokes of the die. The drawer 12 also includes a suitable straightening device 20 through which the wire 11 passes to the drawing die 18, and a drawing grip device 21 adapted to prevent backward movement of the wire during the drawing strokes of the die 18 but which permits feeding of the drawn wire 11^a to the header 13 between successive drawing strokes.

The frame 16 is an upright hollow frame having spaced longitudinal side walls 22 and 23 and provided at the top thereof with laterally spaced ways 24 and 25 defining a longitudinal guideway 26. The frame 16 also includes transverse end walls 27 and 28 extending between and connecting the side walls 22 and 23 at opposite ends of the drawer.

The slide 17 comprises a die box in which the drawing die 18 is mounted and which includes a chamber 29 adapted to contain a quantity of lubricating powder for lubricating the drawing die. This slide includes oppositely extending lateral projections forming guide follower portions 31 and 32 which are slidable in the ways

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24 and 25 and are confined therein by a pair of longitudinal cover plates 33 and 34 which are secured to the frame by suitable screws 35. The slide 17 is also provided with a removable cover 36 for the chamber 29.

The drawing grip 21 may be a conventional grip device comprising a grip box 37 mounted on the frame 16 and a pair of grip blocks or jaws 38 and 39 operable in the grip box and adapted to automatically grip the drawn wire 11^a to prevent backward movement thereof during the drawing stroke of the die 18. At the completion of the drawing stroke the jaws 38 and 39 release the wire for a forward feeding thereof to the header 13.

The draw lever 19 is disposed in upright relation in the chamber 40 of the frame 16 and has its lower end pivotally mounted on the frame by being connected with a rock shaft or transverse pin 41 which is journaled in a pair of laterally spaced bearings 42 and 43 of the frame. At its upper end the lever 19 is provided with a forked portion defined by a pair of laterally spaced rounded arm portions 19^a and 19^b which straddle the drawn wire 11^a and engage laterally spaced portions of the end thrust face 17^a of the slide 17.

During swinging of the upper end of the draw lever 19 toward the left as seen in Fig. 3, this lever moves the slide 17 along the guideway 26 to thereby push the drawing die 18 over the wire 11 thus causing a drawing stroke of the die. During swinging of the draw lever in the opposite direction, that is toward the right as seen in Fig. 3, the lever is returned for the next succeeding drawing stroke of the die. The draw lever 19 is disengageable from the slide 17, and, during the return movement of this lever, its arm portions 19^a and 19^b move away from the end thrust face 17^a of the slide as will be apparent in the more detailed operation hereinafter given.

The straightening device 20 is connected with the slide 17 for actuation thereby by means of a pair of laterally spaced push rods 46 and 47. These push rods are connected at one end thereof with the follower portions 31 and 32 of the slide 17 and at the opposite end are connected with the straightening device 20. The push rods 46 and 47 extend through, and are guided by, a pair of laterally spaced guide lugs 48 and 49 of the frame 16. During the drawing stroke of the die 18, the slide 17 imparts movement to the straightening device 20 by pushing the same over the wire 11 while the latter is being held against backward movement of the drawing grip 21.

A pair of compression springs 50 and 51 constitute a means for causing return movement of the slide 17 and the die 18 carried thereby and also constitutes an auxiliary feed means for advancing, or assisting in advancing, the drawn wire 11^a to the header 13. These springs are located in surrounding relation to the rods 46 and 47 and are disposed between the guide lugs 48, 49 and the follower portions 31, 32 of the slide 17. During each drawing stroke of the slide, the springs 50 and 51 are subjected to compression and during the return movement of the draw lever 19 they cause a return movement of the slide. During this return movement of the slide 17, an advancing or feeding movement of the drawn wire 11^a is produced by reason of the frictional drag between the die 18 and the wire, although the feed rolls 14 and 15 constitute the main feed means for the drawn wire.

An important part of the wire drawer 10 resides in the actuating mechanism for the draw lever 19 which will be described next, and by which a feeding interval, or a feeding and working interval, of increased duration is obtained in comparison to the feeding interval of similar wire drawers heretofore provided. This actuating mechanism for the draw lever 19 comprises a rotary cam 52 which is effective on a bearing block 53 of the draw lever through a swinging lever 54 which constitutes a follower for the cam.

The cam 52 is mounted on and keyed to a cam shaft

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55 which is journaled in pairs of laterally spaced bearings 56 and 57 located in hollow bracket portions 44 and 45 of the frame 16. A drive sprocket 58 is connected in fixed relation on a projecting end 55^a of the cam shaft 55. A chain 60 connects sprocket 58 of the cam shaft 55 with a sprocket 59 of the header 13 so as to be driven by the latter sprocket. The upper reach of the chain 60 passes under a tightener sprocket 58^a which is carried by a lever 59^a pivoted at an intermediate point thereof and swingably adjustable by a link 60^a. For a purpose which will appear hereinafter, the ratio of the sprocket 59 to the sprocket 58 is a 3 to 1 ratio in the combined machine 10.

The swinging cam follower lever 54 is disposed in depending relation between the draw lever 19 and the rotary cam 52. The upper end of the lever 54 is mounted on a transverse shaft or pin 61 having its opposite ends journaled in suitable bearings 61^a and 61^b of the frame 16. Adjacent its lower end the lever 54 is provided with a pin 62 forming a pivot shaft for a roller 63 which constitutes a follower for the cam 52. The cam follower lever 54 is provided along its upright left edge with a solid back portion 64 forming a flat bearing face 65 extending longitudinally of this lever and which is engageable with and rockable on the convexly curved face 53^a of the bearing block 53.

During rotary movement of the cam 52, the roller 63 follows the cam surface resulting in swinging of the lever 54 about the axis of the pivot shaft 61 and causing thrust to be applied to the draw lever 19 through the rocking engagement of the flat bearing face 65 with the convexly curved bearing face 53^a. The thrust thus applied to the draw lever 19 causes swinging thereof about the axis of the pivot shaft 41 to produce the above-mentioned drawing stroke of the slide 17 and the die 18 carried thereby.

The roller 63 is maintained in engagement with the cam 52, and the convex bearing face 53^a is maintained in engagement with the flat bearing face 65, by a compression spring 66 which is also effective to cause the return swinging movement of the draw lever 19. This spring is disposed in surrounding relation to a rod 67 which has one end thereof pivotally connected with the draw lever 19 by a pivot pin 68 and its other end slidably extending through the opening 69^a of a boss 69 of the frame 16. The rod 67 also slidably extends through a collar 70 forming a seat for the outer end of the spring 66. The inner end of this spring engages a collar 71 which is adjustably movable along the rod 67 by means of adjusting nuts 72 for varying the compression of the spring.

An important feature of the actuating mechanism for the draw lever 19 resides in the fact that the contour of the draw cam 52 is such as to provide the above-mentioned feeding and working period of increased duration. For this purpose the cam 52 is constructed with a cam face which includes a rise or thrust portion 73 extending for an angular distance of not more than 90 degrees of the cam periphery (see Fig. 8) and with a fall portion 74 which is contiguous to the rise portion 73 and also extends through an angular distance of not more than 90 degrees of the cam periphery. In the drawer 12, the rise portion 73 and the fall portion 74 are each of an angular extent of 60 degrees of the cam periphery.

The surface of the cam 52 also includes a substantially circular portion 75 extending for an angular distance of at least 180 degrees of the cam periphery and constituting a dwell portion located between the rise portion 73 and the fall portion 74. In the cam 52 as here shown, the dwell portion 75 has an arcuate extent of 240 degrees.

During rotary movement of the cam 52 in a counter-clockwise direction as seen in Figs. 1 and 3, the rise portion 73 acts first on the roller 63 to cause swinging of the draw lever 19 toward the left to thereby produce the drawing stroke of the die 18. After the rise portion

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73 has moved past the roller 63, the fall portion 74 passes this roller during which the spring 66 causes a return swinging movement of the draw lever 19 and the springs 50 and 51 cause a return stroke of the slide 17. Under the influence of the spring 66 the draw lever 19 will swing through its return movement immediately after the completion of the drawing stroke of this lever, although the return stroke of the slide 17 and the forward feeding of the drawn wire 11^a will take place only as rapidly as is permitted by or produced by the operation of the feed rolls 14 and 15.

From the foregoing description of the actuating means for the draw lever 19 it will thus be seen that the rise portion 73 of the draw cam 52 constitutes the thrust applying portion of the cam which is effective to produce the drawing stroke of the die 18, and that the cam portions 74 and 75 constitute what can be termed a relief portion of the cam. The return movement of the draw lever 19 under the influence of the spring 66 is controlled by the fall portion 74 of the cam and when this lever has been returned to its initial position, the dwell portion 75 of the cam provides a rest interval for the lever before the start of the next succeeding drawing stroke movement thereof.

The time interval consumed by the return swinging movement of the draw lever 19 and by the rest interval of this lever between the swinging movements thereof constitute the desired feeding interval of increased time duration during which the drawn wire 11^a can be fed to the header 13 by the rolls 14 and 15 or by the action of the springs 50 and 51, or by the rolls 14 and 15 assisted by the action of the springs 50 and 51. Because of the longer duration of this feeding interval, the header 13 can be provided with die means to accomplish a larger number of die operations on the drawn wire and the header will therefore have a greater range of usefulness and will be able to produce a larger number of blanks or manufactured articles during a given time interval than has heretofore been possible.

Although the associated machine 13 is herein referred to as being of the header type, it can be any fabricating machine suitable for carrying out the die operations desired to be performed on the drawn wire 11^a. In the apparatus 10 the associated machine 13 is a single-blow cold header comprising a frame 78 and a slide 79 reciprocable therein and actuated by a main crankshaft having a flywheel 80 thereon. The header 13 is here shown as being provided with a set of metal working dies 81 which comprise a stationary die 82 suitably mounted on the frame 78 and a punch 83 carried by the slide 79 for cooperation with the die 82.

The die 82 is shown as having a work-forming die passage or recess 84 therein and a knock-out pin extending into such die passage from the inner end thereof and actuated by a knock-out plunger 86. A knock-out lever 87 swingably mounted on the frame 78 has one end thereof in engagement with the plunger 86 and its other end in engagement with a knock-out slide 88. The knock-out slide 88 is a reciprocable slide which is suitably actuated from the crankshaft of the header 13.

Although the set of metal working dies 81 is here shown as comprising only the stationary and movable dies 82 and 83 such set may, if desired, comprise a row of stationary dies and a row of cooperating movable dies for performing a greater number, or a more intricate character, of metal working operations on the drawn wire.

The header 13 also comprises cut-off mechanism 90 to which the leading end of the drawn wire 11^a is fed directly from the drawer 12. The cut-off mechanism 90 comprises a feed stop 91 and a stationary hollow shearing die 92 through which the drawn wire is moved to engage the feed stop. The feed mechanism 90 also

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includes a shear blade 93 movable across the inner end of the stationary die 92 and actuated by a shearing slide 94 on which the shear blade is mounted. The inner end of the slide 94 is provided with a forked portion 95 which straddles the feed stop 91 during the inward shearing stroke of the slide. As is understood by those familiar with the construction and operation of headers, each shearing stroke of the blade 93 causes a stock section or blank to be severed from the inner end of the drawn wire 11^a and to be transferred to a position immediately in front of the die recess 84 for engagement by the punch 83.

The feed stop 91 includes a mounting screw 97 by which the position of the feed stop relative to the stationary shearing die 92 can be varied in accordance with the length of the stock section desired to be cut from the drawn wire. In the header 13 the feed stop 91 is shown as being located relatively close to the stationary shearing die 92, such that the stock sections which are severed from the inner end of the drawn wire 11^a will be relatively short sections or blanks, for example, blanks having a length approximately equal to the diameter of the drawn wire.

The cut-off slide 94 is reciprocably movable in a direction transverse to the direction of reciprocation of the main slide 79 and is actuated by a cut-off cam in the form of a cam groove 100 formed in a flat cam slide 101. The cam slide 101 is reciprocable in a bearing bracket 102 of the frame 78, which bracket also supports the outer end of the cut-off slide 94. A cam follower, preferably in the form of a roller 103, is mounted on a flat portion 94^a of the cut-off slide 94 and extends upwardly therefrom into the cam slot 100, such that axial reciprocating movement of the cam slide 101 produces transverse reciprocating movement of the cut-off slide 94.

The cam slide 101 is suitably actuated from the main crankshaft of the header 13, as by having one end of this slide operably connected with the eccentric pin or crank 104 of a gear 105 which is rotatably mounted on stub shaft 106. The cam slide 101 is connected with the eccentric pin by means of a connecting rod 107. The gear 105 is driven from the main crankshaft at a 1 to 1 ratio by having a meshed engagement with a gear 108 fixed on the latter.

From the construction of the header 13 as thus far described, it will be seen that each working stroke of the slide 79 by which the punch 83 is advanced toward the stationary die 82 is accompanied by a shearing movement of the shear blade 93 in a direction to sever a blank from the leading end of the drawn wire 11^a and to move such blank to a position in front of the die passage 84 for engagement by the punch.

If desired, the set of metal working dies 81 can be omitted from the header 13, in which case the successive strokes of the shear blade 93 will sever blanks from the inner end of the drawn wire 11^a, and such severed blanks can be collected by permitting them to drop downwardly into a suitable container. The severed blanks thus collected can be later supplied to any suitable fabricating machine in which they are desired to be used.

The length of the drawing stroke of the die 18 of the wire drawer 12 as produced by the swinging draw lever 19 is such that each such drawing stroke produces drawn wire of a length sufficient for a plurality of the above-mentioned relatively short stock sections to be cut therefrom by the cut-off mechanism 90. The feed rolls 14 and 15 are therefore actuated so as to cause a plurality of feedings of the drawn wire to the cutoff mechanism 90 during each drawing cycle of the drawer 12. In the apparatus 10, this length of drawn wire produced by each complete drawing cycle of the drawer 12 is adequate for three such blanks, and accordingly, the operation of the feed rolls 14 and 15 is such as to cause three such feed-

ings of drawn wire to the feed stop 91 during each drawing cycle of the drawer. The use of the above-described draw cam 52 provides the long-duration time interval needed in the drawing cycle to permit these multiple feedings of the drawn wire and the die operations of the header 13 thereon.

In accordance with this invention, the feed rolls 14 and 15 are actuated from a multiple-lobe feed cam 110 which is keyed, or otherwise fixed, on the shaft 55 of the wire drawer 12. The feed rolls 14 and 15 are periphery-grooved rolls which grip the drawn wire 11^a therebetween in response to a compressive action of a spring 111 located in a feed roll mount 112. The compression of the spring 111 can be varied by an adjusting screw 113 rotatable by a handle 114 provided on the upper end of this screw. The feed roll mount 112 is here shown as being suitably attached to the adjacent end of the frame 78 of the header 13.

The feed rolls 14 and 15 are drivingly connected by means of gears located in the mount 112, such that when the lower feed rolls 14 is intermittently driven by a ratchet lever 116 the upper feed roll 15 will also be driven. The ratchet lever 116 has its outer end connected with an adjusting block 117 by means of a link 118. The block 117 is located in a slot 119 of the arm 120^a of a bell crank lever 120 and is adjustable along such slot by a screw 117^a for varying the length of the feed stroke of the link 118. The other arm 120^b of the bell crank lever 120 carries a cam follower in the form of a roller 121 which engages the periphery of the feed cam 110.

As mentioned above, the feed cam 110 is a multiple-lobe cam for producing a plurality of feedings of the drawn wire 11^a to the cut-off mechanism 90 of the header 13 during each full cycle of operation of the wire drawer 12. In the apparatus 10 the feed cam 110 has three lobes, 110^a, 110^b and 110^c, which pass under the cam follower 121 in succession and produce actuation of the feed rolls 14 and 15 for causing the above-mentioned three feedings of the drawn wire 11^a to the cut-off mechanism 90 during each full cycle of operation of the wire drawer 12, that is to say, during each long-duration feeding period afforded by the above-described contour of the draw cam 52. Rotation of the feed cam 110 in properly timed relation to the operation of the cut-off slide 94 to produce the desired three feedings of the drawn wire 11^a to the cut-off mechanism 90 during each drawing cycle of the drawer 12, is obtained by reason of the above-mentioned 3 to 1 drive ratio between the sprockets 59 and 58. The three lobes 110^a, 110^b and 110^c of the feed cam 110 are spaced approximately 120 degrees apart.

Fig. 9 of the drawings shows curves 124 and 125 which graphically illustrates, respectively, the cycle of operation of the wire drawer 12 as represented by the movement of the draw lever 19 and the cycle of operation of the header 13 as represented by the feeding movements of the feed rolls 14 and 15. The curve portion 124^a represents the drawing stroke of the draw lever 19 as produced by the rise portion 73 of the draw cam 52 and which drawing stroke corresponds with approximately 60 degrees of rotation of the draw cam. The curve portion 124^b represents the return stroke of the draw lever 19 as permitted by the fall portion 74 of the draw cam 52 under the action of the spring 66 and which return stroke likewise corresponds with 60 degrees of rotation of the draw cam. The straight horizontal curve portion 124^c represents the rest interval of the draw lever 19 after it has completed its return stroke and as permitted by the dwell portion 75 of the drawn cam. The rest interval corresponding with the curve portion 124^c extends through 240 degrees of rotation of the draw cam.

The curve 125 illustrating the feeding action of the feed rolls 14 and 15, represents the three full feed cycles, or cut-off and metal working operations of the header 13, which take place during the one complete drawing cycle

represented by the curve 124. In the curve 125, the upwardly sloping portions 125^a represent the wire feeding movement of the feed rolls 14 and 15 and the downwardly sloping portions 125^b represent the idle periods of the feed rolls. The feedings represented by the curve portions 125^a are each accomplished during 60 degrees of rotation of the cam shaft 55 and it will accordingly be seen that the three feedings, three cut-offs and three metal workings of the header 13 are carried out during the long-duration time interval afforded during the drawing cycle and corresponding with the 300 degrees of rotation of the cam shaft 55 represented by the portion of the curve 125 extending from the 60 degree line 126 to the 360 degree line 127.

The point 128 at the crest of the curve 124 represents the end of the drawing stroke of the draw lever 19 and the beginning of the return stroke of this lever. The crests 129, 130 and 131 of the curve 125 represent the end of the feeding actions of the feed rolls and the start of the idle periods of those rolls. It will be observed from the curve 125 that the idle period of the feed rolls following their third feeding operation occurs during the drawing stroke of the draw lever 19, as is represented by the 60 degree curve portion 132.

In accordance with another feature of the wire drawer 12, the actuating means for the draw lever 19 includes novel means by which the point of application of the actuating movement and force to this lever can be varied with respect to the lever arm distance of such point of application from the axis of the pivot shaft 41. For this purpose provision is made for adjustment of the bearing block 53 longitudinally of the draw lever 19, as will now be described.

As shown in the drawings, the draw lever 19 is constructed with spaced longitudinal side portions 135 and 136 defining therebetween a longitudinal recess 137 in which the bearing block 53 is movable. The side portions 135 and 136 include a pair of longitudinal guide portions 135^a and 136^a on the adjacent faces thereof and along which the bearing block 53 is slidable. The upright edges of the side portions 135 and 136 of the draw lever also form a second pair of longitudinally extending guide surfaces 135^b and 136^b along which the bearing block 53 is slidable.

Adjustment of the bearing block 53 longitudinally of the draw lever 19 is accomplished by rotation of an adjusting screw 138 disposed in the longitudinal recess 137 and which extends through a hole in a transverse web portion 139 of the draw lever. This adjusting screw also extends through, and has threaded engagement in, the stem portion 53^b of the bearing block. When the bearing block has been shifted to the desired position of longitudinal adjustment, the screw 138 is locked against further rotation by the clamping nuts 140 which are located above and below the web 139. The bearing block 53 is also clampingly locked against the bearing surfaces 135^a, 136^a and 135^b, 136^b of the draw lever 19 by tightening the nut of the stud on screw portion 141 which extends through the cap member 142 of this bearing block.

By this adjustment of the bearing block 53 longitudinally of the draw lever 19, the length of the swinging movement imparted to this lever by the draw cam 52 can be varied to obtain whatever length of drawing stroke is desired for the die 18. This adjustment of the bearing block upwardly will result in a shortening of the drawing stroke and downward adjustment of the block will lengthen the drawing stroke. Regardless of the position to which the bearing block 53 is shifted, the contact between this block and the cam follower lever 54 will always be a rocking movement such that frictional drag at this point will be substantially eliminated.

The wire drawer 12 is adapted to stand on a floor or other supporting surface adjacent the header 13 but, in this instance, a supporting base 144 is provided for

the drawer. The frame 16 is shiftable on the base 144, as by means of adjusting screws 145, for adjusting the positions of the drawer relative to the header.

With respect to the cross-sectional shape of the wire 11, it should be explained that the drawer 12 and the header 13 usually operate on wire stock of a round cross-sectional shape, but can be readily adapted to handle wire stock of a round-cornered hexagonal cross-sectional shape or any other desired non-circular shape.

From the accompanying drawings and the foregoing detailed description, it will now be readily understood that this invention provides novel apparatus for performing drawing operations on wire and for performing multiple die operations on the drawn wire substantially as the latter is delivered from the drawing operation. It will now also be understood that the wire drawer of the combination apparatus or machine operates in a manner such that a relatively long-duration period is provided during each drawing cycle, and that the header of the combination machine carries out multiple cut-offs and metal-work operations on the drawn wire being supplied to the header by multiple feedings and that such multiple feedings, cut-offs and metal workings are accomplished during such long-duration period of each drawing cycle of the wire drawer.

It will now likewise be understood that the long-duration feeding and die operation period thus provided in the drawing cycle affords an increased range of usefulness of the header by enabling the latter to carry out a greater number of die operations, or more intricate die operations, in the production of the desired articles being manufactured. Thus, in this combination machine, the header can be operated at a relatively increased speed in relation to the drawer to accomplish the multiple cut-offs and metal workings on the wire made available by the drawer and the multiple feedings, such that the header will produce an increased number of articles during a given operation period as compared with headers heretofore operating in conjunction with reciprocating wire drawers.

Additionally, it will now be seen that the improved wire drawer also embodies novel means by which the length of the drawing stroke of the drawing die can be readily varied by changing the effective lever arm value of the point of application of the actuating force to the draw lever.

The novel drawer-header apparatus has been illustrated and described herein to a somewhat detailed extent, but it should be understood that the invention is not to be regarded as being limited correspondingly in scope but includes all changes and modifications coming within the terms of the claims hereof.

Having thus described my invention, I claim:

1. In metal working apparatus, frame means having a guideway, a slide reciprocably movable along said guideway, a wire drawing die on said slide, a draw lever fulcrumed on said frame means and swingable in one direction through a work stroke while in engagement with said slide for producing a drawing stroke of said die along the wire to be drawn, said lever being disengageable from said slide and swingable in the opposite direction through a return stroke to a rest position, a grip device effective to grip said wire to prevent backward movement thereof during said drawing stroke of said die, rotating shaft means on said frame means, means for swinging said lever through said work stroke and said return stroke including a rotary actuating cam driven by said shaft means, said cam having rise and fall portions for the work and return strokes of said lever and also having a dwell portion for leaving said lever temporarily in said rest position, said fall and dwell portions of said cam providing a feed interval in the operation of the apparatus, means engaging the drawn wire and operable as a feeding means, and means for driving

said feeding means from said shaft means for advancing the drawn wire during said feed interval.

2. Metal working apparatus as defined in claim 1 in which the fall and dwell portions of said cam aggregate at least 270 degrees of arcuate extent.

3. Metal working apparatus as defined in claim 1 in which the fall and dwell portions of said cam aggregate approximately 300 degrees of arcuate extent.

4. In metal working apparatus, frame means having a guideway, a slide reciprocably movable along said guideway, a wire drawing die on said slide, a draw lever fulcrumed on said frame means and swingable in one direction through a work stroke while in engagement with said slide for producing a drawing stroke of said die along the wire to be drawn, said lever being disengageable from said slide and swingable in the opposite direction through a return stroke to a rest position, a grip device effective to grip said wire to prevent backward movement thereof during said drawing stroke of said die, rotating shaft means on said frame means, means for swinging said lever through said work stroke and said return stroke including a rotary actuating cam driven by said shaft means, said cam having rise and fall portions for the work and return strokes of said lever and also having a dwell portion for leaving said lever temporarily in said rest position, said fall and dwell portions of said cam providing a feed interval in the operation of the apparatus, means engaging the drawn wire and operable as a feeding means, and means including a multiple lobe rotary cam for driving said feeding means intermittently from said shaft means for causing a plurality of successive feedings of the drawn wire during said feed interval.

5. In metal working apparatus, frame means having a guideway, a slide reciprocably movable along said guideway, a wire drawing die on said slide, a draw lever fulcrumed on said frame means and swingable in one direction through a work stroke while in engagement with said slide for producing a drawing stroke of said die along the wire to be drawn, said lever being disengageable from said slide and swingable in the opposite direction through a return stroke to a rest position, a grip device effective to grip said wire to prevent backward movement thereof during said drawing stroke of said die, rotating shaft means on said frame means, a rotary actuating cam driven by said shaft means and having rise and fall portions and an intermediate dwell portion, thrust transmitting means between said cam and said lever for causing swinging of the latter through said work stroke in response to rotation of said cam, spring means for causing the return stroke of said lever and for temporarily retaining said lever in said rest position, said fall and dwell portions of said cam providing a feed interval in the operation of the apparatus, a pair of feed rolls engaging the drawn wire and operable as a feeding means, and means for driving said feeding means from said shaft means for advancing the drawn wire during said feed interval.

6. Metal working apparatus as defined in claim 5 in which said thrust transmitting means includes an adjusting means for varying the length of the work stroke of said lever as produced by said cam.

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