

J. F. MADGETT.
TOOL OPERATING MACHINERY.
APPLICATION FILED NOV. 28, 1914.

1,176,584.

Patented Mar. 21, 1916.
2 SHEETS—SHEET 1.

Fig. 1.

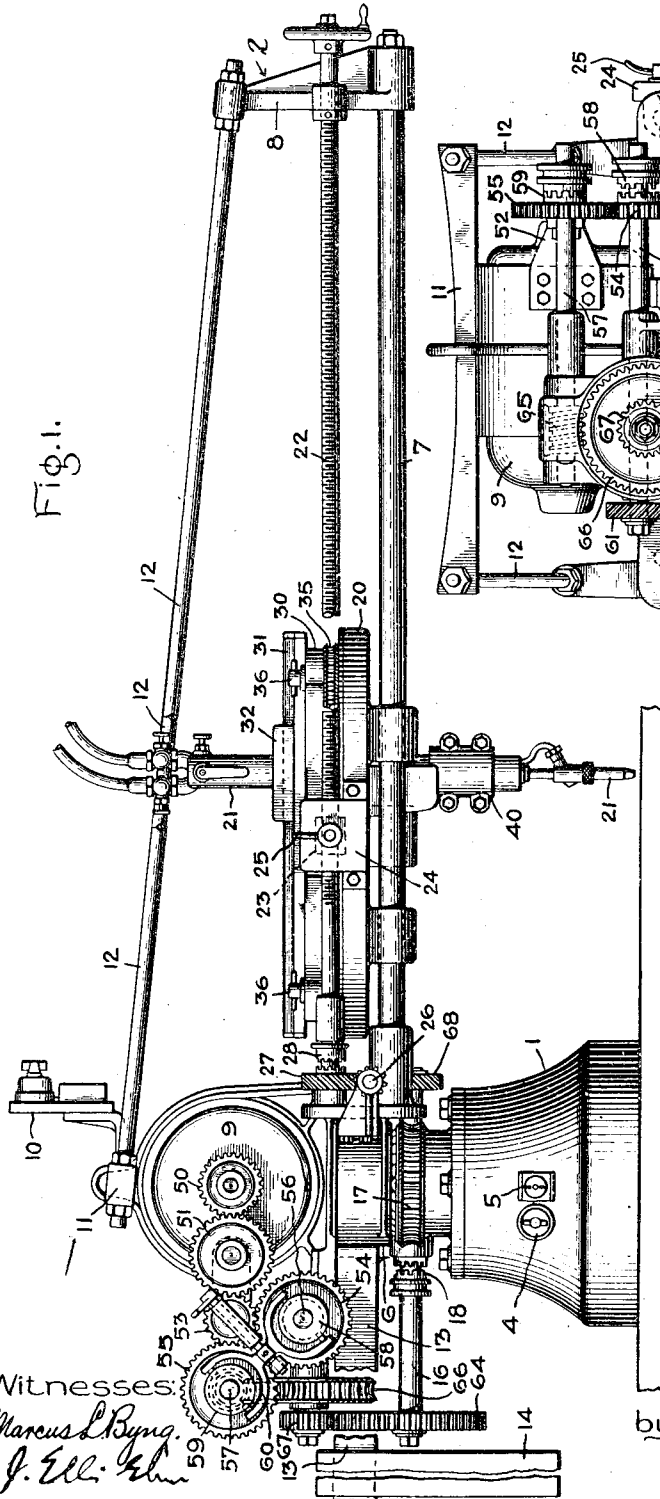


Fig. 3.

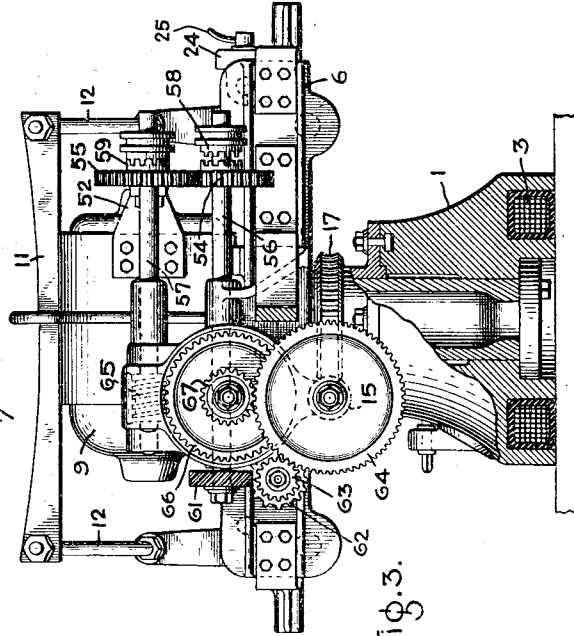
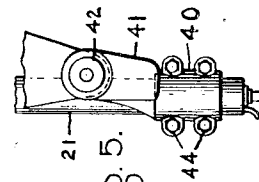


Fig. 5.



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2 SHEETS—SHEET 2.

Fig. 2.

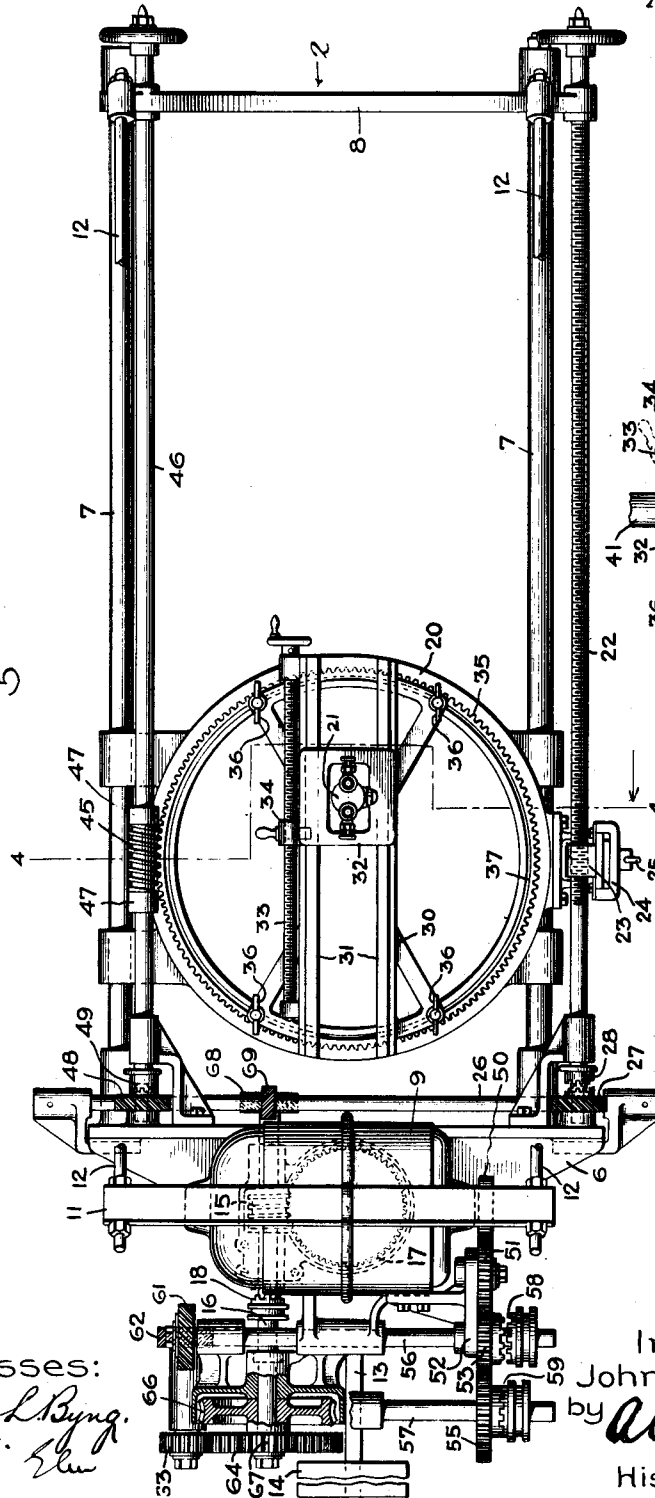
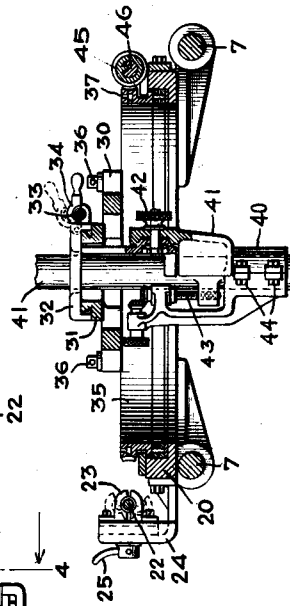


Fig. 4.



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UNITED STATES PATENT OFFICE.

JOHN F. MADGETT, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

TOOL-OPERATING MACHINERY.

1,176,584.

Specification of Letters Patent.

Patented Mar. 21, 1916.

Application filed November 28, 1914. Serial No. 874,529.

To all whom it may concern:

Be it known that I, JOHN F. MADGETT, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Tool-Operating Machinery, of which the following is a specification.

My invention relates to tool operating machinery and the like, and it is more particularly concerned with the relative placing and moving of the tool and the work in such wise as to secure the desired action of the former on the latter. It is my aim to enable these operations to be carried out easily and accurately, and as rapidly as is consistent with the action of the tool, and also to provide for relative movement or shifting of the tool and the work at any rate of speed along practically any path, so that almost any work of which the tool is capable may be executed.

The character and principles of the invention will be understood from the description hereinafter of its embodiment in an apparatus for cutting metal with an oxy-gas torch,—this being a purpose to which the above and other advantages especially adapt it, notwithstanding that it can be otherwise carried out and applied,—while its scope will be indicated in my claims.

In the accompanying drawings, Figure 1 is a side view of an apparatus constructed in accordance with my invention, certain parts being broken away. Fig. 2 is a plan view, certain parts being broken away and others in section. Fig. 3 is a view from the left of Fig. 1, certain parts being broken away. Fig. 4 is a fragmentary detail view, many of the parts shown being in section at a surface corresponding to the irregular line 4—4 in Fig. 2, and Fig. 5 is a fragmentary detail view of certain of the parts shown in Fig. 4.

Referring first to Figs. 1, 2 and 3, it will be seen that the apparatus comprises a supporting member or pedestal 1 and an arm structure 2 mounted on it so that it may swing. The pedestal 1 has in it an electromagnet 3 powerful enough to hold it securely on the work or on a table or support of magnetic material which may advantageously be a carriage movable on suitable ways like the tool carriage of a lathe, this magnet 3 being controlled by a convenient switch 4 and having its current leads connected to a

plug receptacle 5 when it is in use. The arm 2, it will be seen, comprises a main yoke structure 6 having a hollow pivot stud that extends down into the base 1 and a pair of parallel cylindrical members 7 projecting from said main yoke and secured at their free ends to an "outboard" yoke piece 8 (to use a term of nautical origin). On the main yoke 6 is mounted a variable speed motor 9 of any preferred type, controlled by a switch, etc., mounted on the small switch-board 10, and on top of the motor casing is secured a bar 11 from which rods 12 extend to upstanding arms on the outboard yoke 8, these rods serving to reduce the bending stress on the members 7. On a rearwardly extending portion 13 of the main yoke 6 is secured a counterweight 14 that serves to balance the weight of the members 7, yoke piece 8, and other parts carried by or associated with said members 7. The arm 2 can conveniently be swung by means of a worm 15 (Figs. 2 and 3) mounted beneath the main yoke 6 on a shaft 16 and meshing with a worm gear 17 secured to the pedestal 1. The shaft 16 can be driven from the motor 9 through gearing hereinafter described, and the worm can be operated by said shaft through a clutch 18.

A carriage 20 for the oxy-gas torch or tool 21 is arranged to move along the arm 2, being guided by the members 7, which extend through lugs or ears on the carriage. The torch 21 may be an oxyhydrogen or oxy-acetylene blast torch of any preferred construction, or may be of any other approved type. The carriage 20 can be moved either directly by hand or by means of a lead-screw 22 extending along the arm and coöperating with a traverse nut 23 whose separable halves are arranged in a groove in a bracket 24 on the carriage and are actuated by turning a common handle 25. The lead-screw 22 can be rotated either directly by hand, by means of a hand wheel at its outboard end, or from a cross-shaft 26 connected to said screw through worm gearing 27 and a clutch 28.

On the carriage 20 is a tool-supporting structure 30 arranged to rotate horizontally with reference to said carriage and provided with horizontal guide means 31 for a carrier 32 on which the tool 21 is mounted, the guide means shown consisting of a pair of undercut ways. The tool 21 with its car-

rier 32 can be moved along the guide means 31 in either direction radially with reference to the axis of rotation of the supporting structure 30, either directly by hand or by means of a manually operable lead screw 33 that coacts with a nut element 34 pivoted to said carrier so that it can readily be thrown into or out of mesh with said lead screw.

From Figs. 1, 2 and 4 it will be seen that the main portion of the carriage 20 is in the form of an internally flanged ring, and that in this ring is seated and secured a rotatable annular member 35 whose upper portion is in effect a worm wheel by means of which the member can be horizontally rotated with reference to the carriage in a way herein-after described. The ends of the supporting structure 30 rest on the annular member 35; and said structure can either be secured fast to said member so that it can only rotate with it by merely tightening the wing nuts 36 of bolts whose angular heads lie in an undercut groove 37 in the upper side of said member, or it can be released, so that it can be independently rotated directly by hand, by merely loosening said nuts. The torch 21 is arranged in a split sleeve portion 40 of a holder 41 pivotally attached to a depending lug on the carrier 32 and so is angularly adjustable in a vertical plane extending through the axis of rotation of the supporting structure 30, a knurled nut 42 serving to lock the part 41 in adjusted position. A screw 43 mounted in a lug on the sleeve part 40 and engaged in a lug on the torch 21 (Fig. 4) facilitates up and down movement or adjustment of the torch 21 in the sleeve 40, and one or more bolts 44 serve to clamp it securely in place when it is to be maintained at a fixed height for any length of time.

Rotation of the tool-supporting structure 32 with the annular member 35 is effected by means of a worm 45 mounted on a shaft 46 between ears or lugs 47 on the carriage 20. This worm 45 has a splined engagement with the shaft 46 and so is constrained to rotate with the shaft but free to slide along it with the movement of the carriage 20. The shaft 46 can be rotated either directly by means of a hand-wheel at its outboard end or from the same cross-shaft 26 that serves to operate the lead screw 22,—through a connection consisting of worm gearing 48 and a clutch 49.

Coming, now, to the operation of the worm shaft 16 (Fig. 1) and the cross-shaft 26, it will be seen from Figs. 1, 2 and 3 that on the shaft of the motor 9 is a gear 50 which acts through an idler 51 mounted on a stud on a bracket 52 secured to the motor casing to drive a smaller gear 53 also mounted on a stud on said bracket. This latter gear 53 drives gears 54 and 55 mounted loosely on shafts 56 and 57 suitably supported from the main yoke 6. The gears 54

and 55 can be connected to their shafts 56 and 57 alternatively—but not simultaneously—by means of clutches 58 and 59 whose movable members are interlocked and operated by an oscillating double yoke piece 60 (Fig. 1), whose fulcrum is carried by the stud forming the axis of the gear 53. The shaft 56 carries a helical gear 61 which meshes with a similar gear 62 on a short shaft suitably supported from the main yoke 6, and this latter shaft carries a small pinion 63 which meshes with a gear 64 on the worm shaft 16. The shaft 57, on the other hand, carries a worm 65 which meshes with a worm wheel 66 mounted on a stud suitably supported from the main yoke 6, and this worm wheel 66 has attached to it a small pinion 67 in mesh with the aforementioned gear 64 on the worm shaft 16. The worm shaft 16 not only carries the worm 15 with its clutch 18, but also carries a helical gear 68 which meshes with a smaller helical gear 69 on the cross shaft 26.

It will readily be seen that the two trains of gearing controlled by the clutches 58 and 59 have different reduction ratios, and that by properly setting the various clutches 58 and 59, 18, 28 and 49 the arm-swinging worm 15, the carriage-moving lead screw 22, and the tool support rotating shaft 46 (or any of them) can each be driven at two different speeds for each speed of the motor 9. It is to be observed, however, that ordinarily the slow speeds given by the shaft 57 will be most suitable for driving the worm 15 and the high speeds given by the shaft 56 most suitable for operating the lead screw 22 and the shaft 46, and that it will seldom be desired to drive more than one of these from the motor 9 at a time. When the high speed drive through the pinion 63 is in use, the pinion 67 must be removed because of the fact that its train of gearing will transmit power in but one direction, and when the slow speed drive through the pinion 67 is in use, the pinion 63 may be removed to avoid the friction and wear in its train that would otherwise result.

It will be seen that with the apparatus described a great variety of work can be done. For example, if the arm 2 be of fair length, a circle varying from 11 feet or more down to $\frac{1}{2}$ inch or less in diameter can be cut, and the cut can be made either vertical or inclined to almost any extent ordinarily desired. Again,—within the limits of the size of the apparatus,—straight and curved cuts can be made in any direction or about any centers, and various sorts of cuts can be made in any desired succession with very little interruption for changing the motion of the torch 21. Again, the vertical movability of the torch 21 and the flexibility of speed adjustment (both with hand and power operation) makes it easy to deal with

work of uneven surface and varying thickness. Moreover, by the aid of suitable indexes, scales and graduations on the relatively moving parts,—these being omitted from the drawing to avoid confusion,—every movement or adjustment of the torch 21 can be made with great nicety, so that the greatest accuracy of which the tool is inherently capable can be realized.

10 When it is desired to cut a sheet of metal by means of the tool operating machine, the metal to be worked upon is supported in horizontal position in any suitable manner and the machine placed thereon and clamped
15 in position by means of the magnet 3 in its pedestal 1 and electric current introduced at the plug receptacle 5. In case it is desired to cut a large circular disk, the pedestal 1 of the machine will be positioned at
20 the center of the proposed disk and the arm 2 caused to revolve while the carriage 20 with the torch 21 is held stationary upon the arm. If a radial cut is to be made, the whole arm 2 may be held stationary and
25 the carriage 20 with the torch 21 moved inward or outward along it; and if a straight cut in any other direction is to be made, the structure 30 will be turned till the ways 31 extend in the desired direction and the carrier 32 with the torch 21 moved in either
30 direction along said ways. In case it is desired to cut small apertures in the metal sheet, the supporting structure 30 may be caused to rotate in the carriage 20 while the
35 arm 2 is held stationary. By suitable successive or concurrent combination of these movements of the torch 21, any desired figure can be realized in a cut. The means for accomplishing all these movements are
40 fully set forth above.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. An apparatus comprising a pedestal, an arm mounted thereon so that it may
45 swing horizontally, a carriage movable along said arm, a tool supporting structure horizontally rotatable on said carriage and having horizontal guide means, and a vertically directed tool movable along said guide
50 means radially with reference to the axis of rotation of said structure.

2. An apparatus comprising a pedestal, an arm mounted thereon so that it may

swing horizontally, a carriage movable along said arm and means for moving it
55 operable from one end of the arm, a tool supporting structure horizontally rotatable on said carriage, and means extending along said arm for rotating said structure without interference with the movement of the car-
60 riage.

3. An apparatus comprising a pedestal, an arm mounted thereon so that it may swing horizontally, a carriage movable along said arm, a tool supporting structure
65 horizontally rotatable on said carriage, a screw extending along said arm and meshing with a nut member on said carriage, and means for rotating said structure comprising a worm gear and a worm attached to
70 said carriage and in mesh with one another and a shaft for said worm so engaged with it that the worm is constrained to rotate with the shaft but is free to slide along it with the movement of the carriage.
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4. An apparatus comprising a pedestal, an arm mounted thereon so that it may swing horizontally, a carriage movable along said arm, a tool supporting structure horizontally rotatable on said carriage, a motor
80 on said arm and means for swinging the arm operable thereby, and means for moving the carriage along the arm and for rotating the supporting structure on the carriage also operable by said motor.
85

5. An apparatus comprising a pedestal, an arm mounted thereon so that it may swing horizontally, a carriage movable along said arm, a tool supporting structure horizontally rotatable on said carriage and having horizontal guide means, a vertically directed tool movable along said guide means radially with reference to the axis of rotation of said structure, a motor on said arm and means operable by said motor for moving the carriage along the arm and for rotating the supporting structure on the carriage, and means for releasing said carriage and said supporting structure so that either of them may be actuated directly by hand.
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In witnesses whereof, I have hereunto set my hand this 27th day of November, 1914.

JOHN F. MADGETT

Witnesses:

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MARGARET E. WOOLLEY.