Nov. 17, 1953 E. O. KLEMM 2,659,408

WIRE BENDING DIE UNIT

Filed Feb. 13, 1950 4 Sheets-Sheet 1

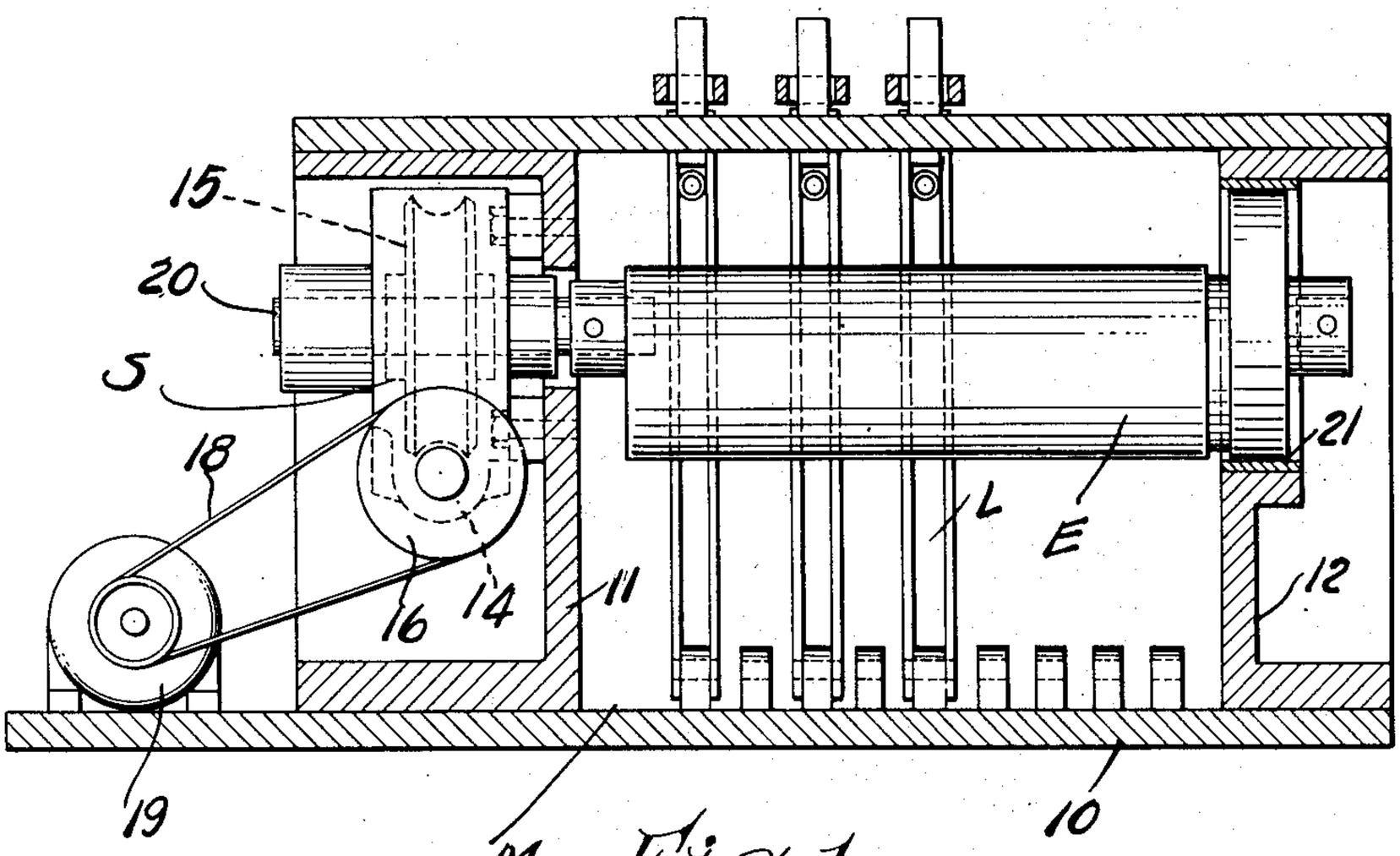

Fig. 1

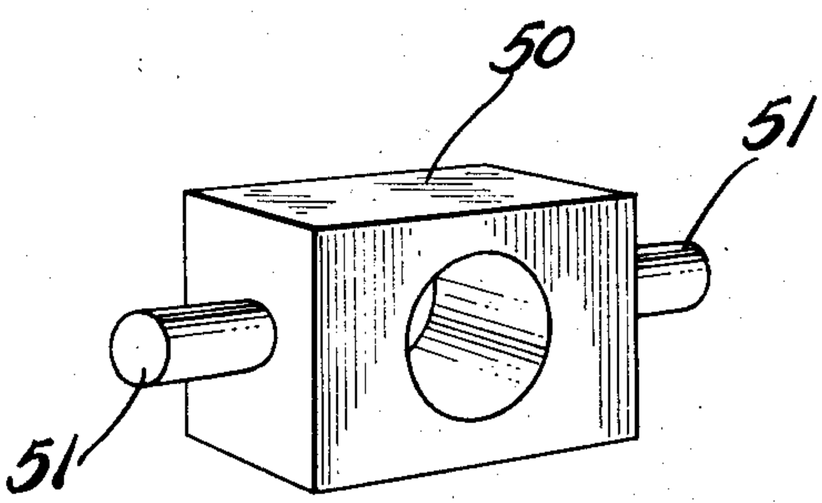

Fig. 4

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WIRE BENDING DIE UNIT

Filed Feb. 13, 1950 4 Sheets-Sheet 2

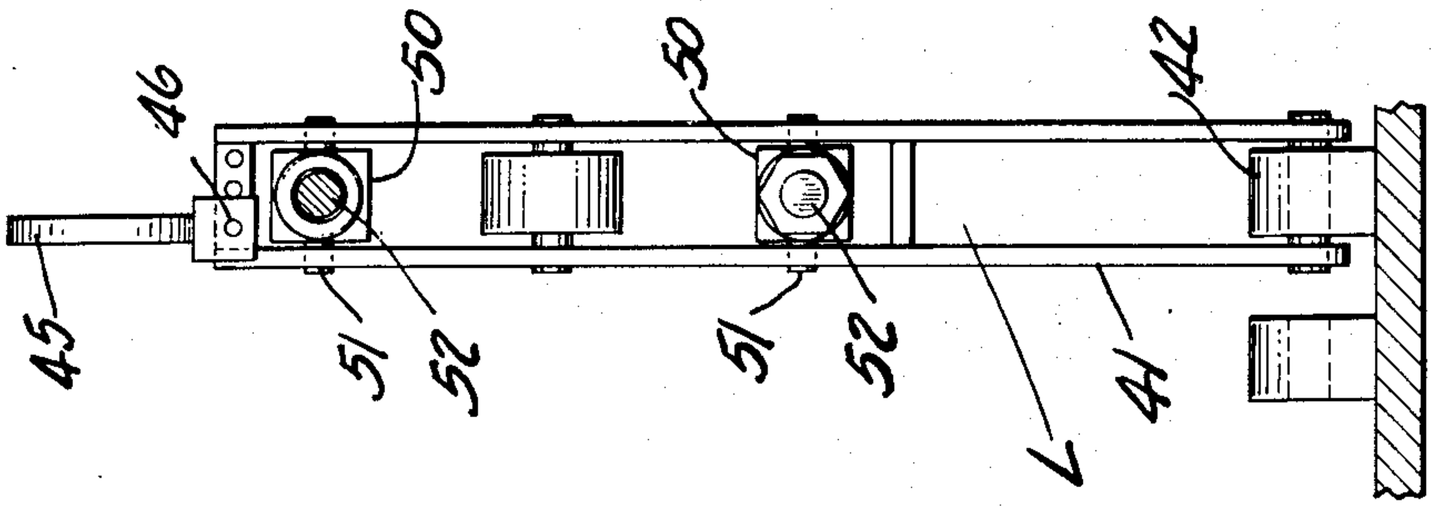

Fig. 3

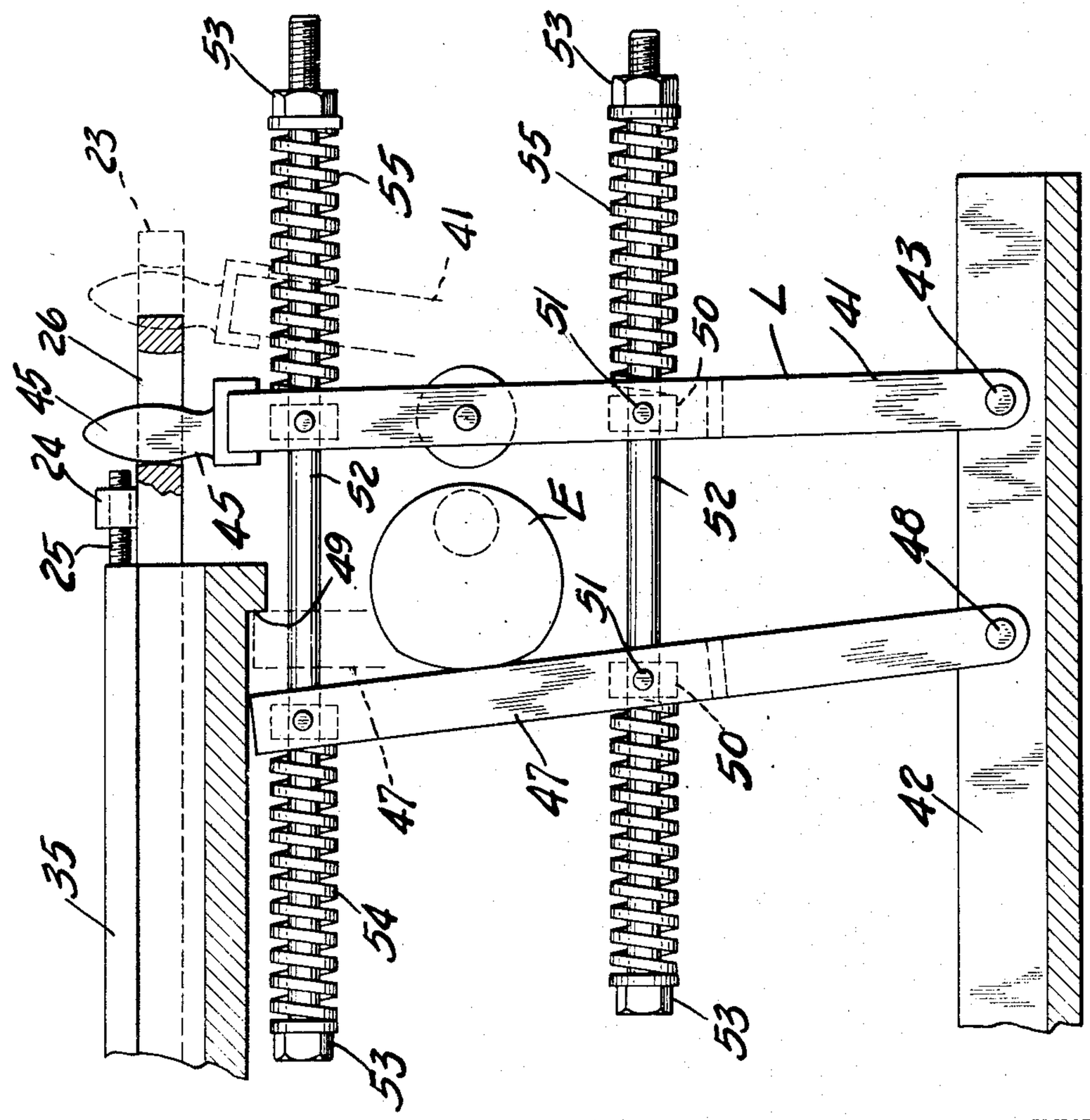

Fig. 2

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Nov. 17, 1953 E. O. KLEMM 2,659,408

WIRE BENDING DIE UNIT

Filed Feb. 13, 1950 4 Sheets-Sheet 3

Fig. 5

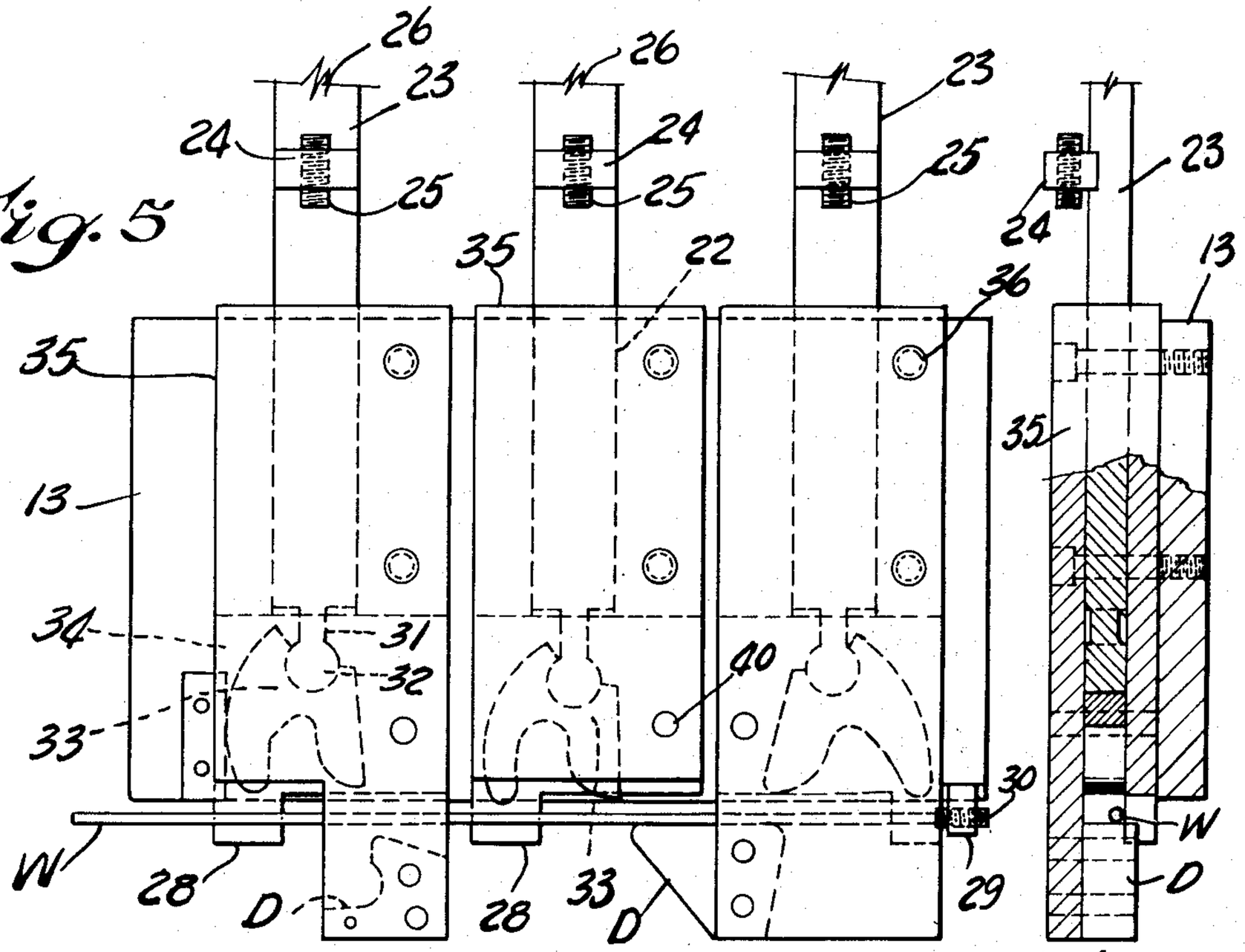

Fig. 6

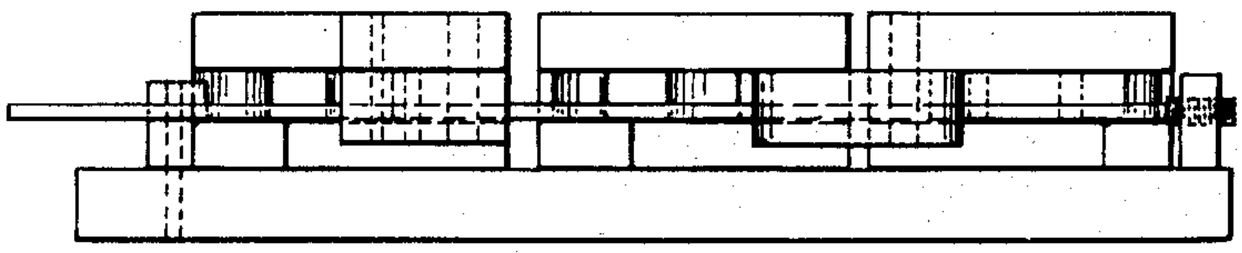

Fig. 7

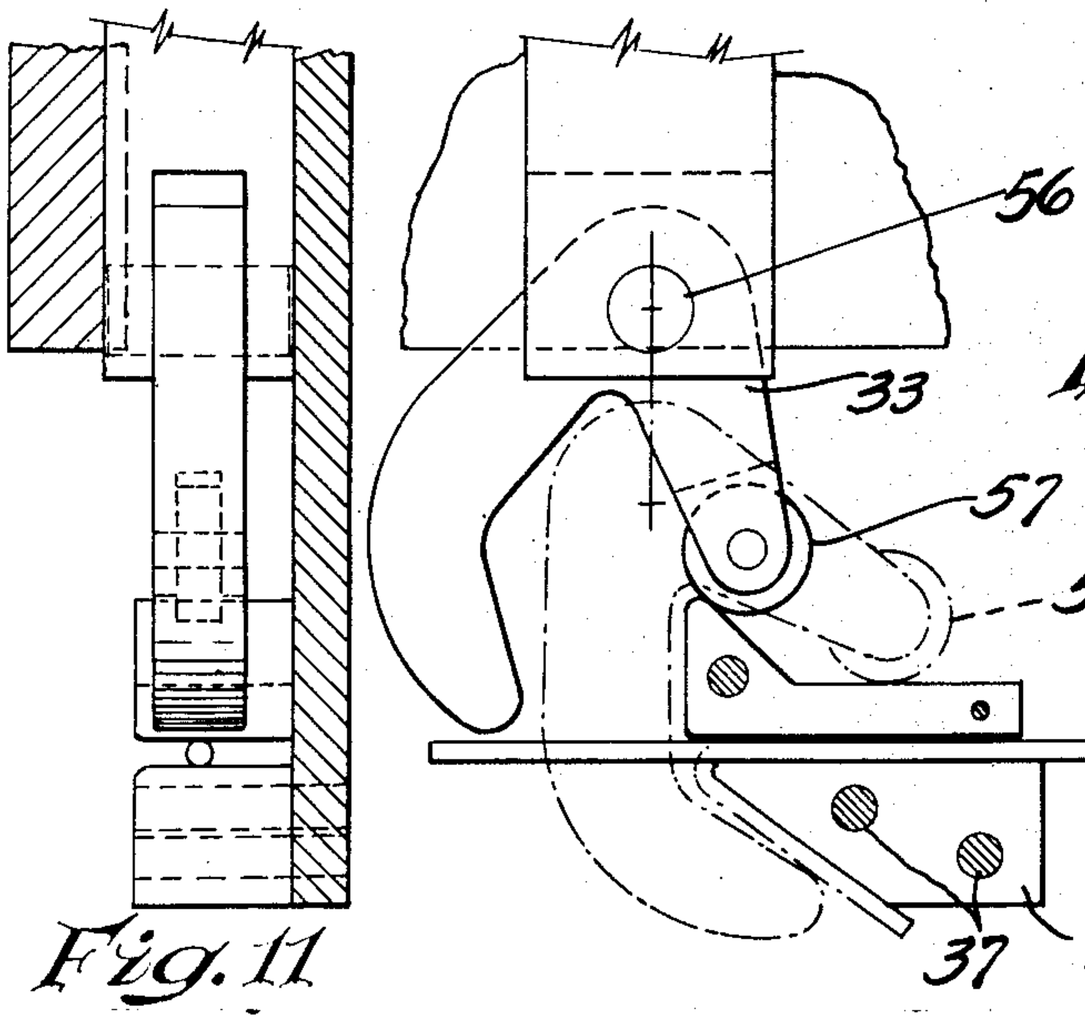

Fig. 10

Fig. 11

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WIRE BENDING DIE UNIT

Filed Feb. 13, 1950

4 Sheets-Sheet 4

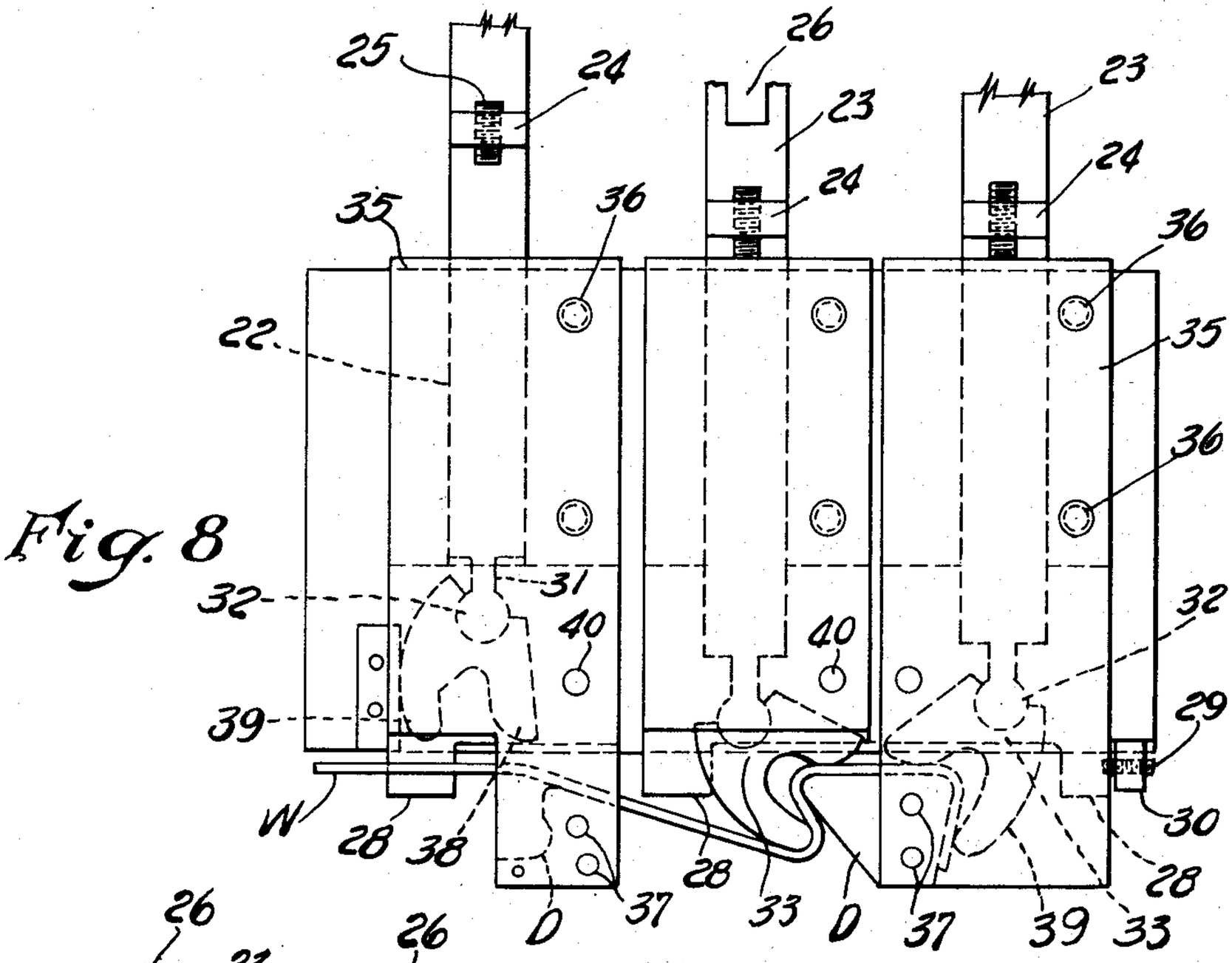

Fig. 8

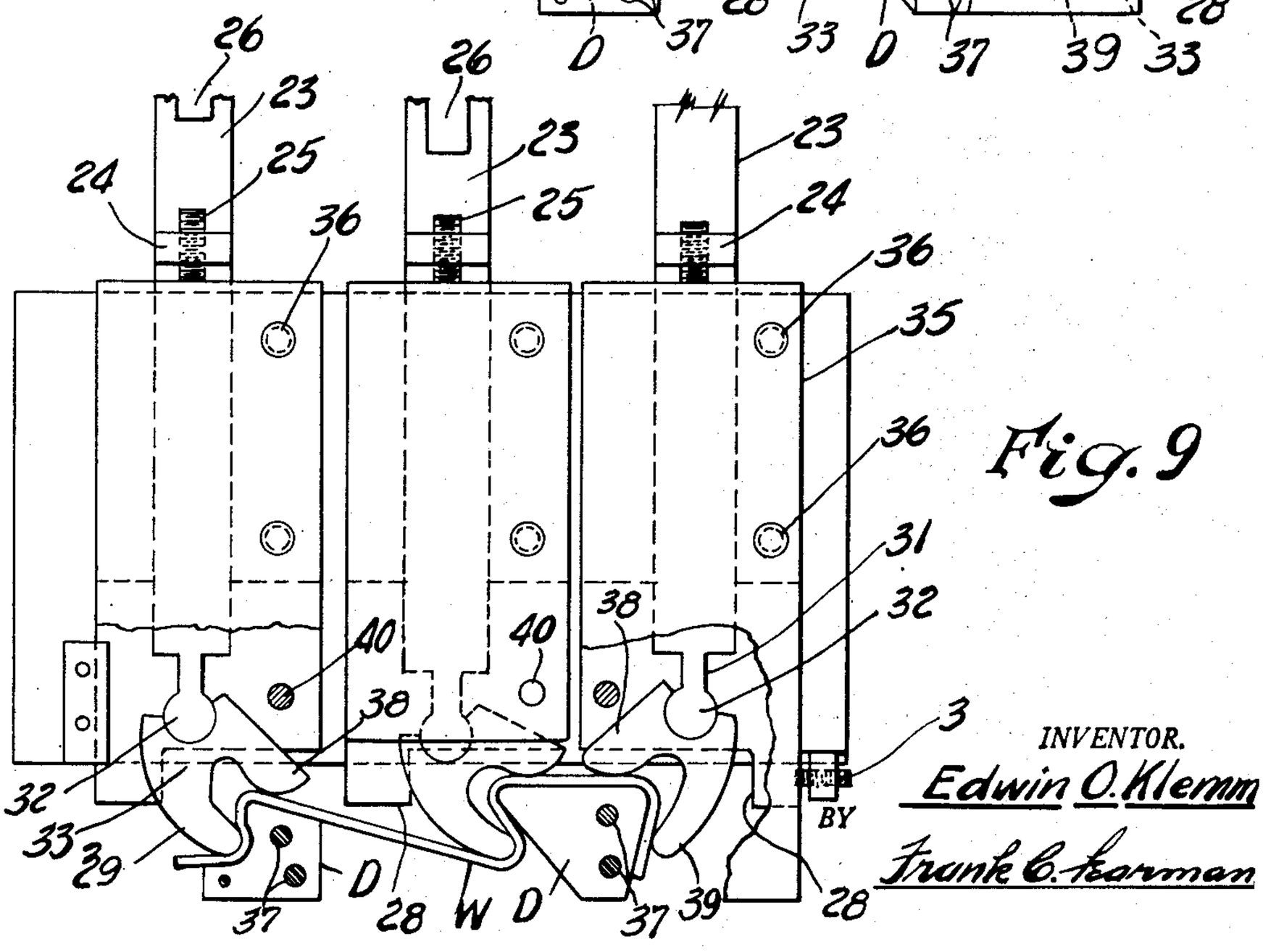

Fig. 9

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Patented Nov. 17, 1953 2,659,408

UNITED STATES PATENT OFFICE

2,659,408

WIRE BENDING DIE UNIT

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Application February 13, 1950, Serial No. 143,865

2 Claims. (Cl. 153—17)

1

My invention relates to die units for wire bending machines of the type used in the automobile and other industries in which the mass production of wire shapes of all lengths, sizes, and descriptions is both necessary and economical.

Machines of this type must be flexible to the extent that a minimum change-over time is required when it is necessary to change from the production of one wire shape to another, so that stock-piling of the various wire shapes is unnecessary, and valuable storage space is thus conserved.

My invention relates more particularly to wire bending machines of the type in which the die unit is adapted to be mounted on a suitable bending machine frame, and in which any suitable source of power is used to reciprocate the slide bar dies in grooves provided in the bed of the machine. In dies of this design, the cam dies are mounted in horizontal spaced relation; a wire of predetermined length is fed onto supports provided on the bed plate of the die between the cam die and die block, and the die bar slides are actuated lineally, in sequence, to progressively form the wire which is interposed between the cam die slides and the die blocks.

The prime object of my invention is to provide die units for use in wire bending machines of the type described, which units incorporate slide bar heads having a limited swiveling motion relative to the slides, so that their action is such as to progressively bend the wire in an easy and natural manner without stretching or fracturing it at the point of bend; creating torsional and other stresses therein or otherwise marring the wire finish; thus scrap is reduced to a minimum.

A further object of my invention is to provide wire forming dies of the type indicated by means of which wire bending may be accomplished in a highly economical manner, and which while assuring the aforementioned bending advantages, retain their flexibility, the entire unit and certain component parts of the unit being adapted for ready mounting and demounting so that a changeover can be effected in a minimum of time.

Still a further object of my invention is to provide a wire forming die unit in which the formed wire falls free of the die units into a hopper or other storage unit after completion of the bending sequence, so that the employment of stripping means to remove the formed wire from the dies is sometimes unnecessary.

Still a further object is to provide a die unit in which the die design and machining of the dies

2

is greatly simplified, the die bar slide heads being adapted to cooperate with the die blocks and being readily mountable and demountable on the slide bars.

A further object still is to design a very simple, practical, and substantial machine by means of which wire bending can be accomplished in a highly economical manner and with a minimum of scrap.

To the accomplishment of the foregoing and related ends, said invention then consists of the means hereinafter fully described and more particularly pointed out in the claims, the annexed drawings and following description setting forth, in detail, certain means and one mode of carrying out the invention, such disclosed means and mode illustrating, however, but one of various ways in which the principle of the invention may be used.

In the drawings:

Fig. 1 is a sectional, side-elevational view of a wire bending machine showing the die units in position thereon.

Fig. 2 is an enlarged, sectional, detail showing the slide-actuating levers, slides, etc., the broken lines indicating the range of movement of the levers.

Fig. 3 is a fragmentary, part-sectional, end-elevational view of one of the levers.

Fig. 4 is a perspective view of one of the swivel bearings.

Fig. 5 is an enlarged, plan view of the die units, the ends of the slide bars being broken away and the wire being shown in bending position on the supports.

Fig. 6 is a part-sectional, edge-elevational view of the machine bed plate and assembled die bar units and slides.

Fig. 7 is a front-elevation of the mechanism shown in Fig. 5.

Fig. 8 is a plan view similar to Fig. 5 showing the die units and wire in an intermediate stage of bending.

Fig. 9 is also a plan view of the die units illustrating the wire formed to shape at the completion of the bending sequence, part of the cover plate being broken away to more clearly show the dies, die blocks, etc.

Fig. 10 is a fragmentary, plan view showing a modified design with a wire positioned for bending, the broken line indicating the shape of the wire when bent and the complementary slide bar die head at completion of the bending stroke.

Fig. 11 is a sectioned edge view thereof.

Referring now more particularly to the ac-

companying drawings, the letter M indicates the main frame of the machine which can be of any desired design and usually comprises a base 10, end members 11 and 12 on which a bed plate 13 is mounted; a speed reducer S being mounted in the end wall 11 and includes a worm and worm wheel assembly 14 and 15, a sheave 16 being mounted on the worm shaft 17, and a drive belt 18 leads to a drive motor 19 which is connected to any suitable source of power.

An eccentric E is drivingly connected to one end of the worm wheel shaft 20, the opposite end of said eccentric being journaled in a suitable bearing 21 provided in the opposite end wall 12. The bed plate 13 is suitably grooved as at 22 to slidably accommodate a plurality of bar slides 23, and raised bosses 24 are provided on said slides and are bored and threaded to accommodate an adjusting screw 25 which serves as a stop.

An opening 26, of predetermined length, is provided in each slide at a point adjacent the stop 25 and is adapted to accommodate an actuating lever L for actuating the slides and in a manner to be hereinafter described.

Projecting sections 28 are provided on the bed plate 13, and the wire W is fed thereon in any desired manner, the end of the wire engaging a horizontally disposed stop 29 provided in a raised boss member 30, said stop being threaded in said boss and is readily adjustable when desired or necessary.

One end of each slide bar 23 is formed with a reduced projecting neck section 31 terminating in a ball-shaped head 32, and on which a cam die 33 is swivelly mounted, and I wish to direct particular attention to the fact that this neck, head, and cam die are of the same thickness as the body of the slide bar, and the bed plate is cut away as at 34 to accommodate said cam die and permit free swiveling movement thereof on the head when the slide bar is actuated.

Plates 35 form a cover for the slide bars 23 and are held in position by means of bolts 36 as usual, these plates projecting beyond the bed plate as shown, and die blocks D are secured to the lower face thereof by means of bolts 37, these die blocks being in horizontal alignment with the cam dies 33, so that as the slide is actuated, the wire W will be engaged by said cam dies and forced against the die blocks.

The cam dies 33 are shaped to suit the work desired, and are customarily formed with spaced-apart fingers 38 and 39 which progressively engage the wire as the slides move outwardly, the fingers 38 forcing the wire firmly against the face of the die blocks while the fingers 39 perform the bending operation, as clearly shown in Figs. 8 and 9 of the drawings. Guide pins 40 are provided in the bed plate 13 adjacent the cam dies 33 and serve to align the cam dies on the return stroke of the slides.

Die bar actuating levers 41 are pivotally connected to a raised rib 42 provided on the machine frame by means of pins 43, each lever comprising spaced-apart bars 44 having an extension shoe 45 secured to the upper end thereof by means of a bolt 46, which shoe projects into the opening 26 provided in the slides 23.

A lever 47 is connected to the raised rib 42 by means of pin 48 and this is formed similar to the lever 41 minus the shoe, the upper end of the lever engaging a shoulder 49 provided on the bed.

Swivel bearings 50 (see Fig. 4 of the drawings)

are mounted on the levers 41 and 47, and are formed with pins 51 which are journaled in suitable openings provided in said levers, and a horizontally disposed threaded rod 52 is mounted in said bearings, the ends of the rod being threaded to accommodate nuts 53.

Springs 54 and 55 are interposed between the respective nuts and swivel bearings as shown, these springs being preloaded by means of the nuts 53 and normally tend to force the levers 41 and 47 towards each other and into engagement with the eccentric E at all times, and while in the present instance I have shown but one set of springs, it will be obvious that more can be used if desired and necessary, depending on the work and power required.

The die bar slides are actuated by the extension shoes 45, the edges of the shoes being suitably curved to minimize wear and thrust, and the stroke of the various slides is governed by the eccentric E and the length of the slot 26, the stop 25 limiting the forward travel of each slide as the machine is operated.

The eccentric E is the timer as it governs the start of the forward travel of the actuating levers 41 and 47, the variation in length of the individual slots 26 in the bar slides controlling the sequence and starting time of said slides when acted on by the stored energy in the preloaded springs. The forward travel of the die bar slides 23 is stopped when the stops 25 engage the edge of the plate 13, the levers stopping simultaneously therewith.

The eccentric E returns the levers to original starting position, the lever 47 engaging the shoulder 49 on the bed plate, all as shown and described in my application for Letters Patent directed to Wire Bending Machines, Serial No. 117,891, filed September 26, 1949.

In operation, the wire W is fed rapidly across and rests on the supports 28 with the end in engagement with the stop 29, said stop serving to position the wire thereon. The slides 23 are then forced forwardly in proper sequence by means of the eccentric and levers above described, or any other suitable mechanism, the cam dies 33 engaging the work and the eccentric E providing a certain amount of dwell during which the dies are held firmly in rolling contact with wire, forming it to shape against the die blocks D, until such time as the bending sequence has been completed, after which the work is free to drop clear and into a hopper or other dispensing device (not shown).

In Figs. 10 and 11 of the drawings, I have shown a modified design in which the cam die 33 is pivotally connected to the end of the slide bar 23 by means of a pin 56, and a roller 57 is pivotally mounted on one of the fingers 38 and 39 to eliminate rubbing action and friction as the bending progresses. The action is otherwise identically the same.

I wish to emphasize the fact that my invention is not restricted to the specific type of machine shown, but is adaptable to any other type of wire bending apparatus.

From the foregoing description, it will be understood that I have perfected a very simple, practical and effective bending die for wire bending machines of all kinds.

What I claim is:

1. In a wire bending die unit, a bed plate formed with a plurality of transversely disposed, parallel grooves therein, individual die bar slides reciprocatingly mounted in said grooves, means

for reciprocating said die bar slides in timed relation, a cover plate for each groove overhanging the front edge of said bed plate, and terminating short of the rear ends of said die bar slides, stationary dies having rear and side walls of predetermined shape mounted on the under face of said overhanging portions a spaced distance forwardly of said bed plate in horizontal alignment with said die bar slides, extension arms on said bed plates for supporting the wire between said bed plate and said stationary dies in the path of travel of said slides, relatively flat cam dies swivelly mounted on the end of each slide and in horizontal alignment therewith to cooperate with said stationary dies in progressively bending said wire to the desired shape, each cam die having a pair of forwardly extending, curved fingers of predetermined length and curvature, each stationary die being so positioned adjacent a cam die so that when the cam die moves forwardly one of said fingers will form the wire to the shape of the rear wall of the stationary die and guide thereon, while the second finger progressively completes the bending by forming the wire to the side wall of said stationary die, a forwardly and rearwardly adjustable stop member mounted adjacent the rear end of each die bar slide in the horizontal plane of the cover plate over each groove to engage said plate when each slide is moved forwardly and prevent forward motion of each slide past a predetermined point, stop means on the sides of said bed plate projecting transversely into the path of said wires to engage the end thereof and position said wire, and abutting members on said bed plate adjacent said fingers to be engaged thereby for realigning said cam dies as they are retracted.

2. In a wire bending die unit, a bed plate formed with a plurality of transversely disposed, parallel grooves therein, individual die bar slides reciprocatingly mounted in said grooves, means for sequentially actuating said die bar slides forwardly and rearwardly in timed relation, a cover

plate over each groove and overhanging the front edge of said bed plate, stationary dies having rear and side walls of predetermined shape mounted on the under face of said overhanging portions a spaced distance forwardly of said bed plate and in horizontal alignment with said die bar slides, extension arms on said bed plate for supporting the wire between said bed plate and said stationary dies in the path of travel of said slides, relatively flat cam dies swivelly mounted on the end of each slide and in horizontal alignment therewith to cooperate with said stationary dies in progressively bending said wire to the desired shape, each cam die having a pair of forwardly extending curved fingers of predetermined length and curvature, each stationary die being positioned adjacent a cam die in a position where, when the cam die moves forwardly, one of said fingers will form the wire to the shape of the rear wall of the stationary die and guide thereon, while the second finger progressively completes the bending by forming the wire to the side wall of said stationary die, and abutting members on said bed plate adjacent said fingers to be engaged thereby for realigning said cam dies as they are retracted.

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