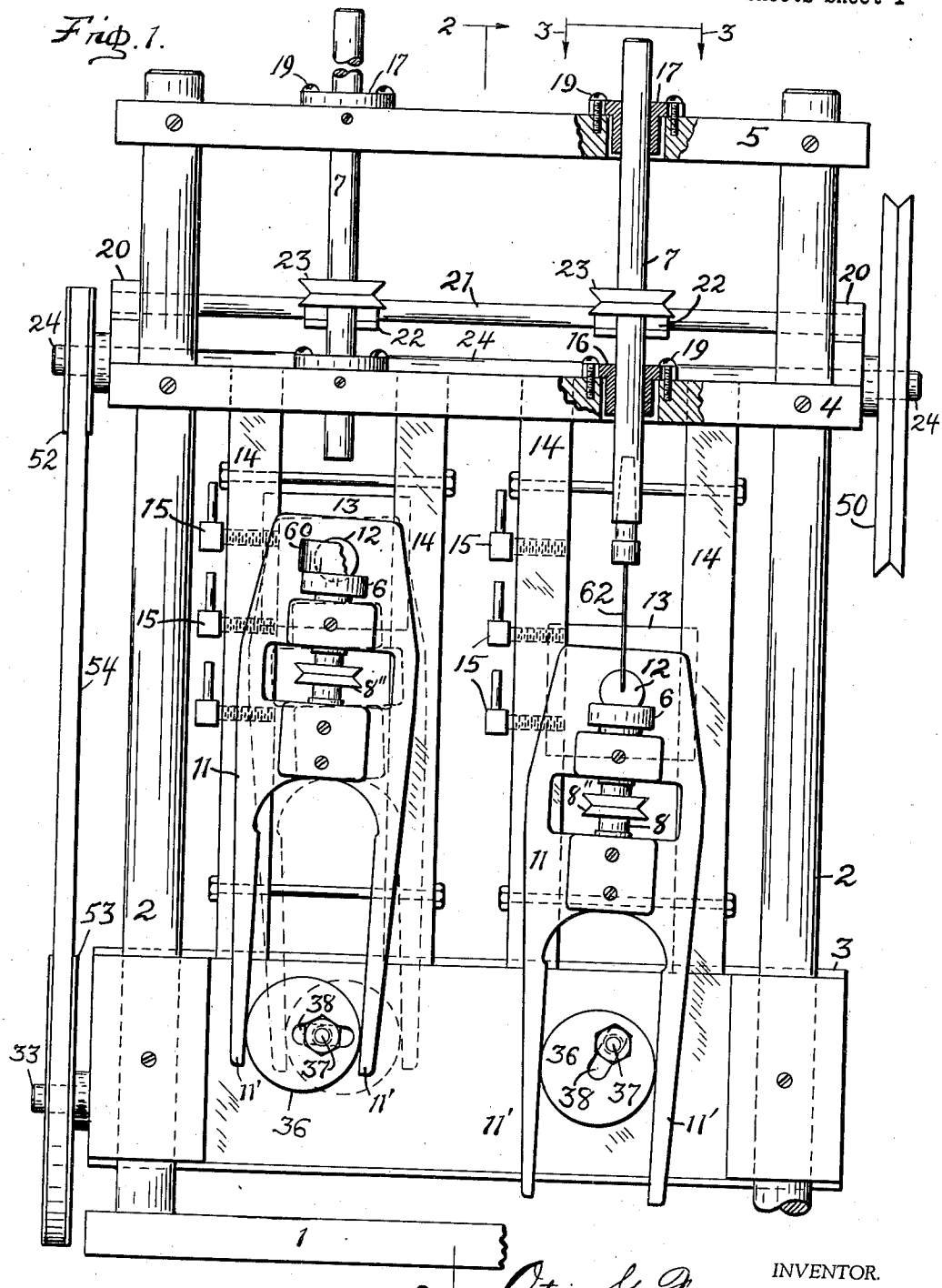
May 30, 1944. O. G. FERRIER 2,350,023

LAPPING MACHINE FOR WIRE DRAWING DIES

Filed April 28, 1941 3 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

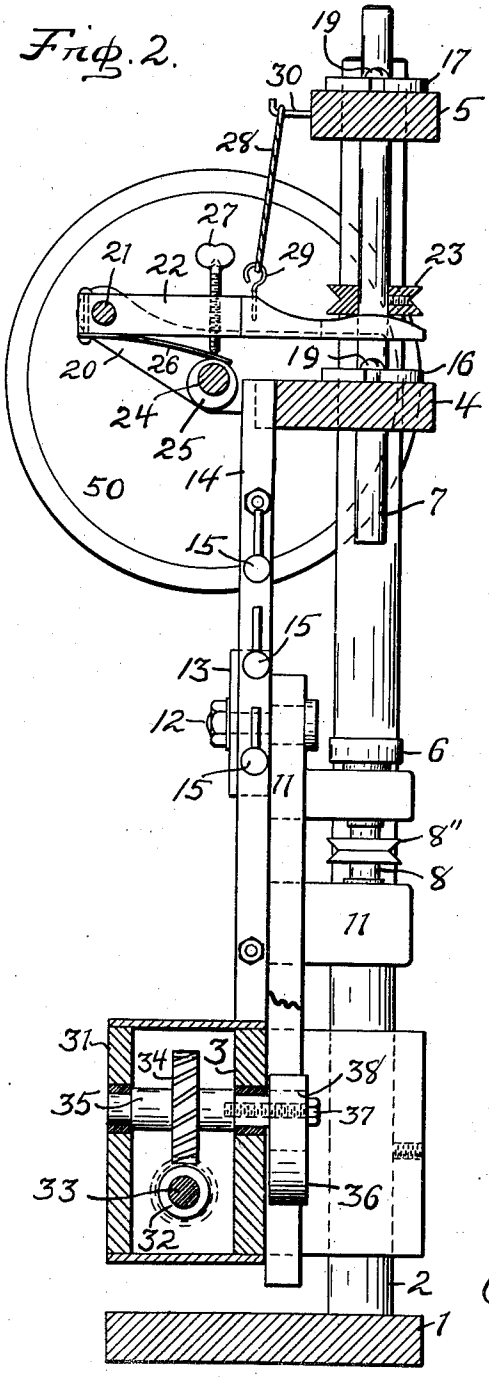


Fig. 3.

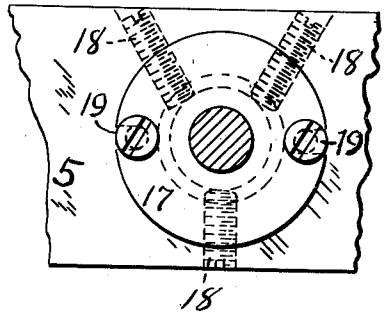
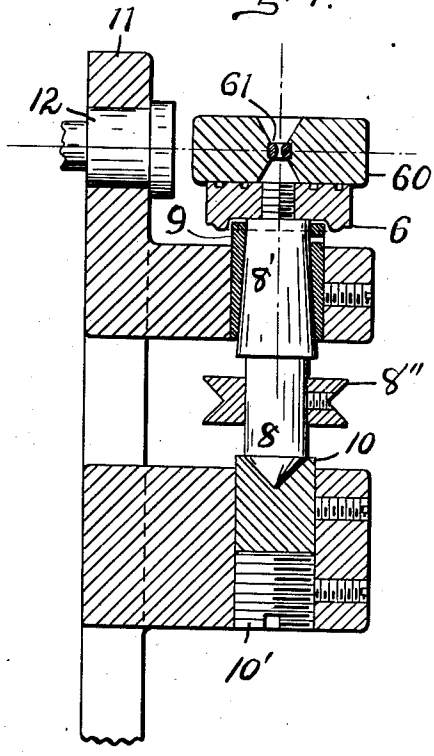


Fig. 4.



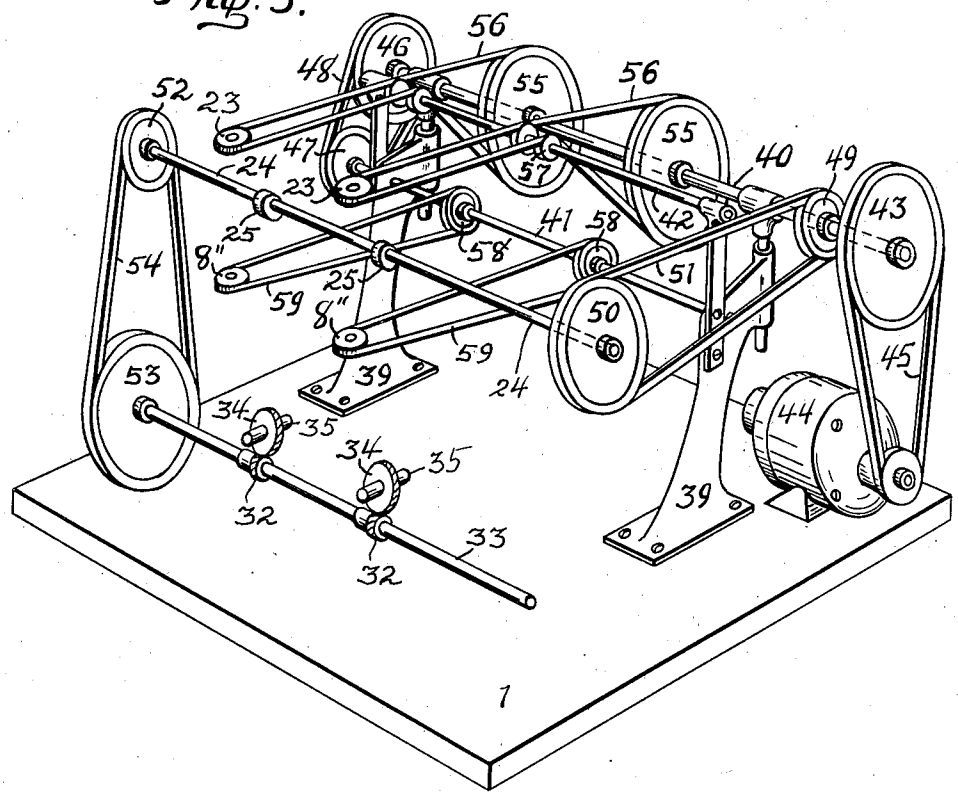
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Filed April 28, 1941 3 Sheets-Sheet 3

Fig. 5.



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UNITED STATES PATENT OFFICE

2,350,023

LAPPING MACHINE FOR WIRE-DRAWING DIES

Otis G. Ferrier, Fort Wayne, Ind.

Application April 28, 1941, Serial No. 390,839

3 Claims. (Cl. 51—46)

This invention relates to improvements in lapping machines for wire drawing dies, such dies for example as those in which a highly refractory die body is located in an encasement and pierced to provide a die opening therethrough, the purpose of the invention being to afford an expedient for dressing the wall of the die body surrounding the die opening therethrough in order that the bore will be truly circular in cross-section and will have the precise minimum diameter at its medial point and uniform curvature about its ingress and egress apertures when completed.

Ordinarily, die lapping machines have been employed in which a lapping tool or needle is angularly rotated and gyrated by its supporting spindle while the needle is projecting through the opening in the die, and concurrently revolving the die upon its axis. Such arrangement generally fails in effecting uniform or equal distribution of the cutting or dressing action of the needle over the wall surrounding the die opening which frequently results in the finished opening being irregular or "out of circle" so that a wire when drawn through the opening is formed "out of round" and therefore defective.

An object of the instant invention is to afford a machine by which is applied to a lapping tool angular rotation and axial reciprocation concurrently with angular rotation and rocking movement imparted to the die as it is being dressed by the tool.

Another object of the invention is to effect by mechanical expedients relative movements of the dressing tool and the composite constituted of the die body and its encasement so that uniform cutting effect of the dressing tool is applied over the inner wall of the die body during the dressing thereof whereby the die opening is rendered truly circular transversely both at the point of its choke and throughout its apertures.

A further object of the invention is to provide a die lapping machine having a group of individual lapping units that are operable and adjustable independently of each other suitably according to the particular bore of the die bodies or the stages of the lapping operations reached.

Also, precision in lapping operations on wire drawing die bodies is an outstanding object of the inention.

Other objects and advantages of the invention appear in the following description.

An illustrative embodiment of the invention is shown in the accompanying drawings, in which:

Fig. 1 is a front elevational view of a machine in which the invention is incorporated, parts being broken away;

Fig. 2 is an elevational view in section projected from Fig. 1 on the line indicated by the arrows 2—2 thereon;

Fig. 3 is a detail top plan view of that region of the machine shown in Fig. 1 indicated by the arrows 3—3 thereon;

Fig. 4 is a fragmentary elevation in section showing a rotatable mount with a composite thereon containing the die body to be dressed, and its swinging carriage; and

Fig. 5 is a perspective fragmentary diagram showing the relative arrangement of certain parts of the driving mechanism for the machine.

The illustrative embodiment of the invention consists of a machine having a main frame constituted of a base 1, uprights 2 surmounting the base, and a series of transversely disposed beams 3, 4 and 5 that are permanently secured upon the uprights at points thereon spaced apart from each other.

Supported in said frame are one or more wire drawing die lapping units, each of which consists of a movable die mount 6 and a movable spindle 7.

The die mount consists of a face plate secured concentrically upon one end of a rotatable arbor 8 which is supported in bearings 9 and 10 located in a swinging carriage 11 that has lateral swinging movement about the axis of a supporting stud 12 which projects from an adjustable block 13 located in the frame between guides 14 vertically disposed and supported by the cross beams 3 and 4. The block 13 is vertically movable and is secured in adjusted position therebetween by means of clamp screws 15 located in one of said guides.

Preferably, the arbor 8 has a tapered upper portion 8' that is encompassed by the bearing 9 which is correspondingly internally tapered to fit said portion. The lower end of the arbor 8 is tapered and is centered in the bearing 10 which rests upon an adjusting screw 10' by which the bearing 10 in the carriage is vertically adjusted. Thus, when the bearing 10 is moved upwardly the tapered upper portion of the arbor is caused to snugly fit within the bearing 9 so as to take up play between the arbor and its bearings. The spindle 7 for each unit is mounted in bearings 16 and 17 in which the spindle is rotatable and axially movable, and said bearings are adjustably positioned on the respective cross beams 4—5, there being adjusting screws 18 radially disposed about each bearing, in its supporting cross beam, by means of which to center the bearing to a desired location, and also clamp screws 19 are

provided to hold the bearings definitely in position after being properly centered. The purpose of the centering operation is to adjust the spindle 7 to such position that its axis will intersect precisely at right angles the axis of the stud 12 upon which the corresponding carriage swings, and will extend also precisely in the vertical plane in which the axis of the arbor laterally swings.

Mechanism is provided for actuating the spindle 7 and the carriage 11 for each unit, which includes an outrigger consisting of rearwardly extending brackets 20 mounted on the cross-beam 4 on the frame, and a transversely disposed fulcrum rod 21, the ends of which are secured in the rear ends of said brackets. Upon said fulcrum rod are loosely mounted actuating levers 22, one for each of said spindles, the forward end of each lever being bifurcated and extending astride of the corresponding spindles 7 beneath sheaves 23 secured respectively thereon. In said brackets 20 is journaled a cam shaft 24 having secured thereon cams 25, one for each unit, and spring tongues 26 are secured to the levers that rest upon the corresponding cams 25, so that upon rotation of the cam shaft the levers are caused to swing vertically upon the fulcrum rod thereby imparting axial movement to the spindles through the medium of the sheaves 23 which rest upon the free ends of said levers. The weight of the spindles and their sheaves is born by the levers and their downward gravital movement is limited by an adjusting screw 27 in each lever which bears upon the corresponding tongue 26.

As a means of partially counterbalancing the weight of the spindles there are provided elastic cables or rubber bands 28 that are connected at their ends with hooks 29 on the levers 22 and hooks 30 that project from the cross beam 5. The resistance of the elastic bands is sufficiently weak as to be overcome more or less by the weight of the spindles. In this manner sensitiveness in the stroke of the spindles is regulated. By turning of the screws 27 the termination of the downward strokes of the spindles are adjustably varied.

The mechanism for imparting swinging movement to the carriages 11 includes a gear case 31, supported by the cross beam 3, in which is contained gearing, preferably consisting of worms 32, one for each unit, secured upon a common drive shaft 33 that extends through said case, and worm wheels 34 disposed in said case so as to engage the corresponding worms. Each worm wheel is mounted upon an individual shaft 35 the forward end of which has bearing in the cross beam 3 and has adjustably secured thereon an eccentric 36 by means of a threaded bolt 37 that extends through a radial slot 38 into the corresponding eccentric 36 concentrically into the adjacent end of the shaft 35. When the bolt is tightened the eccentric is thereby clamped against the shaft and thereupon rotates therewith, and the throw of the eccentric is dependent upon its adjusted position relative to the shaft.

The eccentrics when in operative position are disposed in the bifurcated lower ends of the corresponding carriages between the arms 11' thereof, so that upon rotation of the eccentrics more or less swinging movement is imparted to the carriages according to the throw of the eccentrics and the vertical position to which the carriages are adjusted.

Motion transmitting mechanism

There is provided means for imparting continuous rotary movement to the spindles 7 and arbors 8, which preferably consist of standards 39, that surmount the base 1, by which are supported a main drive shaft 40, a countershaft 41 and an idler supporting shaft 42.

The main drive shaft has secured on one end thereof a drive pulley 43 connected with a motor 44 by means of a belt 45. The opposite end of the drive shaft has secured thereon a pulley 46 which is operatively connected with another pulley 47 secured on one end of the countershaft 41 by means of a belt 48.

The main drive shaft 40 and the cam shaft 24 are operatively connected through the medium of pulleys 49 and 50 secured respectively on said shafts and a belt 51, and the cam shaft 24 and the worm shaft 33 are operatively connected through the medium of pulleys 52 and 53, secured respectively upon these shafts, and a belt 54 trained on said pulleys.

On the main drive shaft 40 are secured drive pulleys 55, one for each unit, that are operatively connected with the pulleys 23 on the spindles 7 by means of belts 56 that are trained over corresponding idlers 57 on the supporting shaft 42 to preserve proper guidance therefor, and the countershaft 41 is operatively connected with the arbors 8 through the medium of pulleys 58 and 8'' secured respectively on the countershaft and arbors 8, and corresponding belts 59. Thus, upon operation of the motor 44 the spindles and arbors are rotatively actuated, the spindles are axially reciprocated and the carriages are laterally swung to and fro concurrently.

Operation

In use, a compact 60, after the die body 61 previously pierced, is centrally secured on the face plate 6 in the usual manner, preferably by use of an adhesive such as beeswax, so that the axes of the pierced opening through the die and the arbor are precisely alined. A lapping tool or needle 62, of the usual type, is secured in the lower end of the spindle, axially alined therewith, so that upon proper vertical adjustment of the corresponding carriage support, the needle protrudes through the pierced opening in the die body. When the motor is set in motion the lapping tool is both rotated and axially reciprocated, and concurrently therewith the compact is rotated upon its axis and tilted laterally to and fro upon the axis of the supporting stud 12 upon which the carriage oscillates. In this manner the lapping action of the tool is evenly distributed over the entire surface of the wall surrounding the opening through the die body which is conducive to accuracy in preparing a die opening that is truly circular in cross section and of a definite predetermined dimension.

Variations of the particular construction of the appliance above disclosed may readily be made by exercise of engineering skill without departure from the spirit or scope of the invention, and the following claims are intended to be inclusive of such variations.

What I claim is:

1. In a lapping machine for wire drawing dies, a supporting frame including an outrigger and guides, a rotative and axially movable spindle supported in the frame provided with a lapping tool, a lever fulcrumed in the outrigger and arranged to impart axial movement to the spindle in one direction, a spring tongue on said lever, a rotative cam shaft supported adjacent said lever provided with a cam secured thereon engaged by said tongue, an adjusting screw in the

lever bearing upon said tongue to limit downward movement of said lever, a block adjustably secured to said guides provided with a stud, a carriage supported on said stud, a rotative arbor in said carriage provided with a concentric die mount, the axes of said spindle and arbor being disposed in a common plane that extends at right angles to the axis of said stud, mechanism to impart swinging movement to said carriage upon the axis of said stud, and means in connection with the spindle and arbor to rotate same.

2. In a lapping machine for wire drawing dies, a supporting frame including an outrigger and guides, a rotative and axially movable spindle supported in the frame provided with a lapping tool and means to axially move said spindle, a block adjustably secured to said guides, a carriage pivotally supported on said block for swinging movement and having a bifurcated free end, a rotative arbor supported by the carriage provided with a concentric die mount, the axes of said spindle and arbor being disposed in a common plane, gear mechanism including a rotative shaft in said frame, an eccentric having a radial slot provided with a threaded bolt extending therethrough into said shaft to secure said eccentric adjustably thereon, said eccentric being disposed in the bifurcated end of said carriage, and means in connection with the spindle and arbor to rotate same.

3. A wire drawing die lapping machine consisting of a frame having guides, a supporting block adjustably secured to said guides, a carriage pivotally supported on said block, an axially rotative arbor in the carriage, a mechanism in the frame including a rotative shaft provided with an eccentric adjustably mounted thereon engaging said carriage to actuate it, and axially rotative and reciprocative spindle provided with a lapping tool supported by the frame and axially disposed with its axis in the plane of the axis of said arbor, the arrangement being such that the swing of the carriage is increased or decreased according to adjustment of the carriage relative to said eccentric, and means for actuating said shaft, arbor and spindle.

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