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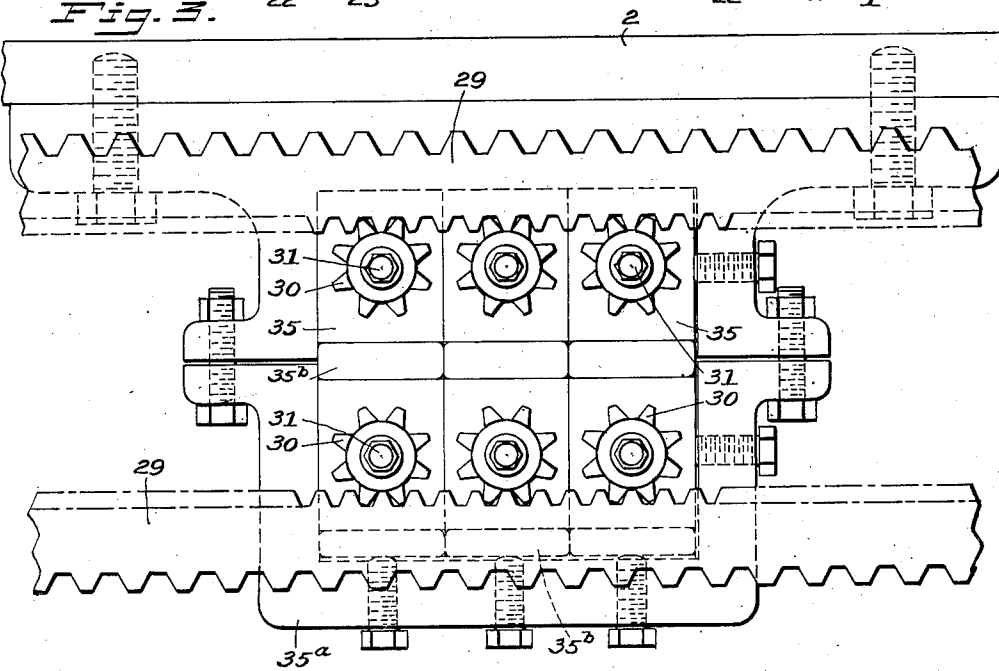
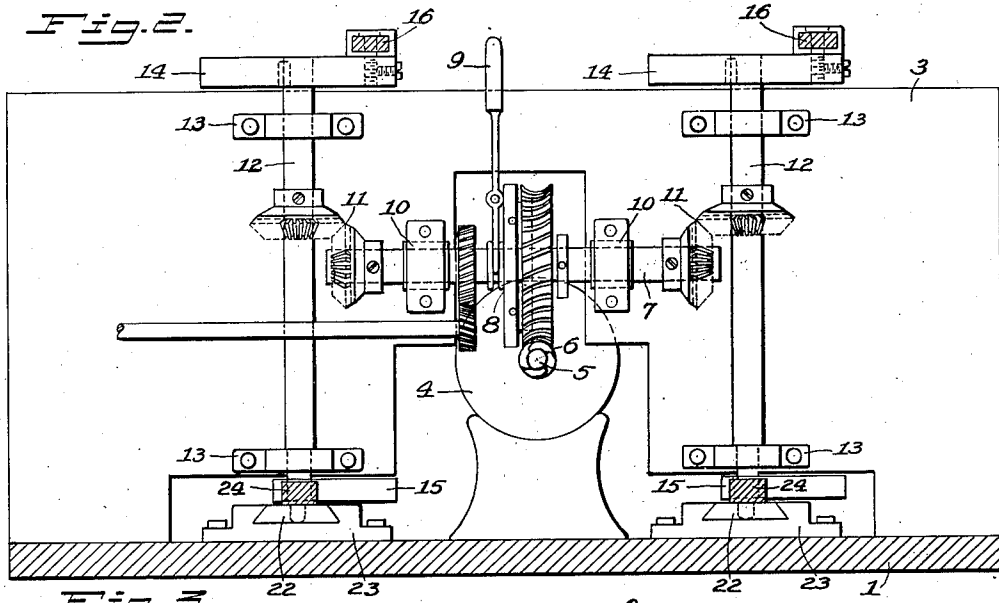
A. ILLSCHE

2,470,985

GEARING FOR DRIVING A PLURALITY OF SPINDLES

Filed March 1, 1946

4 Sheets-Sheet 2



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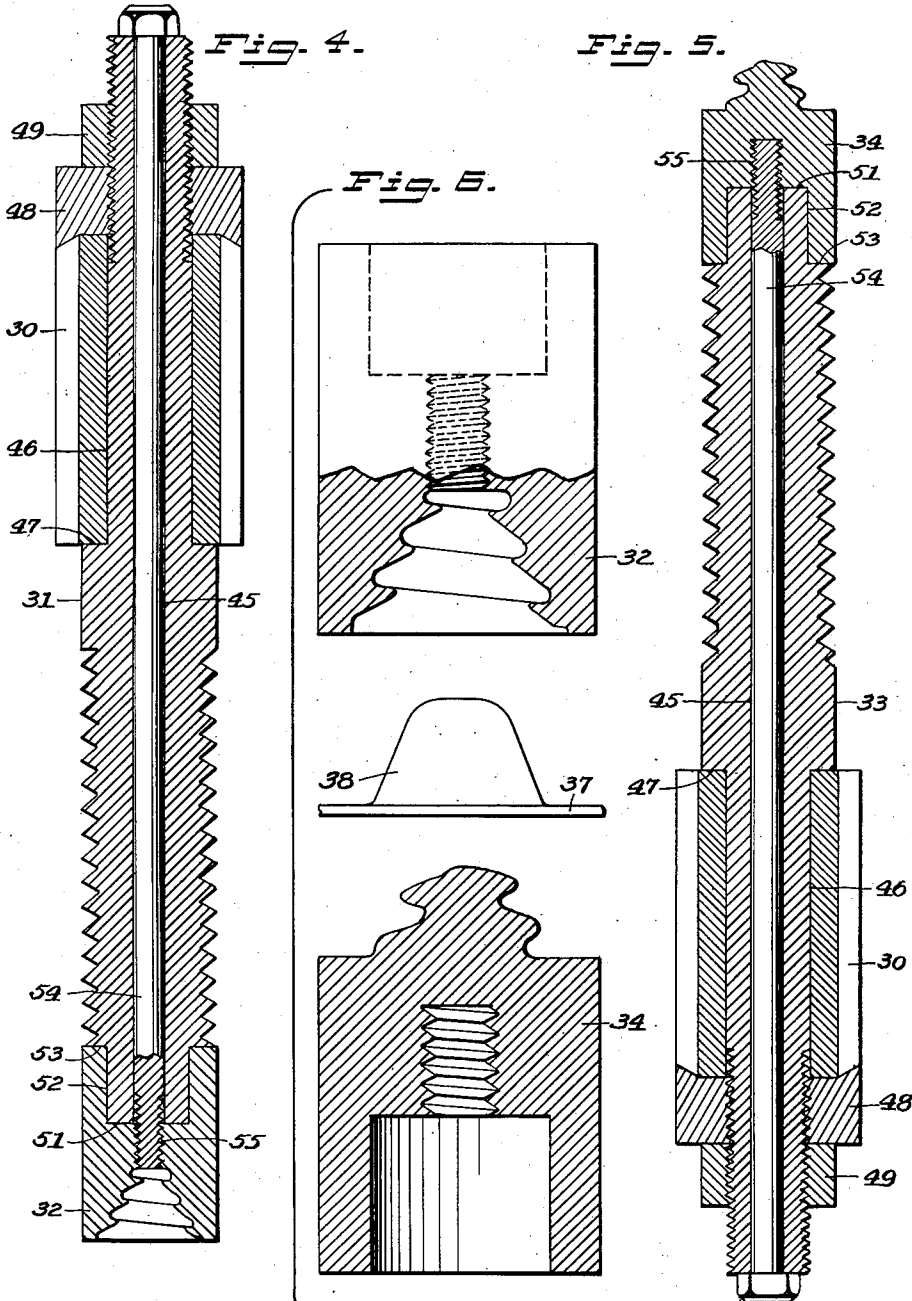
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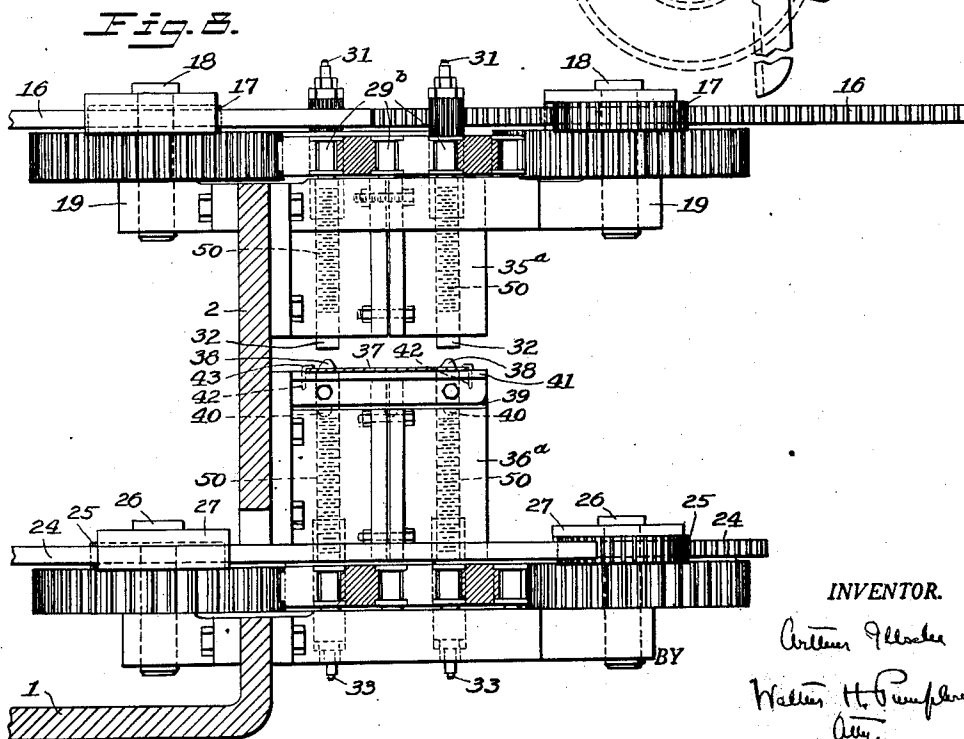
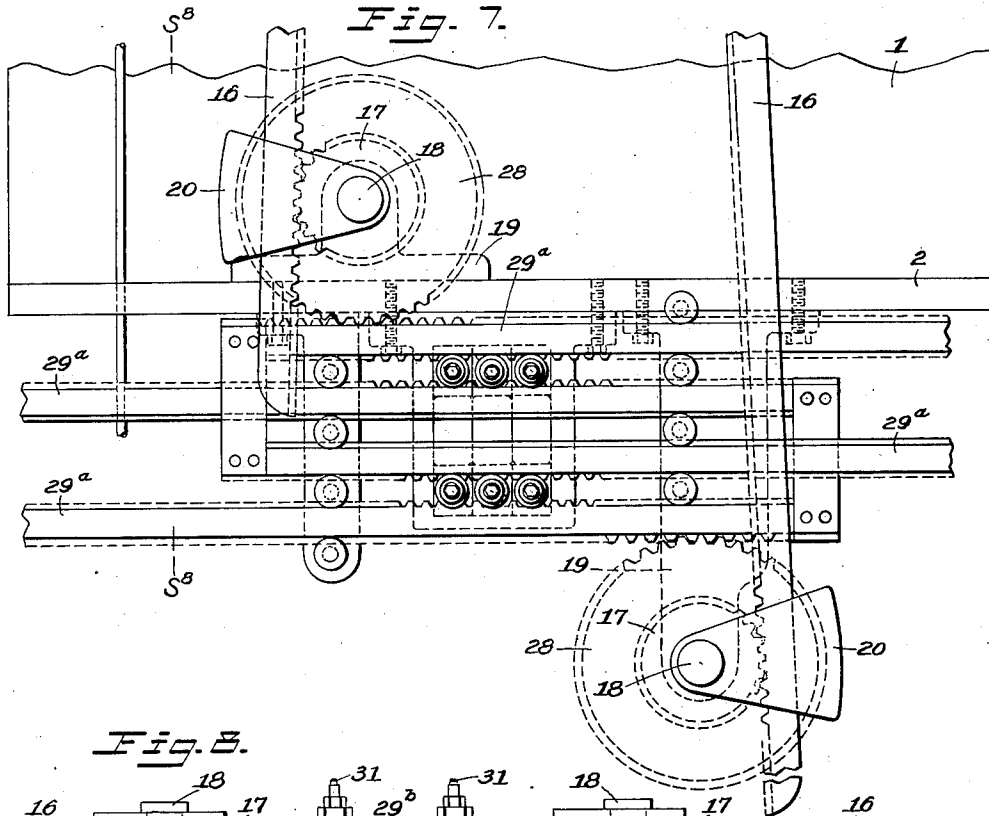
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UNITED STATES PATENT OFFICE

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GEARING FOR DRIVING A PLURALITY
OF SPINDLES

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7 Claims. (Cl. 74—389)

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The invention relates to gearing for mass production machines designed for die-forming sheet metal articles and while not limited to a particular product, the machine, as herein embodied, is specially adapted for die-forming mated screw threads on members of sheet metal buttons, by means of which such members are separably secured together.

In die-forming screw threads in sheet metal blanks, I have found that heavy loss from defective and imperfect die work can be avoided by causing the dies to press, draw and spin the metal in each thread-forming operation. Combining these actions eases the strain on the metal blank and enables it to withstand formation by the dies without cracking, wrinkling, collapsing or being otherwise damaged.

The necessity for combining the actions mentioned, becomes at once apparent in threading the conical or frusto-conical portion of small blanks of button sizes, which could not be done by pressing or drawing or spinning alone, owing to the limited area of the metal presented and the small amount of clearance that is available for action by the dies and as the thread spirals from the base to the apex of the cone, where it terminates in a blunt point, a perfect terminal formation can only be produced by easing the die action as above described on the thinly-drawn metal at the apex of the cone.

To obtain the above described die action, the dies of each coacting pair, while being rotated in opposite directions, to give them a drawing and spinning action on the blank, are caused to approach and contact the blank at different speeds, the male die advancing more rapidly than the female die, which enables the male die to enter and be utilized as a filler and support for the blank, thus reinforcing it preliminary to the action of the slower moving female die, by which, assisted by the male die, the blank is pressed, drawn and spun over the male die, to form the thread.

For mass production, a suitable number of coacting pairs of die-carrying spindles are assembled, preferably in double-line formation, for simultaneous operation by reciprocating rack bars engaging pinions on the spindles. The rack bars that drive the spindles carrying the male dies, are intermittently reciprocated at comparatively high speed, by cam action, to give the male dies a rapid advance into the cones of the blanks, then a period of rest and a rapid retraction, following the action of the female dies on the blanks. The rack bars that drive the spindles carrying

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the female dies, are continuously reciprocated by eccentric action to give them a comparatively slow advance and retraction.

The conical blanks to be threaded, are pre-formed in a strip of ribbon metal drawn from a reel and the strip is given a step by step advance by an automatic feed, that brings a cone blank in centered relation between each cooperating pair of dies.

Following the threading operation, the strip is run through a punching machine by which the threaded cones are punched out with a marginal flange at the base of the cone for a suitable edge finish or attachment to an ornamental button overlap or the like.

Other features of the invention not specially mentioned above will be brought to attention in the detail description that follows:

A machine construction suitable for carrying the invention into effect, is illustrated in the accompanying drawings, but, it will be understood, that no limitations are intended by this showing, other than are imposed by the appended claims.

In the drawings—

Fig. 1 is a top plan view of the machine.

Fig. 2 is a vertical cross section on the line S^2-S^2 of Fig. 1.

Fig. 3 is a detail plan view, on an enlarged scale, of the gearing for rotating the die-carrying spindles in groups.

Figs. 4 and 5 are central vertical longitudinal sections of a cooperating pair of die-carrying spindles.

Fig. 6 includes detail views, on an enlarged scale, of a cooperating pair of male and female dies and a metal blank on which they are designed to operate.

Fig. 7 is a top plan view illustrating an addition to the spindle-driving gearing shown in Fig. 1.

Fig. 8 is a vertical sectional view on the line S^3-S^3 , of Fig. 7.

Fig. 9 is a detail plan view of one of the cam drives.

Referring now to the drawings, the main frame of the machine, as best shown in Figs. 1 and 2, consists of a rectangular base plate 1, from the longer opposite sides of which front and rear walls 2, 3, rise to provide support for the operating mechanism. The die-carrying spindles are mounted on the outer side of the front wall 2, along with certain elements of the gearing, by which the spindles are alternately rotated in opposite directions to advance and retract the dies carried by cooperating pairs of the spindles. The main portion of the spindle driving gear is

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mounted on the inner side of the rear wall 3 and on the opposite side of the wall, a source of power is indicated, in the form of a motor 4.

The motor shaft 5 is suitably geared, as indicated at 6, in Fig. 2, to drive the main cross shaft 7 of the machine and power from the motor to the shaft is controlled by a clutch 8, the operating lever of which is indicated at 9, in Figs. 1 and 2.

The cross shaft 7 is mounted in bracketed bearings 10, 10, projecting from the inner side of the rear wall and through bevel gearing 11, 11 at opposite ends, is connected to drive two vertically disposed shafts 12, 12 in opposite directions. The shafts 12, 12 are mounted in bracketed bearings 13, 13, projecting from the rear wall and have fast thereon eccentrics 14, 14, at their upper ends and cams 15, 15, at their lower ends, as best shown in Figs. 1 and 2.

The eccentrics 14, 14, through gearing hereinafter described, operate to continuously impart alternate rotation in opposite directions, to the upper series of spindles that carry the female dies and the cams 15, 15, as hereinafter described, operate to impart intermittent rotation in opposite directions to the lower series of spindles that carry the male dies. It may be added, as will later on appear, that excepting the difference between the eccentric drive and the cam drive, the form of gearing through which motion is transmitted from each of them to the die-carrying spindles, is substantially identical.

Rack bars 16, 16, connected to be reciprocated by the eccentrics 14, 14, engage pinions 17, 17, mounted on stud shafts 18, 18, carried by brackets 19, 19, projecting from opposite sides of the front wall 2. The rack bars are held in engagement with the pinions by suitable retaining devices 20, 20, free to move about the shafts, to adapt themselves to variations in the angle of the rack bars as they swing under the drive of the eccentrics.

The cams 15, 15, each acting between two rollers 21, 21, of a slide 22, movable in a guide 23 (see Figs. 2 and 9), operate to intermittently reciprocate the rack bars 24, 24, in opposite directions. The rack bars are pivoted to the slides and engage pinions 25, 25, mounted on stud shafts 26, 26, carried by brackets projecting from opposite sides of the front wall 2. Retaining members 27, 27, similar to those above described in reference to the eccentrically driven rack bars, are here employed to serve the same purpose.

Forming a continuation of each eccentric drive through an engaging rack and pinion, as above described, a gear 28 is mounted on the shaft with each pinion to rotate with the same. Each of the gears 28 engages the teeth on one side of a rack bar 29, which is toothed on the opposite side to mesh with pinions 30 of a three-member group of die-carrying spindles, arranged in line formation, as best shown in Figs. 1 and 3. Movement of the rack bars 29, 29, in opposite directions, will cause the spindles of both groups to be simultaneously rotated in the same direction and as these two groups form the upper series of spindles that carry the female dies, the action of the rack bars in reciprocating, will first rotate them clockwise, to advance the dies to the blanks and then reverse the rotation, to retract the dies, to enable the strip of blanks to be fed forward for the next operation.

The rack bars 29, 29 are supported and guided on vertically and horizontally disposed roller bearings, indicated at 29^b and 29^c. The rollers

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29^b, vertically disposed on opposite sides of the bars, are flanged at the ends of a greater depth than the teeth of the bars, to straddle and clear the teeth and permit the flanges to come to a bearing on the bar above and below the teeth, as best shown in Fig. 8. The rollers 29^c, are horizontally disposed and bear on the underside of the bars as cooperating supports for the same.

As an exact duplication of the gearing, above described in connection with the eccentric drives, is employed as continuations of the cam drives through engaging rack bars and pinions, to the two groups of spindles that form the lower series and carry the male dies, the construction and arrangement will be apparent without the aid of a detailed description.

For purposes of illustration, twelve die-carrying spindles are shown, arranged in six cooperating pairs but this number may be increased or decreased as will be apparent. As previously stated, the spindles 31, carrying the female dies 32, are shown forming the upper group and the spindles 33, carrying the male dies 34, as the lower group, an arrangement that may be reversed, if desired.

The spindles, mounted in supporting blocks 35, 36, are assembled in separate clamp frames 35^a, 36^a, which are bolted or otherwise secured to the outer side of the front wall of the machine, as best shown in Figs. 3 and 8, the assemblies being arranged one above the other, suitably spaced apart to provide clearance between them for entrance and passage of a strip of sheet metal 37, in which conical or frusto-conical blanks 38 have been preformed. Suitable spacing members 35^b, 36^b, are employed between the blocks to separate the spindles or group them into closer relation, as may be required, to bring them into centering register with the blanks on the strip.

A booster block 39, doweled to the lower block assembly, as indicated at 40, is provided with a shelf-like extension 41 and together they serve as a support for the strip of blanks. In addition to being bored for the passage of the spindles, parallel slots 42, 42 are formed in the booster block to receive guides 43, 43, by which the strip of blanks is steadied as it is advanced to the dies by an automatic feed, indicated at 44, which is of the conventional form and need not therefore be described in detail.

The spindles 31 and 33, of the upper and lower series, are of identical construction and each consists of a tubular body 45, reduced as indicated at 46 and shouldered at 47, to receive the pinion 30, by which, through the gearing above described, the spindle is given alternate rotation in opposite directions. The pinion is secured to the spindle by being clamped against the shoulder 47, by a main nut 48 and an added clamp nut 49, threaded on the spindle, as shown in Figs. 4 and 5.

The advance and retraction of the dies is effected by a screw feed provided by threading each spindle in its supporting block, as indicated at 50, the pitch of the thread being such that as the spindles are given a predetermined number of turns, first in one direction, then in the other, the required movement will be imparted to them by the screw feed to bring the dies into and out of cooperating relation with the blanks.

The end 51 of the spindle to which the die is attached, is reduced, as indicated at 52 and shouldered at 53, to provide a seat for the die

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block, which is socketed to conform to the seat and secured thereon by a long bolt 54, that extends through the tubular body of the spindle and is threaded into the block as indicated at 55. To remove a die for inspection or renewal, it will only be necessary, as will be seen, to unscrew the bolt, which leaves the spindle otherwise intact.

To form perfect screw threads in small metal blanks of button sizes, very fine adjustments of the dies are required and in order that they may be made without removing or disengaging the spindle driving gearing, two such adjustments are provided, one to advance or retard the reversal of the stroke of any one or more of the eccentrics or cams, with relation to the movement of either group of dies and the other to advance or retract any one or more of the dies individually, that may be under-acting or over-acting, in the formation of the screw threads.

The first mentioned adjustment is best shown in Fig. 1, in which either of the rack bars 16, may be shifted lengthwise, a limited distance, in either direction, by means of the screw bolts 56, 56, without moving the eccentric. These bolts, acting on the block 57, movable in a guide slot 58, in the rack bar, may be turned to shift the bar lengthwise relative to the stud 59, that projects through the block and connects the bar to the eccentric. In thus shifting one of the rack bars 16, for example, the gearing connecting it to a group of the spindles will be given proportionate movement, causing the dies of that group to move up or down, depending upon the direction in which the bar is shifted.

For individual adjustment of any one or more of the dies, it is only necessary to run the clamp nut 49, and the main nut 48, back a few turns on the spindle to reduce the clamp pressure that holds the pinion fast thereon and as the pinion is held against turning by being engaged by the rack bar, the spindle, thus freed, may be rotated in either direction by hand or the aid of a suitable tool and the screw feed acting, will raise or lower the die as required. After the die is adjusted and the nuts 48 and 49 are tightened up, the spindle will be ready for use.

The modification shown in Figs. 7 and 8, consists in providing a double rack bar drive for each group of spindles, otherwise the construction is the same as in Fig. 1. As shown, a rack bar engaging the pinions of one group of spindles, is connected by a cross piece at its free end, to a second rack bar which engages the pinions of a second group of spindles, the arrangement being such as to increase and balance the power applied to the spindles.

As the operation and many advantages of the machine will be apparent from the foregoing, it will not be necessary to further describe the same.

I claim:

1. Gearing for operating a spindle assembly the spindles of which are arranged in cooperating pairs and the spindles of each pair in axially aligned relation presenting two cooperating sets of spindles adapted to be driven independently of each other, the said gearing comprising a transmission train for each set of spindles, each train including a plurality of rack bars operatively connected through interposed means to be reciprocated one by the other and terminating in a plurality of pinions driven by one of the aforesaid rack bars, the reciprocation of which periodically reverses the direction of rotation of the pinions, the said pinions being individually

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mounted fast on the individual spindles of one of the aforesaid sets of spindles; driving means for the trains adapted to impart different speeds of rotation to the two sets of spindles, and an automatic feed for each spindle responsive to rotation thereof for periodically advancing and retracting the two sets of spindles with relation to each other.

2. Gearing for driving a spindle assembly the spindles of which are arranged in cooperating pairs with the spindles of each pair axially aligned one above the other, presenting an upper set and a lower set of spindles, the said gearing comprising a transmission train from a common source of power for each set of spindles, each train including a pair of reciprocating rack bars operatively connected through interposed gears and terminating in pinions individually mounted on individual spindles of one of the sets and engaged by one of the rack bars, the reciprocation of which periodically reverses the direction of rotation of the pinions and the spindles on which they are mounted, means for driving the trains at different speeds to impart different speeds of rotation to the upper and the lower sets of spindles, screw feed for each spindle actuated by rotation thereof by which the spindles of the upper set and the spindles of the lower set are periodically advanced toward each other at different speeds and retracted at different speeds.

3. Gearing for driving a spindle assembly the spindles of which are arranged in cooperating pairs with the spindles of each pair axially aligned one above the other, presenting an upper set and a lower set of spindles, the said gearing comprising a transmission train from a common source of power for each set of spindles, each train including a pair of reciprocating rack bars operatively connected in angularly disposed relation to each other through interposed gears and terminating in a plurality of pinions individually mounted on individual spindles of one of the sets and severally engaged by one of the rack bars, the reciprocation of which periodically reverses the direction of rotation of the pinions and the spindles on which they are mounted, an eccentric drive for one of the trains and a cam drive for the other train by which different speeds of rotation are imparted to the two sets of spindles, and a screw feed for each spindle actuated by rotation thereof by which the spindles of the two sets are periodically advanced towards each other and retracted by different speeds, the spindles of the upper set moving at a higher speed than the spindles of the lower set.

4. Gearing for driving a cooperating pair of spindles axially aligned one above the other, comprising a separate transmission train from a source of power for each spindle, each train including a pair of reciprocating rack bars connected through interposed gears and terminating in a pinion fast on one of the spindles and engaged by one of the aforesaid rack bars, the reciprocation of which periodically reverses the direction of rotation of the pinion and the spindle on which it is mounted, means for driving the trains at different speeds to impart different speeds of rotation to the spindles and a screw feed for each spindle responsive to rotation thereby by which the spindles are periodically advanced toward each other at different speeds and retracted at different speeds.

5. Gearing for driving a cooperating pair of spindles axially aligned one above the other, comprising a separate transmission train from a

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common source of power for each spindle, each train including a pair of reciprocating rack bars operatively connected in angularly disposed relation to each other through interposed gears and terminating in a pinion fast on one of the spindles and engaged by one of the aforesaid rack bars, the reciprocation of which periodically reverses the direction of rotation of the pinion and the spindle on which it is mounted, one of the trains being driven by an eccentric and the other train by a cam to impart rotation to the spindles for different intervals of time and at different speeds, and a screw feed for each spindle actuated by rotation thereof by which the spindles are periodically advanced toward each other at different speeds and retracted at different speeds.

6. Gearing for operating a spindle assembly consisting of several groups of spindles, the spindles of each group being arranged in cooperating pairs and the spindles of each pair axially aligned one above the other, presenting an upper series and a lower series of spindles, the two series adapted to be driven independently of each other, the said gearing comprising two transmission trains for each group of spindles, each train including a plurality of rack bars operatively geared together to be reciprocated one by the other and terminating in a plurality of pinions engaged and driven by one of the aforesaid rack bars, the reciprocation of which periodically reverses the direction of rotation of the pinions, the said pinions being individually mounted fast on the individual spindles forming one series of a

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group of spindles, driving means for the trains adapted to impart different speeds of rotation to the upper series and the lower series of spindles, and an automatic feed for each spindle responsive to rotation thereof for periodically advancing and retracting the two series of spindles with relation to each other.

7. Gearing for operating a spindle assembly, as defined in claim 6, in which the rack bars of the two transmission trains that engage and drive the pinions of the upper and lower series of one group of spindles, are connected in cooperative relation to impart motion to other rack bars that engage and cooperatively aid in driving the pinions of the upper and lower series of a second group of spindles.

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