Nov. 1, 1932. R. BSTEH 1,885,178

DIE LAPPING AND GRINDING MACHINE

Filed Oct. 31, 1929 2 Sheets-Sheet 1

Fig. 1

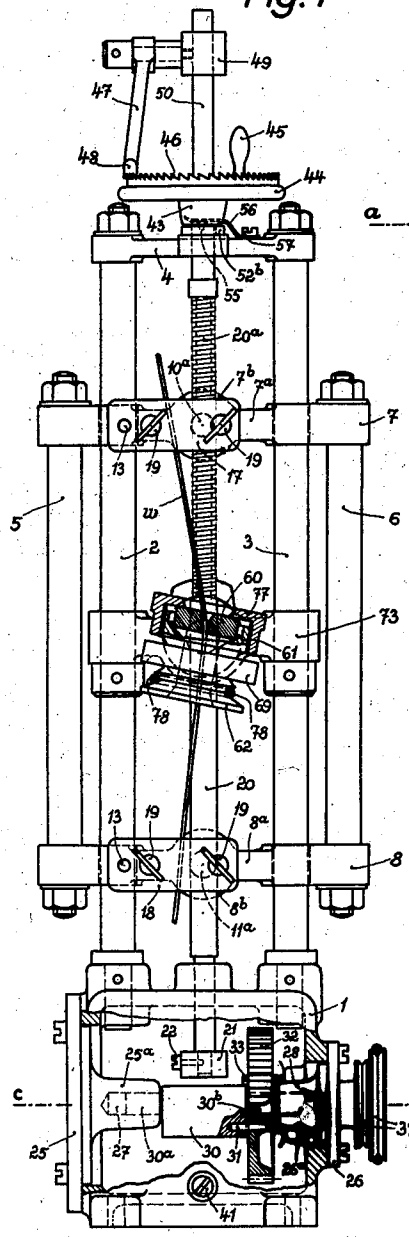
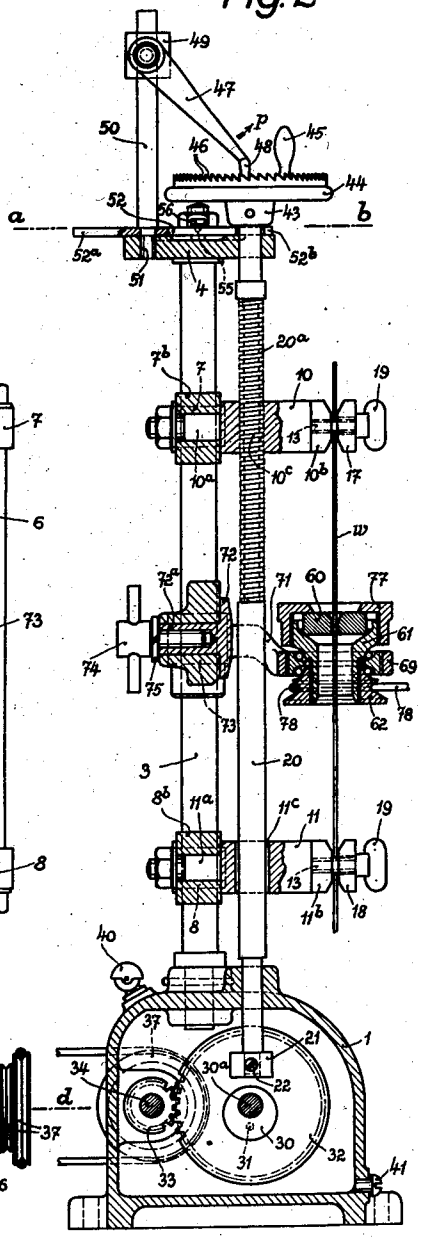


Fig. 2



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Fig. 3

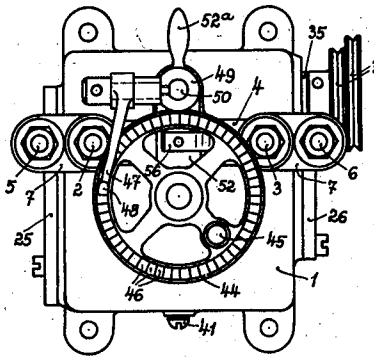


Fig. 4

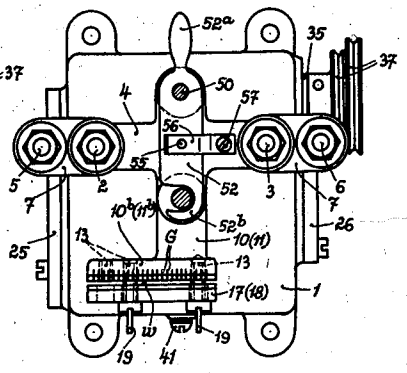
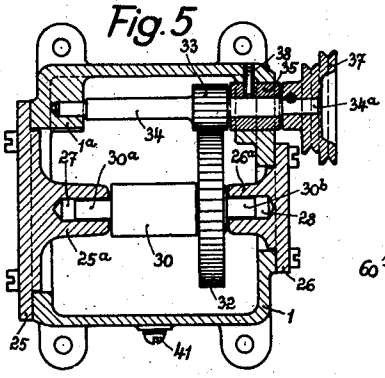


Fig. 5



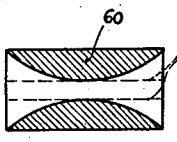


Fig. 8

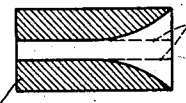


Fig. 9

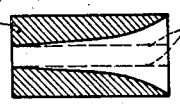


Fig. 10

Fig. 6

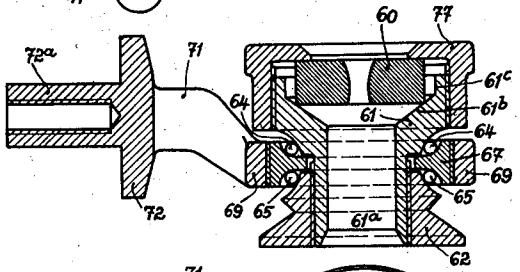
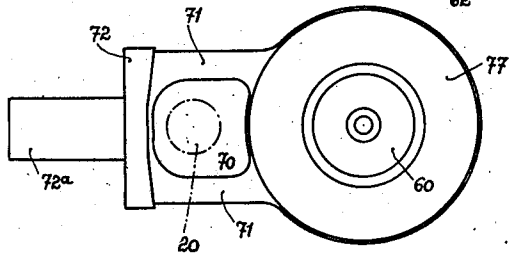


Fig. 7



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UNITED STATES PATENT OFFICE

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DIE LAPPING AND GRINDING MACHINE

Application filed October 31, 1929, Serial No. 403,762, and in Austria October 11, 1929.

This invention relates to improvements in die lapping and grinding machines of the kind in which the lapping or grinding tool consists of a wire, for instance of copper covered with an abrasive powder such as carborundum or diamond powder, a certain length of which is clamped in two clamping jaws carried by a reciprocating frame and is drawn through the opening of the die to be ground, polished or re-polished, said latter being secured to a rotating die-holder.

The essential feature of the present invention consists in the provision of an immovable support above the operating or driving casing, the said support serving as slide for guiding the reciprocating frame carrying the clamped portion of the polishing wire.

One mode of carrying out the present invention is illustrated by way of example on the accompanying sheets of drawings in which—

Figs. 1 and 2 show the machine in front view and side view respectively and partly in section.

Fig. 3 is a plan view of the machine, the clamping jaws and the die holder being not shown for the sake of clearness.

Fig. 4 is a sectional view of the machine, the section being taken on line *a—b* of Fig. 2.

Fig. 5 is a sectional view of the machine, the section being taken on line *c—d* of Fig. 1.

Figs. 6 and 7 illustrate the die holder with the die to be treated in longitudinal section and plan view respectively.

Figs. 8, 9 and 10 show different forms of standard dies which may be suitably polished or ground with the machine according to the present invention.

In Figs. 1 and 2, 1 designates the casing for the driving gear of the machine. Two posts 2 and 3 are arranged on the casing 1 and at the upper end are stayed by a stay plate 4. The said posts also serve as vertical guides of the reciprocating frame carrying the clamped portion of the wire and as carrier or support of the die holder. The reciprocating frame consists of two vertical bars 5 and 6, which at their ends are stayed by two stay plates 7 and 8. The posts 2 and 3 pass through recesses of said stay plates 7 and 8, which are provided with webs 7^a and 8^a, furnished with journal bearings 7^b and 8^b for securing the clamping jaw holders 10 and 11. Each holder 10, 11 is rotatably secured by means of a pin 10^a and 11^a respectively in the corresponding journal bearing 7^b and 8^b and, as shown in Fig. 4, is provided with a clamping plate 10^b and 11^b respectively, furnished with holes 13. By means of wing screws 19, clamping plates 17 and 18 are forced towards the clamping plates 10^b and 11^b respectively for clamping the polishing wire *w*. A graduation G provided at the top side of the clamping plates 10^b and 11^b, serves for adjusting the position of the wire *w* in the clamping jaws 17, 10^b and 18, 11^b, the screw threaded holes 13 being used for the reception of a plurality of wing screws 19. The bottom holder 11 is provided with a bore 11^c for the free passage of an operating shaft 20, while the upper holder 10 is furnished with a square threaded bore 10^c, which is engaged by a square threader top portion 20^a of the shaft 20. Thereby the entire frame 5, 6, 7, 8 is operatively coupled with the shaft 20. The latter passes through the upper part of the casing 1 and at its bottom end is provided with a foot 21, which is secured by a screw 22. On both sides, the casing 1 is closed by lids 25 and 26 respectively, which are provided with inner bosses 25^a and 26^a. The latter are provided with holes 27, 28 for the reception of the bearing pins 30^a, 30^b of an eccentric 30, coupled with a toothed wheel 32 by means of a pin 31. This toothed wheel meshes with a pinion 33, mounted on a shaft 34, which is located in a boss 1^a of the casing (Fig. 5) and in a sleeve 35. The end 34^a of this shaft 34 carries a rope pulley 37. The sleeve 35 is fixed in a corresponding opening of the casing 1 by means of a stud 38. The casing 1 is provided with an oil inlet 40 and an oil outlet 41, which is closed by a screw. The shaft 20 and thus also the reciprocating frame 5, 6, 7, 8, guided by the posts or pillars 2 and 3, are raised during each revolution of the eccentric 30 and again forced down by their own weight. By means of a collar 43, a ratchet wheel 44 provided with a handle 45

is fixed at the upper end of the shaft 20 and is provided with ratchet teeth 46, which are engaged by a pawl 48 integral with a rocking lever 47. The latter is rotatably arranged on a shaft screwed into the head 49, which is secured on a post 50. This post is screwed at 51 into the stay plate 4. An engaging lever 52 is furnished with a handle 52^a (Fig. 4), the hook-shaped end 52^b of which normally engages the upper end of the shaft 20. This position is illustrated in Figs. 1 and 2. The engaging lever 52 is secured in this position by a spring 56, which is provided with a locking member 55 and fixed by a screw 57 to the stay plate 4. During every lift, the shaft 20 is slightly rotated by means of the lever 47 adapted to be turned in the direction of the arrow *p*, (Fig. 2) because the pawl 48 is then engaged in a tooth 46 of the ratchet 44. In view of the square threaded part 20^a of the shaft 20, the entire clamping frame of the polishing-wire *w* is slightly shifted downward with respect to the posts 2, 3. In the position shown in Figs. 1 and 2 in which the lever 52 engages the upper end of the shaft 20 during the lift of the clamping frame, the said relative movement will cause a slight feed of the polishing wire, the extent of which depends on the height of the lift of the shaft 20.

The die to be treated for instance a draw-die or spinning nozzle made of diamond, synthetic stone or steel (Figs. 8, 9 and 10), and provided with a cylindrical bore indicated by the dotted lines *g* is first clamped in its holder, which consists of a sleeve 61 (Fig. 6) with a cylindric bore 61^a, a cone-shaped clamping part 61^b, a cylindric extension 61^c and a counter-head 62 in the shape of a rope-pulley. The two parts 61 and 62 are screwed together on both sides of a ring 67, balls 64 and 65 being interposed to permit a free rotation of the said parts 61, 62, which together with the ring 67 forms ball-races. The ring 67 is screwed into an annular holder 69, carried by a fork 71, 72, 72^a, between the arms 71 of which is provided an opening 70 for the passage of the shaft 20. The pin 72^a of the fork is inserted in a clamping plate 73, adapted to be fixed in any desired vertical position to the pillars 2 and 3, and tightened by a handle 74 which rests on a washer 75. This arrangement permits also an inclined adjustment of the whole die holder in the way shown by way of example in Fig. 1. The die 60 is clamped down onto the cone-shaped part 61^b of the part 61 of the tool head by means of a screw-cap 77, provided with a suitable opening. Thereby the die is automatically set or centered. The die holder is rotated at a high speed by the agency of a rope 78, passing round the pulley 62 and operated by a suitable source of power for instance by an electric motor. When the eccentric 30 rotates, the whole frame, consisting of the members 5, 6, 7 and 8 is reciprocated with the clamped wire *w*, whereby the latter rubs and grinds the central opening of the die 60. As the wire is thus moved up and down through the die at the same time the die holder with the die is rapidly rotated, so that the bore of the latter is shaped as shown in Figs. 8, 9 or 10, the shape or profile depending on the adjustable position of the points of attachment of the wire on the two clamping devices 10, 11, and on the angular position of the die holder with respect to the vertical.

It must be noticed that setting the die holder in different angular positions makes it possible to grind and polish simultaneously the inlet, the bearing and the outlet of a large variety of die profiles.

I claim:

1. Die lapping and grinding machine of the type using a wire as carrier for an abrasive powder, including the combination, with a gear casing, of a gear associated with an eccentric and a toothed wheel rotatably coupled with said eccentric and a pinion meshing with said toothed wheel, a vertical fixed frame consisting of two pillars connected by means of a tensioning plate and fixed on said gear casing, a reciprocating wire clamping frame having spaced posts and clamping plates screwed together slidably mounted on said vertical frame and provided with a vertical shaft journaled on the vertical frame and being movable up and down by said eccentric, jaws disposed on the intermediate portions of said clamping plates for clamping the wire, a rotating die holder mounted on said fixed frame and means for adjusting the height and the angular position of the latter on the pillars.

2. Die lapping and grinding machine of the type using a wire as carrier for an abrasive powder, including the combination, with a gear casing, of a gear associated with an eccentric and a toothed wheel rotatably coupled with said eccentric and a pinion meshing with said toothed wheel, a vertical fixed frame consisting of two pillars connected by means of a tensioning plate and fixed on said gear casing, a reciprocating wire clamping frame having spaced posts and clamping plates screwed together slidably mounted on said vertical frame and provided with a vertical shaft having a smooth bottom portion and a square threaded upper portion and both journaled on the vertical frame and movable up and down thereon by said eccentric, jaws disposed on the intermediate portions of said clamping plates for clamping the wire, a rotating die holder mounted on said fixed frame and means for adjusting the height and the angular position of the latter on the pillars.

3. Die lapping and grinding machine of the type using a wire as carrier for an abrasive powder, including the combination, with

a gear casing, of a gear associated with an eccentric and a toothed wheel rotatably coupled with said eccentric and a pinion meshing with said toothed wheel, a vertical fixed frame consisting of two pillars connected by means of a tensioning plate and fixed on said gear casing, a reciprocating wire clamping frame having spaced posts and clamping plates screwed together slidably mounted on said vertical frame and provided with a vertical shaft having a smooth bottom portion and a square threaded upper portion and both journaled on the vertical frame and movable up and down thereon by said eccentric, a square thread on one of said clamping plates of the reciprocating frame engaging the said square threaded upper portion of said vertical shaft, jaws disposed on the intermediate portions of said clamping plates for clamping the wire, a rotating die holder mounted on said fixed frame and means for adjusting the height and the angular position of the latter on the pillars.

4. Die lapping and grinding machine of the type using a wire as carrier for an abrasive powder, including the combination, with a gear casing, of a gear associated with an eccentric and a toothed wheel rotatably coupled with said eccentric and a pinion meshing with said toothed wheel, a vertical fixed frame consisting of two pillars connected by means of a tensioning plate and fixed on said gear casing, a reciprocating wire clamping frame having spaced posts and clamping plates screwed together slidably mounted on said vertical frame and provided with a vertical shaft having a smooth bottom portion and a square threaded upper portion, and both journaled on the vertical frame and movable up and down by said eccentric, a square thread on one of said clamping plates of the reciprocating frame engaging the said square threaded upper portion of said vertical shaft, a toothed ratchet wheel secured to the upper end of said shaft beyond the threaded portion thereof, jaws disposed on the intermediate portions of said clamping plates for clamping the wire, a rotating die holder mounted on said fixed frame and means for adjusting the height and the angular position of the latter.

5. Die lapping and grinding machine of the type using a wire as carrier for an abrasive powder, including the combination, with a gear casing, of a gear associated with an eccentric and a toothed wheel rotatably coupled with said eccentric and a pinion meshing with said toothed wheel, a vertical fixed frame consisting of two pillars connected by means of a tensioning plate and fixed on said gear casing, a reciprocating wire clamping frame having spaced posts and clamping plates screwed together slidably mounted on said vertical frame and provided with a vertical shaft which is provided with a smooth lower part freely passing through one of the clamping plates of the reciprocating frame, also provided with a square threaded upper portion and both journaled on the vertical frame and movable up and down by said eccentrics, a square thread on the other clamping plate of said reciprocating frame engaging the said square threaded upper portion of said vertical shaft, a ratchet wheel provided with teeth and secured to the upper end of said shaft beyond the threaded portion thereof, jaws disposed on the intermediate portion of said clamping plates for clamping the wire, a rotating die holder mounted on said fixed frame and means for adjusting the height and the angular position of the latter on the pillars.

6. Die lapping and grinding machine of the type using a wire as carrier for an abrasive powder, including the combination, with a gear casing, of a gear associated with an eccentric and a toothed wheel rotatably coupled with said eccentric and a pinion meshing with said toothed wheel, a vertical fixed frame consisting of two pillars connected by means of a tensioning plate which is provided with a post having in turn a supporting member projecting therefrom, said post being fixed on said gear casing, a feed lever integral with a pawl secured to said projecting supporting member, a reciprocating wire clamping frame having spaced posts and clamping plates screwed together slidably mounted on said vertical frame and provided with a vertical shaft which is provided with a smooth lower part freely passing through one of the clamping plates of the reciprocating frame, also provided with a square threaded upper portion and both journaled on the vertical frame and movable up and down by said eccentrics, a square thread on the other clamping plate of said reciprocating frame engaging the said square threaded upper portion of said vertical shaft, a ratchet wheel provided with teeth and secured to the upper end of said shaft beyond the threaded portion thereof, jaws disposed on the intermediate portion of said clamping plates for clamping the wire, a rotating die holder mounted on said fixed frame and means for adjusting the height and the angular position of the latter on the pillars.

7. Die lapping and grinding machine of the type using a wire as carrier for an abrasive powder, including the combination, with a gear casing, of a gear associated with an eccentric and a toothed wheel rotatably coupled with said eccentric and a pinion meshing with said toothed wheel, a vertical fixed frame consisting of two pillars connected by means of a tensioning plate which is provided with a post having in turn a supporting member projecting therefrom, said post being fixed on said gear casing, a feed lever

integral with a pawl secured to said projecting supporting member, a reciprocating wire clamping frame having spaced posts and clamping plates screwed together slidably mounted on said vertical frame and provided with a vertical shaft which is provided with a smooth lower part freely passing through one of the clamping plates of the reciprocating frame, also provided with a square threaded upper portion and both journaled on the vertical frame and movable up and down by said eccentrics, a square thread on the other clamping plate of said reciprocating frame engaging the said square threaded upper portion of said vertical shaft, a ratchet wheel provided with teeth on its upper face and secured to the upper end of said shaft beyond the threaded portion thereof, jaws disposed on the intermediate portion of said clamping plates for clamping the wire, a rotating die holder mounted on said fixed frame and means for adjusting the height and the angular position of the latter on the pillars, said feed lever and pawl engaging said ratchet wheel and rotating said vertical shaft during each of its upward strokes.

8. Die lapping and grinding machine of the type using a wire as carrier for an abrasive powder, including the combination, with a gear casing, of a gear associated with an eccentric and a toothed wheel rotatably coupled with said eccentric and a pinion meshing with said toothed wheel, a vertical fixed frame consisting of two pillars connected by means of a tensioning plate which is provided with a post having in turn a supporting member projecting therefrom, said post being fixed on said gear casing, a feed lever integral with a pawl secured to said projecting supporting member, a reciprocating wire clamping frame having spaced posts and clamping plates screwed together slidably mounted on said vertical frame and provided with a vertical shaft which is provided with a smooth lower part freely passing through one of the clamping plates of the reciprocating frame, also provided with a square threaded upper portion and both journaled on the vertical frame and movable up and down by said eccentrics, a square thread on the other clamping plate of said reciprocating frame engaging the said square threaded upper portion of said vertical shaft, a ratchet wheel provided with teeth on its upper face, and secured to the upper end of said shaft beyond the threaded portion thereof, said feed lever and pawl engaging said ratchet wheel and rotating said shaft during each of its upward strokes, a rotating die holder mounted on said fixed frame, means for adjusting the height and the angular position of the latter on the pillars, and jaws which are disposed on the intermediate portion of said clamping plates for clamping the wire and consisting of a middle part, a pin for attachment to the clamping plate and a plate-shaped head portion, an outer clamping plate and manually adjustable screws for screwing the latter towards said head portions.

9. Die lapping and grinding machine of the type using a wire as carrier for an abrasive powder, including the combination, with a gear casing, of a gear associated with an eccentric and a toothed wheel rotatably coupled with said eccentric and a pinion meshing with said toothed wheel, a vertical fixed frame consisting of two pillars connected by means of a tensioning plate which is provided with a post having in turn a supporting member projecting therefrom, said post being fixed on said gear casing, a feed lever integral with a pawl secured to said projecting supporting member, a reciprocating wire clamping frame having spaced posts and clamping plates screwed together slidably mounted on said vertical frame and provided with a vertical shaft which is provided with a smooth lower part freely passing through one of the clamping plates of the reciprocating frame, also provided with a square threaded upper portion and both journaled on the vertical frame and movable up and down by said eccentrics, a square thread on the other clamping plate of said reciprocating frame engaging the said square threaded upper portion of said vertical shaft, a ratchet wheel provided with teeth and secured to the upper end of said shaft beyond the threaded portion thereof, jaws which are disposed on the intermediate portions of said clamping plates for clamping the wire and consisting of a middle part, a pin for attachment to the clamping plate and a plate-shaped head portion, an outer clamping plate and winged screws for screwing the latter towards said head portions, a rotating die holder, a ring on the latter, a bolt provided with a plate, and arms connecting the ring with said plate for adjusting the die holder on the pillars.

10. Die lapping and grinding machine of the type using a wire as carrier for an abrasive powder, including the combination, with a gear casing, of a gear associated with an eccentric and a toothed wheel rotatably coupled with said eccentric and a pinion meshing with said toothed wheel, a vertical fixed frame consisting of two pillars connected by means of a tensioning plate which is provided with a post having in turn a supporting member projecting therefrom, said post being fixed on said gear casing, a feed lever integral with a pawl secured to said projecting supporting member, a reciprocating wire clamping frame having spaced posts and clamping plates screwed together slidably mounted on said vertical frame and provided with a vertical shaft which is provided

with a smooth lower part freely passing through one of the clamping plates of the reciprocating frame, also provided with a square threaded upper portion and both journaled on the vertical frame and movable up and down by said eccentrics, a square thread on the other clamping plates of said reciprocating frame engaging the said square threaded upper portion of said vertical shaft, a ratchet wheel provided with teeth and secured to the upper end of said shaft beyond the threaded portion thereof, jaws which are disposed on the intermediate portions of said clamping plates for the clamping of the wire and consisting of a middle part, a pin for attachment to the clamping plate and a plate-shaped head portion, an outer clamping plate and winged screws for screwing the latter towards said head portions, a rotating die holder consisting of an upper main part, and an auxiliary part screwed to the latter, a ring, a bolt provided with a plate, and arms connecting the ring with said plate for adjusting the die holder on the pillars.

11. Die lapping and grinding machine of the type using a wire as carrier for an abrasive powder, including the combination, with a gear casing, of a gear associated with an eccentric and a toothed wheel rotatably coupled with said eccentric and a pinion meshing with said toothed wheel, a vertical fixed frame consisting of two pillars connected by means of a tensioning plate which is provided with a post having in turn a supporting member projecting therefrom, said post being fixed on said gear casing, a feed lever integral with a pawl secured to said projecting supporting member, a reciprocating wire clamping frame having spaced posts and clamping plates screwed together slidably mounted on said vertical frame and provided with a vertical shaft which is provided with a smooth lower part freely passing through one of the clamping plates of the reciprocating frame, also provided with a square threaded upper portion and both journaled on the vertical frame and movable up and down by said eccentrics, a square thread on the other clamping plate of said reciprocating frame engaging the said square threaded upper portion of said vertical shaft, a ratchet wheel provided with teeth and secured to the upper end of said shaft beyond the threaded portion thereof, jaws which are disposed on the intermediate portions of said clamping plates for the clamping of the wire, and consisting of a middle part, a pin for attachment to the clamping plate and a plate-shaped head portion, an outer clamping plate and winged screws for screwing the latter towards said head portions, a rotating die holder including an upper main member, an intermediate portion with a conically shaped interior, and an upper cylinder having an outer screw thread disposed close to said intermediate portion, and an auxiliary part screwed to said main member, a ring, a bolt provided with a plate, and a screw securing the bolt to aforesaid pillars for adjusting the height and the angular position of the rotating die holder on said pillars.

12. Die lapping and grinding machine of the type using a wire as carrier for an abrasive powder, including the combination, with a gear casing, of a gear associated with an eccentric and a toothed wheel rotatably coupled with said eccentric and a pinion meshing with said toothed wheel, a vertical fixed frame consisting of two pillars connected by means of a tensioning plate which is provided with a post having in turn a supporting member projecting therefrom, said post being fixed on said gear-casing, a feed lever integral with a pawl secured to said projecting supporting member, a reciprocating wire clamping frame having spaced posts and clamping plates screwed together slidably mounted on said vertical frame and provided with a vertical shaft which is provided with a smooth lower part freely passing through one of the clamping plates of the reciprocating frame, also provided with a square threaded upper portion and both journaled on the vertical frame and movable up and down by said eccentrics, a square thread on the other clamping plate of said reciprocating frame engaging the said square threaded upper portion of said vertical shaft, a ratchet wheel provided with teeth and secured to the upper end of said shaft beyond the threaded portion thereof, jaws which are disposed on the intermediate portions of said clamping plates for the clamping of the wire, and consisting of a middle part, a pin for attachment to the clamping plate and a plate-shaped head portion, an outer clamping plate and winged screws for screwing the latter towards said head portions, a rotating die holder including an upper main member consisting of a bottom cylinder having an outer screw thread, an intermediate portion with a conically shaped interior, and an upper cylinder having an outer screw thread disposed close to said intermediate portion, a cap for self-centering of the die screwed to said upper cylinder and an auxiliary part screwed to said upper main member, a ring, an auxiliary ring screwed into the latter, balls for locating the main part and the auxiliary part on said auxiliary ring, a bolt provided with a plate, arms connecting the ring with said bolt, the shaft passing between said arms, and a screw securing the bolt to aforesaid pillars.

In testimony whereof I affix my signature.

RUDOLF BSTEH.