March 31, 1942. C. B. GRAY 2,278,174

SHEET METAL NIBBLING TOOL

Filed May 1, 1940

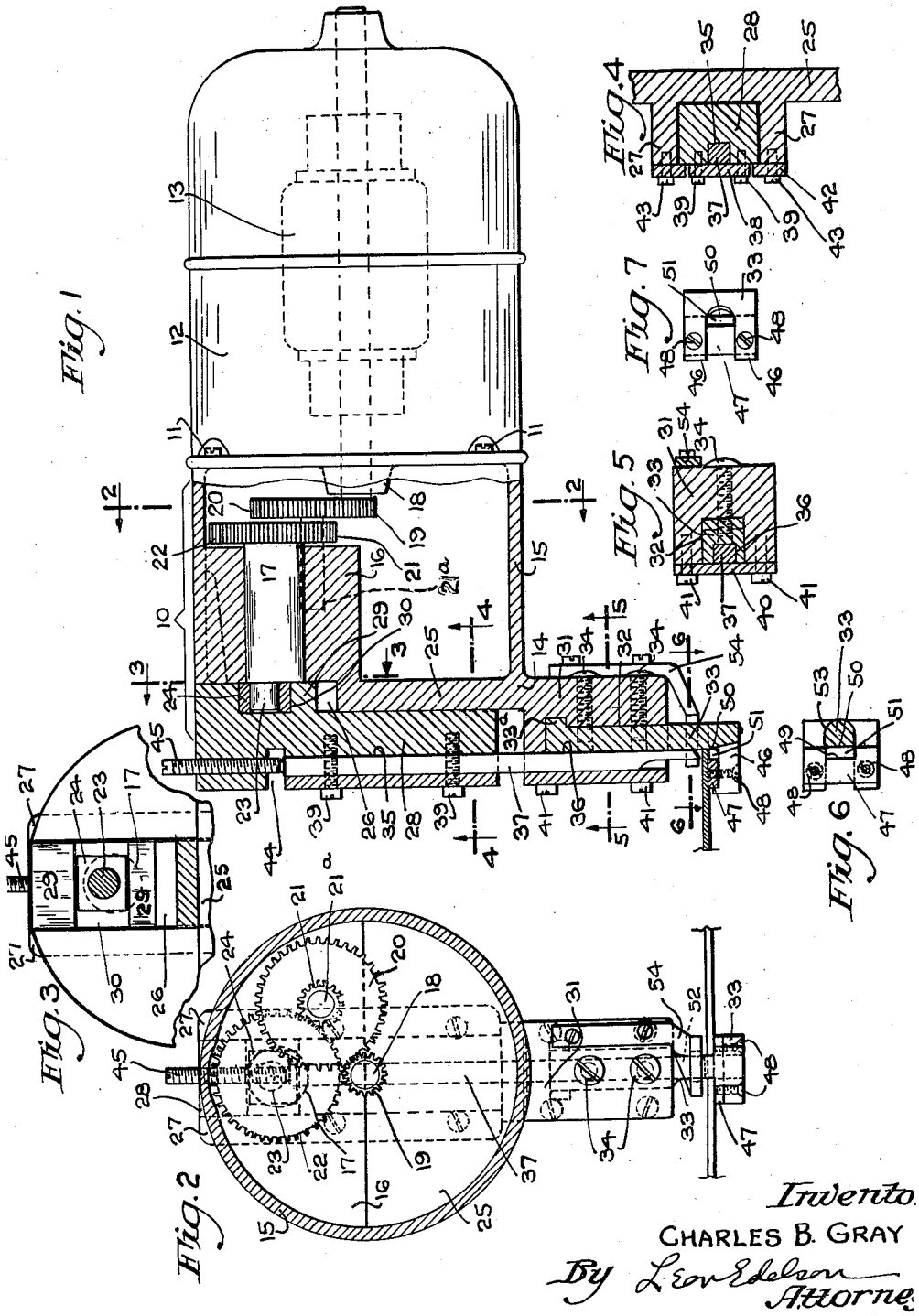


Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

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Patented Mar. 31, 1942 2,278,174

UNITED STATES PATENT OFFICE

2,278,174

SHEET METAL NIBBLING TOOL

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Application May 1, 1940, Serial No. 332,658

11 Claims. (Cl. 30—228)

This invention relates to a metal cutting tool and more particularly to an improved construction of portable, hand-held sheet metal cutting tool of the nibbler type.

It is among the principal objects of the present invention to provide a small, portable and compact nibbling tool adapted to be hand-held for convenience of operation and to facilitate moving of the tool relatively to and about the work to be cut, the tool being provided with a relatively fixed die with which coacts a reciprocating punch or cutting tool whereby as the tool is fed to and through the work to be cut the punch and die coact to rapidly cut out of the sheet metal and along a given line a successive series of chips or slugs to form a slot in the work.

A further and important object of the invention is to provide a portable nibbling tool of the character above described with a relatively fixed die which is so associated with respect to the reciprocating punch and which is of such design as to enable the tool to be readily turned in either direction about the reciprocating axis of the punch to facilitate the cutting of curved slots and other irregular designs in the sheet metal.

Still another object of the invention is to provide a portable hand-held nibbling tool of the character described wherein the relatively fixed support for the die serves in itself as a pilot or feed-limiting member for limiting the feed of the stock as the nibbling tool cuts a slot therein, the said pilot portion of the support for the die being designed not only to facilitate cutting of slots along curved or irregular outlines but also to withstand the downward cutting thrust of the punch as it penetrates the stock and passes into the cooperating die.

Further objects of the invention are to provide a nibbling tool of the character above described which is exceedingly simple and sturdy in construction and economical to manufacture and assemble, which has a minimum number of operating parts, and in which the punch and die are each readily accessible for replacement and repair as desired.

Other objects and advantages of the invention will appear more fully hereinafter, it being understood that the invention consists substantially in the combination, construction, location and relative arrangement of parts, all as will be described more fully hereinafter, as shown in the accompanying drawing and as finally pointed out in the appended claims.

In the said accompanying drawing, which illustrates a preferred construction of the apparatus of the present invention:

Figure 1 is a side view showing partly in elevation and partly in vertical cross-section of a tool constructed in accordance with and embodying the principles of the present invention;

Figure 2 is a transverse view taken on the line 2—2 of Figure 1;

Figure 3 is a transverse view taken along the line 3—3 of Figure 1;

Figure 4 is a horizontal sectional view taken along the line 4—4 of Figure 1;

Figure 5 is a horizontal sectional view taken along the line 5—5 of Figure 1;

Figure 6 is a horizontal sectional view taken along the line 6—6 of Figure 1; and

Figure 7 is a bottom plan view of the relatively fixed support for the die.

Referring now to the drawing and more particularly to Figure 1 thereof, it will be observed that the nibbling tool of the present invention is of a form and construction adapted to be conveniently held in the hand of the operator thereof, the operating head of the tool designated generally by the reference numeral 10 being secured in any suitable manner, as by a plurality of circumferentially spaced screws 11, to the annular rim of the casing 12 in which is housed a conventional electric motor 13 for operating the tool. The operating head 10 of the tool includes a main body 14 having a rearwardly extending annular section 15 which is adapted to be secured by the screws 11—11 aforesaid or in any other suitable manner in axial alignment with the motor casing 12. The annular or cylindrical section 15 when so secured to the generally cylindrical motor housing 12 thus provides an elongated cylindrical body which may be conveniently grasped in the hand during operation of the tool. It will be understood, of course, that if desired the said elongated cylindrical body formed by the interconnected cylindrical parts 12 and 15 may be provided with a suitable handle (not shown), which handle may be of the form generally provided on other portable, hand-held electrically driven tools, such as drills and the like. It is preferable, however, to so design the said cylindrical parts 12 and 15 of the present tool as to permit the unitary cylindrical casing or body to be conveniently grasped by the hand and so dispense with the need for any auxiliary handle.

As most clearly appears in Figure 1, the cylindrical section 15 of the tool is provided interiorly thereof with a longitudinally bored bearing boss 16 within which is journalled the driven shaft 17

of the tool. Rotation is imparted to this shaft 17 by a series of entrained gears interconnecting said driven shaft 17 with the shaft 18 of the motor. As clearly appears in Figures 1 and 2, the inner end of the motor drive shaft 18 has fixed thereto a pinion gear 19, this gear 19 being in turn entrained with a larger intermediate gear 20. The gear 20 in turn is provided upon its forward face with a coaxial small pinion gear 21 which latter is in turn entrained with the final driven gear 22. This latter driven gear 22 is fixedly secured in any suitable manner to the rearwardly projecting end of the shaft 17 which is journalled, as described above, in a bearing boss 16 formed as an integral part of the cylindrical section 15. This bearing bore 16 preferably is in the form of a solid semi-circular web extending across the upper half of the said cylindrical section 15 and serves not only as a bearing for the shaft 17 but also as a bearing for a stub shaft 21*a* (see Figure 2) upon which are journalled, as a unit, the coaxial gears 20 and 21. The shaft 17 is provided at its outer extremity with a forwardly extending eccentric 23 which is fitted in a block or shoe 24.

Formed as an integral part of the cylindrical section 15 at the forward extremity thereof is a front wall 25, the upper portion of which is recessed, as at 26, to provide a vertically elongated groove or guideway for a purpose which will presently appear. Along either side of this recess or guideway 26 are a pair of laterally spaced parallel flanges 27—27 which project forwardly of the front face of the member 25. These flanges 27—27 are preferably formed integrally with the member 25 and extend from points adjacent the top of the tool casing as viewed in Figure 1 to points adjacent the bottom of the tool casing. In other words, these flanges 27—27 extend along chordal lines spaced equi-distantly to either side of the vertical diametric line of the front member 25 of the tool casing, thus providing a pair of laterally spaced parallel guides for a reciprocating member 28.

This reciprocating member 28 is provided in its upper part with a rearwardly extending portion 29 which projects into the vertical groove or recess 26 formed in the member 25. The rear face of the said rearwardly projecting portion 29 of the reciprocating member 28 is transversely grooved, as at 30, to receive the block or shoe 24 which is fitted upon the eccentric 23. It will thus be apparent that as the shaft 17 rotates, the eccentric 23 shifts the block or shoe 24 laterally within the groove 30 simultaneously as said block or shoe acts on the member 28 to effect vertical reciprocation of the latter.

Formed as an integral part of the cylindrical section 15 of the tool operating head and depending from the bottom of the forward closure member 25 thereof is a part 31. This part 31 is provided with a vertical channel or groove 32 extending upwardly from the bottom thereof to a point short of the top thereof, the said vertical groove being rearwardly offset, as at 33*a*. Adapted to be fitted in this vertical groove of the member 31 is a support 33 for the lower die of the tool, it being observed that the said support 33 is secured in position within its accommodating groove 32 by means of the screws 34 which pass through the body 31 from the rear face thereof into threaded engagement with the said die support 33. The arrangement is such that as these screws 34—34 are tightened, the member 33 is drawn securely into its grooved seat 32 and therein rigidly and immovably supported.

As appears most clearly in Figures 1, 4 and 5, the front faces of the reciprocating member 28 and the die support 33 are respectively provided with vertical grooves 35 and 36 arranged in vertical alignment one above the other. Disposed commonly in these grooves 35 and 36 is the squared shank of a punch 37 which is secured to the reciprocating member 28 in such manner that as the latter reciprocates it effects corresponding reciprocation of the punch 37.

As most clearly appears in Figures 1 and 4, the upper portion of the punch 37 which is accommodated within the groove 35 is firmly and immovably clamped in said groove by means of a clamping plate 38 which is secured to the reciprocating member 28 by the bolts or screws 39. The lower portion of the punch 37 which is received within the groove 36 of the die support 33 is secured against displacement from said groove 36 by means of a front cover plate 40 which is secured to the body 31 by the bolts 41—41. It will be noted in this connection that the said cover plate 40 does not clampingly engage the lower portion of the punch 37 but instead cooperates with the groove 36 in the die support 33 to provide a vertical guide within which said punch is free to reciprocate in unison with the reciprocating member 28.

In order to prevent displacement of the reciprocating member or ram 28 from its proper position between lateral guide flanges 27—27, a pair of vertically extending retaining plates 42—42 are respectively secured to the forward edges of the said guide flanges 27—27 by means of bolts 43 (see Figure 4). These retaining plates 42 overlap the vertical marginal edges of the reciprocating ram 28 sufficiently to prevent forward displacement of the ram and at the same time permit free vertical reciprocatory movement of said ram 28.

As appears in Figure 1, the upper part of the ram is horizontally notched, as at 44, immediately above the upper end of the punch 37 and threadedly receives an adjusting screw 45 arranged in vertical alignment with said punch. The lower end of this adjusting screw 45 normally engages the upper end of the punch 37 and serves as an upper abutment thereof to prevent upward displacement of the punch at each impact of the punch against the metal being cut during the downward working stroke of the punch. The said adjusting screw 45 serves also as a means for adjusting the punch vertically along its reciprocating axis, it being apparent that by adjusting the screw 45 in one direction or another a punch of given length may be positionally adjusted to present its cutting edge in more or less closely spaced relation to the cooperating die for the punch.

Referring now again to the lower die support 33, it will be observed that this support is formed at its lower end with a pair of laterally spaced forwardly projecting arms 46—46. Bridging the upper surfaces of these arms is a die plate 47 which is secured in position by means of screws 48—48 projected upwardly through each of the arms 46 into threaded engagement with the said die plate 47. As appears most clearly in Figures 1 and 6, the said die plate 47 is centrally notched at its rear edge, as at 49, in such manner that the three walls of said notch 49 cooperate with the forward wall 50 of the die support 33 to provide a rectangular die opening 51 into which the

lower extremity of the punch is adapted to project as it penetrates the sheet material overlying the die. In this connection, it will be noted that the lower extremity of the said punch **37** is ground to a rectangular shape corresponding to the shape of the said die opening **51**. Operatively associated with the punch to strip the sheet material therefrom when the punch is raised, is a stripper **54**, the purpose and operation of which are well understood in the art.

It is important further to observe that the portion of the die support **33** which projects freely below the body **31** is reduced in width, (see particularly Figures 2 and 6) so that its lateral thickness in the zone of the working feeding plane is substantially equal to the width of the die opening **51**. In other words, the portion **52** of the die support **33** extending between the lower end of the body **31** and the upper surface of the die plate **47** is of a width substantially equal to the width of the cutting part of the punch **37**. Also, it will be observed that the rear surface of said portion **52** of the die support is rounded, as at **53**. By so shaping the said portion **52** of the die support in the vicinity of the feeding plane of the sheet material to be cut, it becomes possible to cut a slot in the sheet material of a width equal to that of the punch and at the same time permit the tool as a whole to be more or less freely rotated in said slot to change the direction of the latter as circumstances may require. Thus, the tool is adapted to slit the sheet material along curved as well as straight lines. It will further be observed that the overall dimensions of the die and its immediately associated supporting structure are sufficiently small to permit the same to be projected through a relatively small opening preliminarily provided in the sheet metal to be cut when it is desired to cut a design or outline in the sheet metal without passing through an edge thereof. Still further, it will be observed that in the tool of the present construction reduced portion **52** of the die support **33** in its surface serves as a feed-limiting member or pilot to limit the feed of the work as the latter is shifted relatively to the tool during the cutting operation. In addition, the said reduced portion **52** of the support **33** backs up and so reinforces the lower cutting portion of the punch which is of reduced cross-section and thus permits the use of a punch having a relatively thin cutting edge providing for an exceedingly small overlap on the material being cut. Thus, the bite of the punch on each downward stroke thereof is sufficiently small to prevent jamming of the punch in the work, to provide neat, smooth cuts and to enable the tool to be operated at high speed.

It will be understood, of course, that the invention is susceptible of various changes and modifications which may be made from time to time without departing from the general principles or real spirit thereof and it is, accordingly, intended to claim the same broadly, as well as specifically, as indicated by the appended claims.

What is claimed as new and useful is:

1. A portable self-contained motor-driven sheet metal cutting tool comprising a main casing in which is housed the motor drive for the tool, said casing having an elongated guideway formed in its outer face, a vertically reciprocable ram fitted in said guideway and having a longitudinally extending groove therein for reception of a punch, means intervening said motor drive and said ram for imparting reciprocation to said ram by said motor drive, a die support detachably disposed in spaced relation to said guideway, said die support being grooved in longitudinal alignment with the ram groove and having a die opening therein, and a punch fitted in said ram groove and arranged in axial alignment with said die opening for cooperation with the latter to cut sheet material fed between said reciprocating punch and its cooperating die, the groove in said die support terminating short of said die opening and the die support in the immediate zone of the feeding plane of said material being of a thickness substantially equal to the effective width of the punch and die opening.

2. In a motor-operated portable hand-held nibbling tool, a main casing housing the motor drive for the tool, said casing being provided at one end thereof with an elongated guideway, a ram disposed in said guideway, means interconnecting said ram and motor drive for effecting reciprocation of said ram in said guideway, a punch carried by and movable with said ram, a portion of said punch being extended freely from one extremity of said ram, a punch guide member rigid with said casing and arranged in spaced relation to said reciprocating ram and adapted to receive and guide the freely extending portion of said punch, a punch die operatively associated with said member for coaction with said punch, and work stripping means arranged in spaced relation with said die and operatively associated with said punch to strip the same from the work upon each return stroke thereof.

3. In a motor-operated hand-held nibbling tool for slitting sheet material, a main casing housing the motor drive for the tool, a punch disposed at the forward end of said casing for reciprocation along a line extending transversely of the casing means for effecting reciprocation of said punch, a fixed member for supporting a guide for the free extremity of the punch, a die operatively associated with the punch, and means for supporting said die in fixed relation to said punch guide, said die supporting means including an upper punch guiding part nested in said fixed member and a lower part with which the back face of the punch is in flatwise engagement and which, in the immediate zone of the feeding plane of the sheet material to be cut, is of a width not exceeding the effective width of the punch.

4. In a motor-operated hand-held nibbling tool for slitting sheet material, a main casing housing the motor drive for the tool, a punch disposed at the forward end of said casing for reciprocation along a line extending transversely of the casing means for effecting reciprocation of said punch, a fixed guide for the punch, a die operatively associated with the punch, and means for supporting said die in fixed relation to said punch guide, said die supporting means including a solid part immediately above the plane of said die which serves as a reinforcing backing for the reciprocating punch and as a feed-limiting member, and work stripping means arranged in spaced relation with said die and operatively associated with said punch to strip the same from the work upon each return stroke thereof.

5. In a motor-operated hand-held nibbling tool for slitting sheet material, a main casing housing the motor drive for the tool, a guideway disposed at the forward end and extending transversely of said casing, a ram slidably disposed in said guideway, means for effecting reciprocation of said ram in said guideway, a member fixedly associated with said casing at one extremity of said guide-

way, a die support carried by said member, said ram and said die support being provided with longitudinally alined grooves for commonly receiving a punch, means fixedly securing the upper part of said punch in the ram groove, the lower part of the punch being freely slidable in the die support groove, means for retaining the ram against displacement from its said guideway, and means for retaining the reciprocating punch against displacement from its guiding groove in said die support.

6. In a motor-operated hand-held nibbling tool for slitting sheet material, a main casing housing the motor drive for the tool, a punch disposed at the forward end of said casing for reciprocation along a line extending transversely of the casing, means for effecting reciprocation of said punch, a relatively fixed channel-shaped guide for the free extremity of said punch, said guide including as the base part thereof a detachable solid support for a die, and a die carried by said support for cooperation with said punch, said detachable die support being substantially L-shaped in longitudinal section and so disposed that the longitudinal portion thereof serves as a backing for the punch and as a feed-limiting member, while the transverse portion thereof supports the die in position extending transversely across the reciprocating axis of said punch.

7. In a motor-operated hand-held nibbling tool for slitting sheet material, a main casing housing the motor drive for the tool, a punch disposed at the forward end of said casing for reciprocation along a line extending transversely of the casing, means for effecting reciprocation of said punch, a relatively fixed channel-shaped guide for the free extremity of said punch, said guide including as the base part thereof a detachable solid support for a die, and a die carried by said support for cooperation with said punch, said detachable die support serving commonly as a backing for the lower free extremity of the reciprocating punch, as a feed-limiting member and as the rear boundary of the die opening, and work stripping means arranged in spaced relation with said die and operatively associated with said punch to strip the same from the work upon each return stroke thereof.

8. A tool of the character defined in claim 7 including means for adjusting said punch axially with respect to said die.

9. A tool of the character defined in claim 7 including a reciprocating ram in which said punch is fixedly secured, and an adjusting screw mounted in said ram in axial alinement with said punch and engaging the upper end thereof, said screw serving as an upper fixed abutment for said punch.

10. In a motor-operated portable hand-held nibbling tool, a main casing housing the motor drive for the tool, a reciprocating ram disposed at the forward end of said casing and adapted to be reciprocated by said motor drive, a punch fixedly associated with said ram and reciprocable therewith, a channeled member fixedly associated with said casing and disposed in longitudinally spaced relation with respect to said ram, a die support nested within and operatively associated with said channeled member to provide a solid backing and guide for the free extremity of the reciprocating punch, said die support having a portion extending freely beyond said fixed member of a width not exceeding that of the punch, and a die carried by said support for coaction with said punch.

11. In a motor-operated hand-held nibbling tool for slitting sheet material, a main casing housing the motor drive for the tool, a punch disposed at the forward end of said casing for reciprocation along a line extending transversely of the casing, means for effecting reciprocation of said punch, a fixed member for supporting a guide for the free extremity of the punch, a die operatively associated with the punch, and means serving commonly to guide the free extremity of the punch and to support said die in fixed relation to said punch-guide supporting member, said die supporting means including a punch guiding part nested in said fixed member and a punch backing part freely extending between said die and said punch guiding part, said punch backing part having an overall width not greater than the effective width of the punch and said die supporting means providing throughout its entire extent a solid backing for the reciprocating punch.

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