(No Model.)

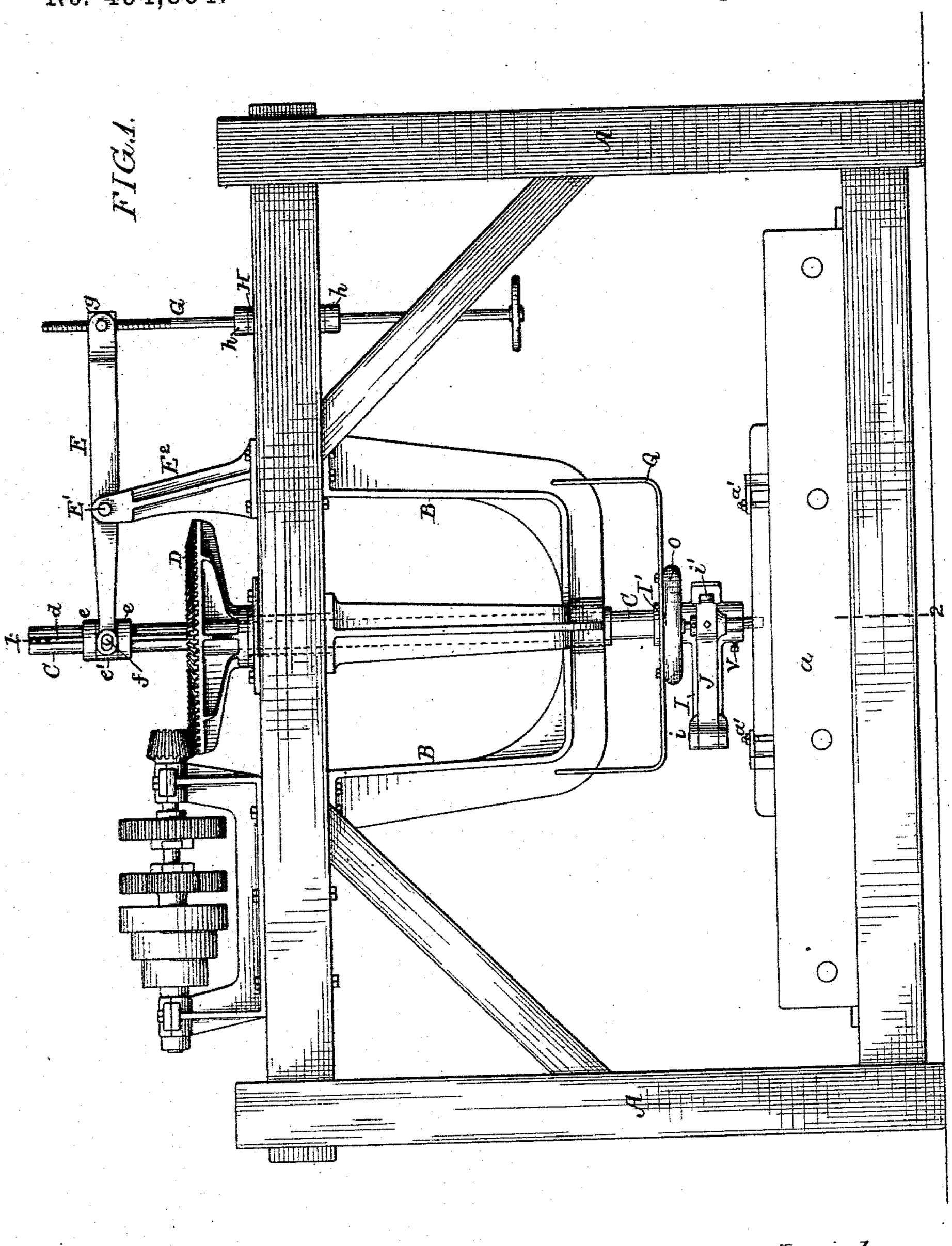
4 Sheets—Sheet 1.

C. L. HUSTON.

METAL CUTTING MACHINE.

No. 494,864. Patented Apr. 4, 1893.

FIG. 1.



Witnesses:
A. V. Groupe
William A. Baier

Inventor:
Charles L. Huston
by his Attorneys
Howson & Howson

(No Model.) 4 Sheets—Sheet 2.

C. L. HUSTON.

METAL CUTTING MACHINE.

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FIG. 3.

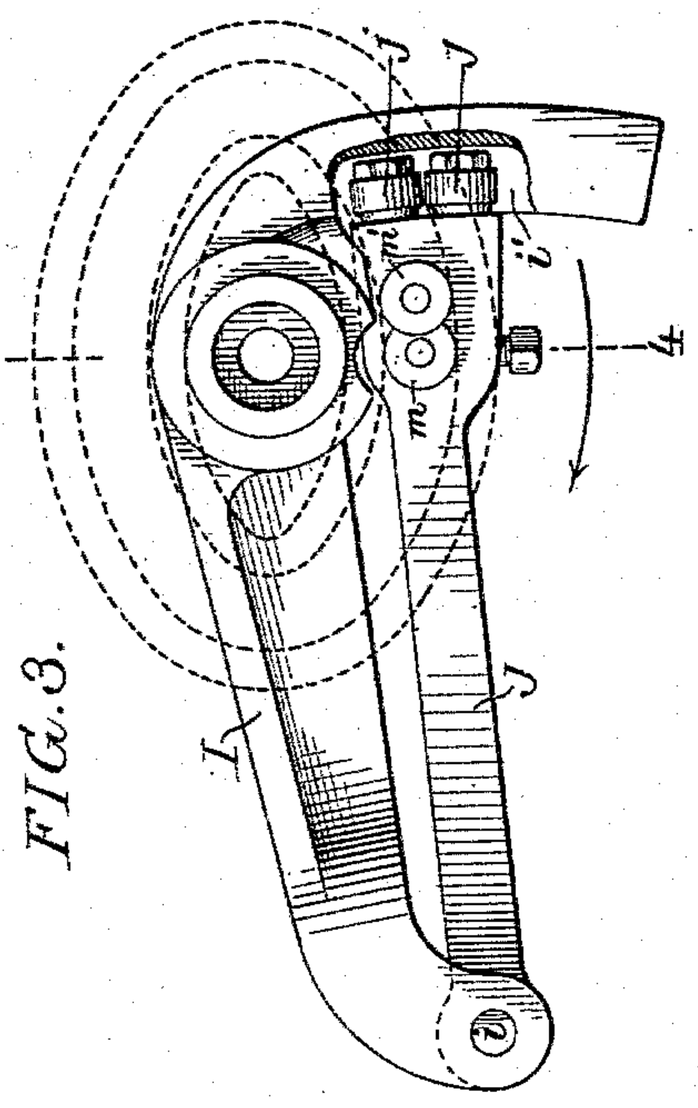


FIG. 4.

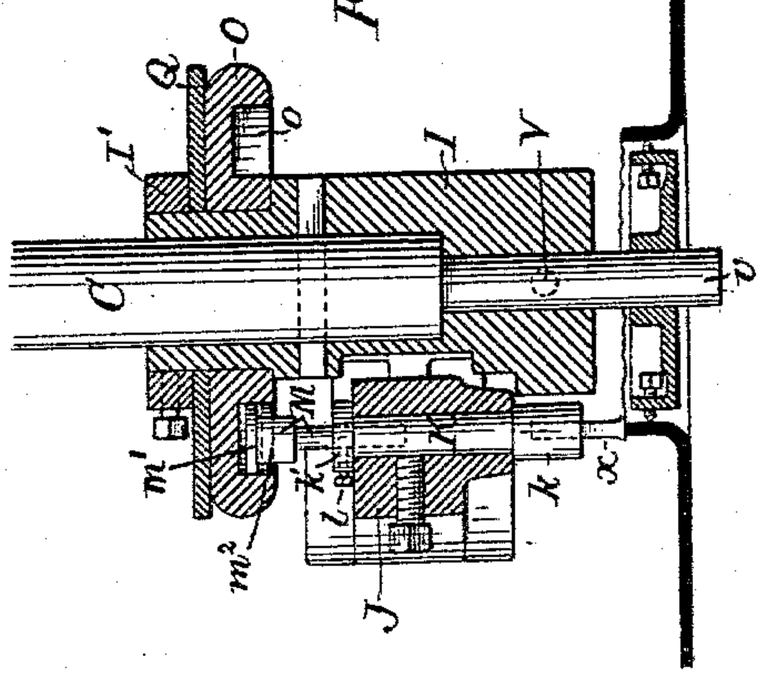
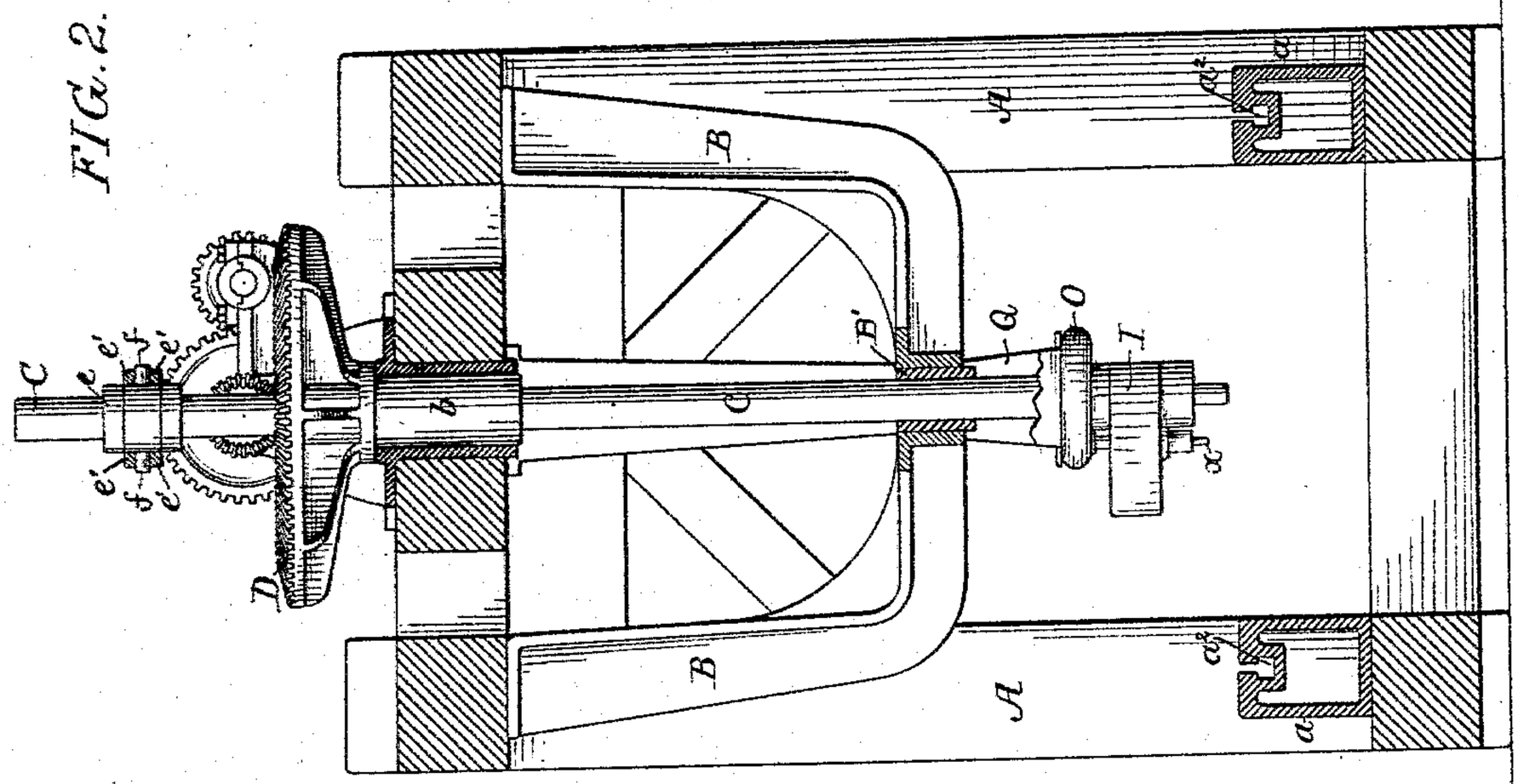


FIG. 2.



Witnesses:
A. V. Groupe
William A. Pyer.

Inventor:
Charles L. Huston
by his Attorneys
Howson & Howson

(No Model.) 4 Sheets—Sheet 3.

C. L. HUSTON.

METAL CUTTING MACHINE.

No. 494,864. Patented Apr. 4, 1893.

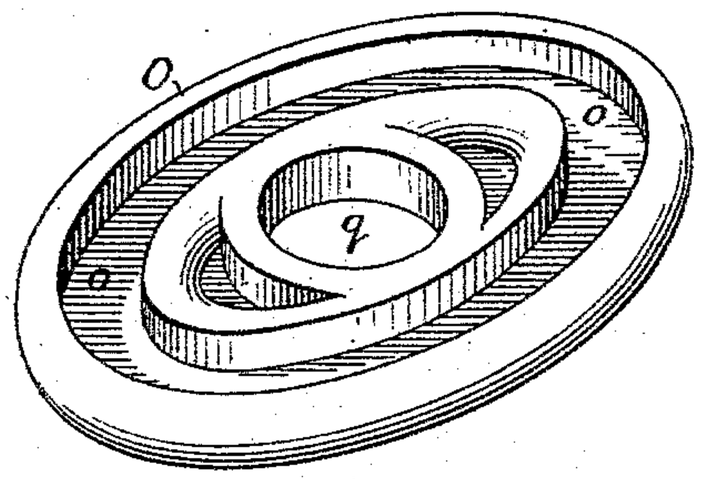


FIG. 5.

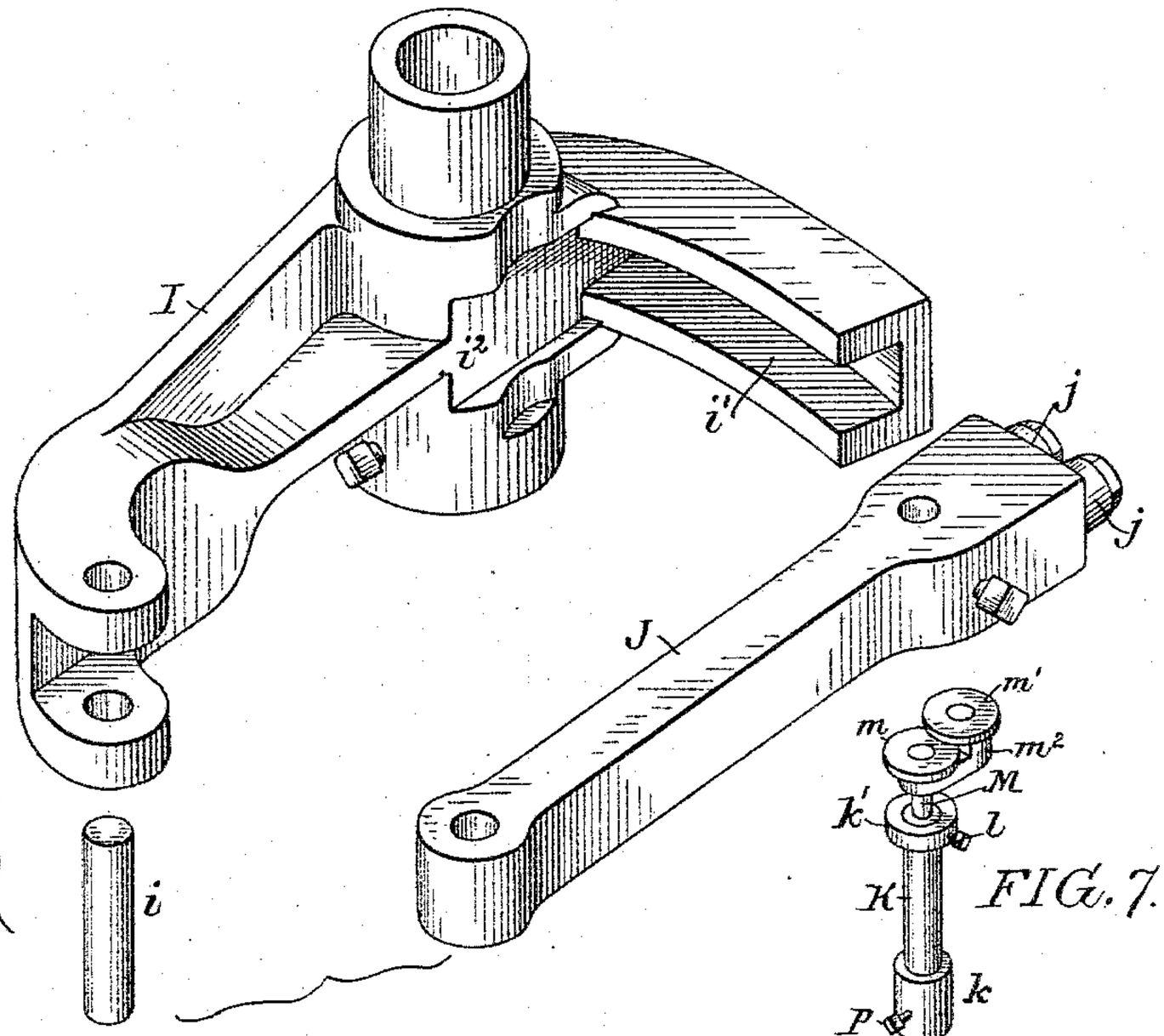
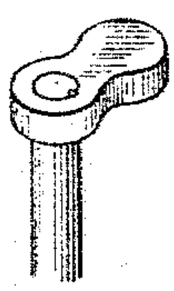


FIG. 6.

FIG. 7.

FIG. 13.



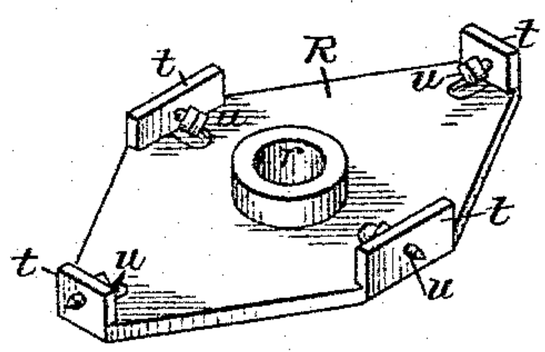


FIG. 8.

Witnesses:
A. V. Groupe
William A. Baer.

Inventor:
Charles L. Huston
by his Attorneys
Howson & Howson

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C. L. HUSTON.

METAL CUTTING MACHINE.

No. 494,864. Patented Apr. 4, 1893.

FIG. 9.

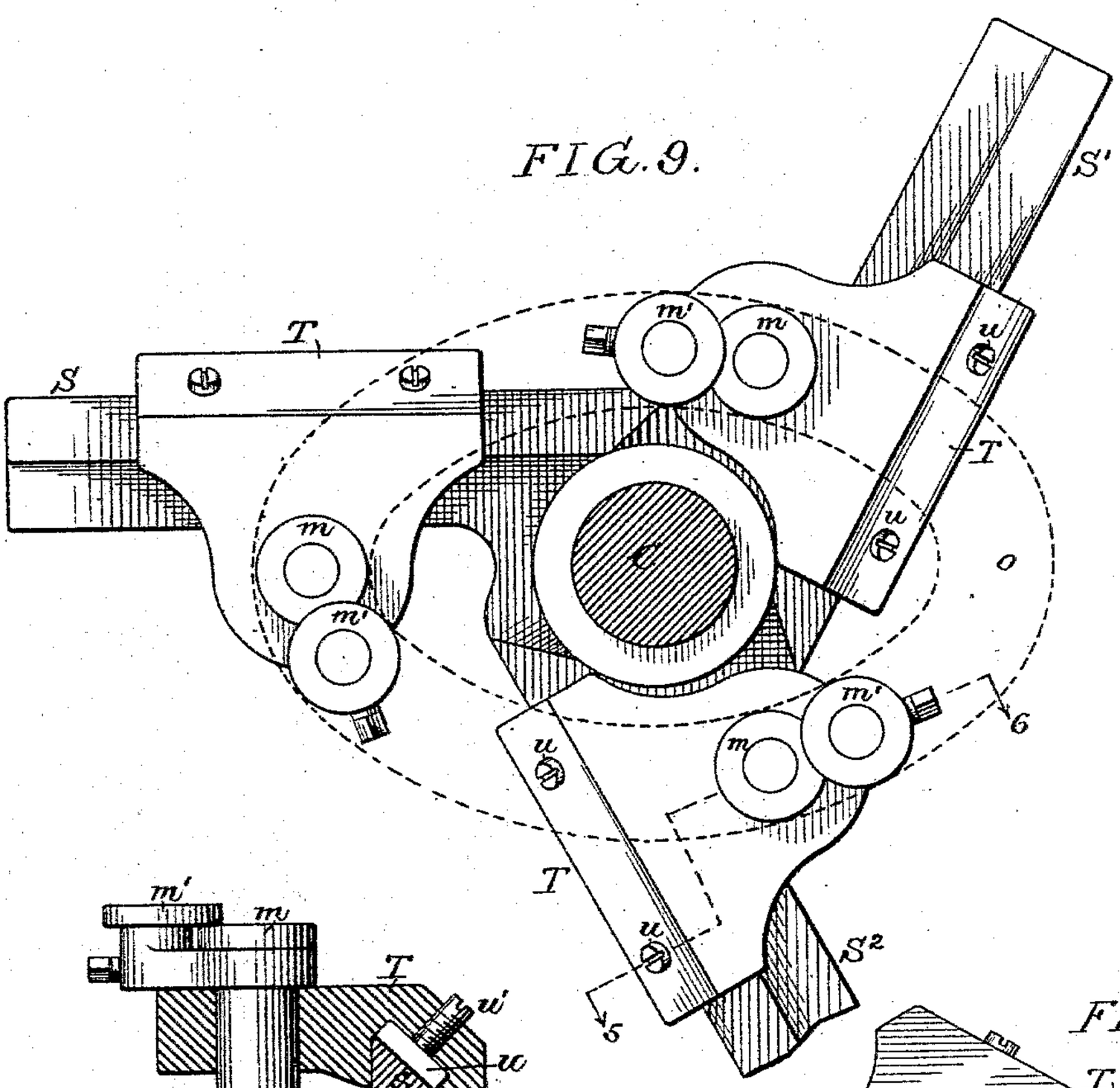


FIG. 10.

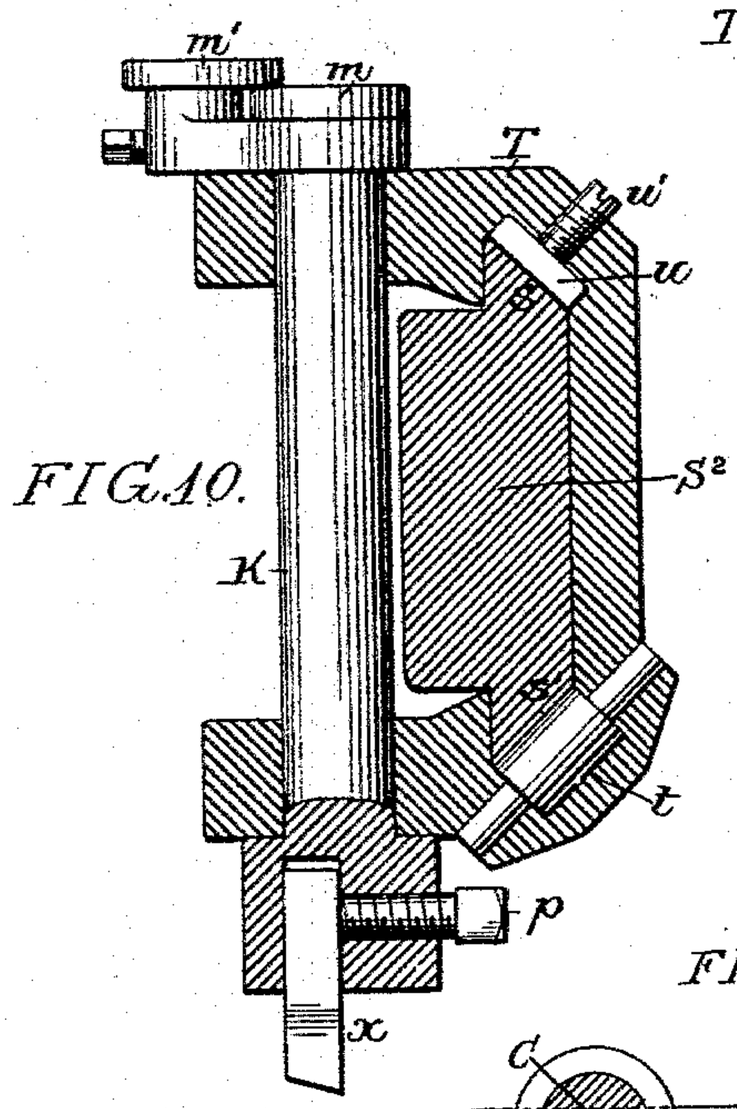


FIG. 12.

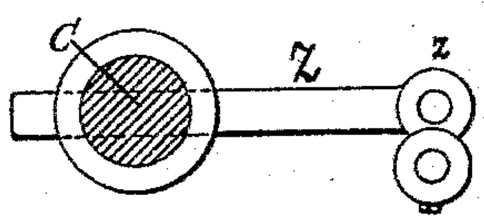
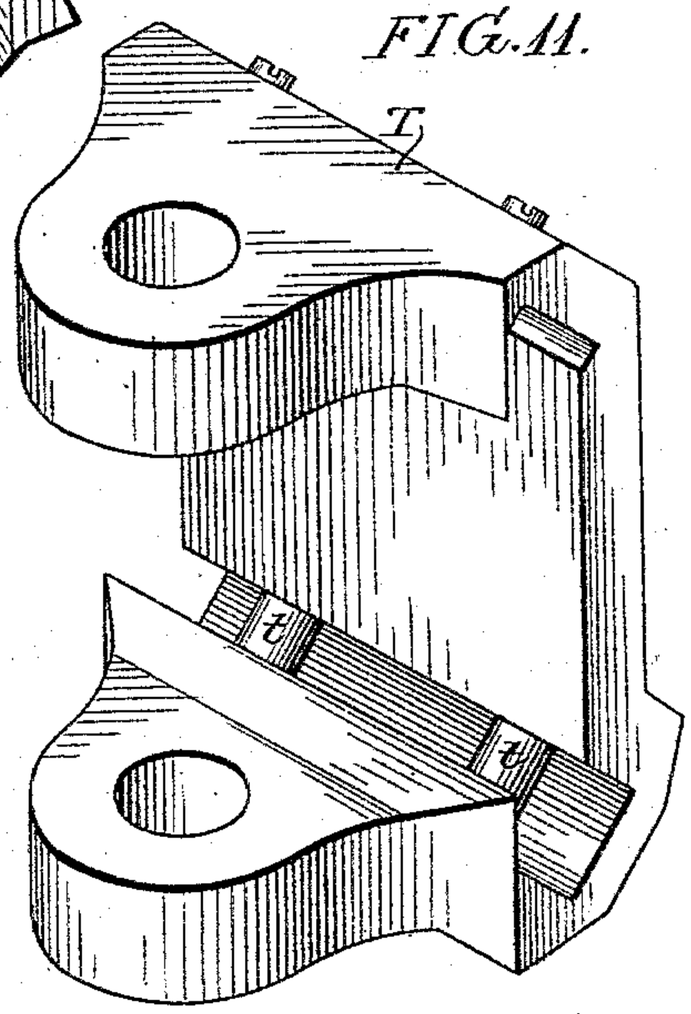


FIG. 11.



Witnesses:
A. V. Groupe
William A. Barr.

Inventor:
Charles L. Huston
by his Attorneys
Howson & Howson

UNITED STATES PATENT OFFICE.

CHARLES L. HUSTON, OF COATESVILLE, PENNSYLVANIA.

METAL-CUTTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 494,864, dated April 4, 1893.

Application filed January 9, 1893. Serial No. 457,790. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. HUSTON, a citizen of the United States, and a resident of Coatesville, Chester county, Pennsylvania, have invented certain Improvements in Metal-Cutting Machines, of which the following is a specification.

My invention relates to certain improvements in metal cutting machines and while designed principally for the purpose of cutting openings of elliptical shape in boiler heads for the attachment of the flues or for man hole openings and the finishing of the edges of such openings after flanging, it may also be used for cutting, finishing or shaping any irregular, oval or elliptical openings or surfaces.

In the accompanying drawings:—Figure 1, is an elevation of a metal cutting machine constructed in accordance with my invention. Fig. 2, is a transverse sectional elevation of the same on the line 1—2, Fig. 1. Fig. 3, is a plan view partly in section and on a somewhat larger scale, of a portion of the machine. Fig. 4, is a transverse section on the line 3—4, Fig. 3. Figs. 5, 6, 7 and 8, are perspective views of details of construction which will be more specifically referred to hereinafter. Fig. 9, is a sectional plan view which illustrates another form of tool embodying my invention. Fig. 10, is a transverse sectional view on the line 5—6, Fig. 9. Fig. 11, is a perspective view of a detail; and Figs. 12 and 13, are views of modifications which will be referred to hereinafter.

The working parts of the machine are supported on a suitably shaped frame work A of any desired construction and on the lower portion or base of the frame are supports *a a* on which the work may be firmly clamped by means of bolts *a'*, the heads of which are adapted to the slotted guideways a^2 in the supports *a* as shown in Fig. 2, or any other suitable frame or work holding devices may be employed to operate upon specially shaped pieces of metal.

Secured to the upper cross bars of the framework A is a hanging frame B the lower end of which has a bearing B' adapted to guide a vertically adjustable driven shaft C, the upper end of which passes through the elongated hub *b* of a bevel gear D, the said hub carrying a suitable key or feather adapted to a key way *d* in the shaft C so that while a free vertical movement is permitted the shaft, it must rotate with the bevel gear D. Near the upper end of this shaft C are firmly secured two collars *e*, *e*, one on either side of a loose sleeve *e'*, in which the shaft may freely rotate, and projecting from either side of the sleeve *e'* are pins *f* adapted to slotted openings in one end of a lever E, fulcrumed at E' to a supporting bracket E^2. The opposite end of the lever E is bifurcated and carries between its opposite jaws a swiveled nut *g* to which is adapted the threaded portion of a screw stem G, the latter being suitably supported and prevented from moving vertically by means of suitable retaining collars *h* one of which is secured to the screw stem on either side of a fixed supporting bracket H extending from the frame work.

To the lower end of the shaft C is secured an arm I having at one end a pivot pin *i* for a second arm J, and at its opposite end is a grooved segmental guideway *i'*, in which the opposite end of the arm J may travel and by preference, this opposite end of the arm J is provided with suitable antifriction rollers *j j* the diameter of which is about equal to the height of the grooved portion *i'*. This arm J is designed to carry the tool post and is so arranged that it may swing on the pivot pin *i*, the rollers *j j* traveling in the segmental guides *i'* from and toward the center of rotation of the arm I and said arm I being cut away somewhat at i^2 to permit a greater extent of movement of the arm J.

Secured in a suitable opening in the arm J is a tool post K (see Fig. 7) in the lower end of which is secured a suitable cutting tool *x* which may operate upon the metal or other material, the tool post being held from moving vertically by means of the enlarged collar or chuck *k* in which the tool is placed and the upper end of which bears against the arm J, and by a collar *k'* secured to the tool post above the arm J by a set screw *l*. The tool *x* is preferably fixed in the lower end of the tool post K at a point some little distance to the rear of the tool post center so that the cutting edge may be at the exact center of

the tool post and is held in position by a set screw *p*, or any ordinary form of chuck or fastening device may be employed for the purpose.

In the construction shown in Figs. 4 and 7, the upper portion of the tool post K is recessed and fitting snugly therein is a post M securely held in position by the set screw *l* and having at its upper end a cranked arm m^2 on which are two small wheels or rollers *m m'*, the axis of the wheel *m* being concentric with the center of the tool post and the wheel *m'* being mounted on a stud projecting from the crank m^2 which latter is preferably formed integral with the post M. In the construction illustrated in Fig. 10, I have shown this cranked arm m^2 secured directly to the upper end of the tool post, thus dispensing with the post M, or as shown in Fig. 13, the cranked arm alone may be used without the wheels *m m'*.

The two wheels *m m'* on the cranked arm proper, are adapted to travel in a cam groove of a contour corresponding to the path in which it is desired to travel the tool and this groove may be of any form, circular, oval, elliptical or other irregular shape.

In Fig. 5, I have shown an inverted perspective view of a plate O having elliptical cam groove *o* in which the wheels *m m'* travel when the tool is cutting or finishing an opening or surface of similar shape, it being understood, of course, that the cam plate may be readily removed from the machine and another of different size or form be substituted if desired. The cam plate O is preferably held in place by providing it with a central opening *q* adapted to fit over the reduced upper portion of the hub of the arm I over which is also fitted a guiding strip Q to which the plate O is bolted or otherwise secured and the opposite ends of the strip Q are held and guided vertically in any suitable manner, the ends of the strip in this instance being slotted and adapted to the ribs of the hanging frame B and both the strip and the cam plate may be held in position by securing the collar I' to the reduced portion of the hub of the arm I.

When the parts have been adjusted to the proper position to operate upon the work, the direction of travel of the tool will be that indicated by the arrow in Figs. 3 and 7, so that the wheel *m'* will always travel in the cam groove to the rear of the wheel *m* and will thus keep the cutting edge of the tool to the front, and as the arm I is rotated the cam plate (being stationary) will act through these wheels *m m'* to swing the arm J on its axis *i* and cause the tool post to travel in a path corresponding exactly to the contour of the cam groove.

In operation as the tool proceeds with its work a gradual downward feed of the shaft C through the medium of the screw stem G, will cause the descent of the cam plate, the arms I and J, and the tool post and its tool, so that a gradual turning of this screw stem G will enable the operator to cut away as much metal as may be necessary.

In Figs. 9, 10 and 11, I have illustrated another form of machine by which my invention may be carried into effect. Fig. 9, representing a sectional plan view through the shaft C and showing a series of arms S, S', S^2 each of which corresponds to some extent, with the arm I, and on each of these arms is mounted a tool post carriage T corresponding to the arm J and of a construction more clearly shown in the sectional view Fig. 10, and the perspective view Fig. 11, which represents a detached view of one of said carriages. The arms S, S', S^2 are placed at regular intervals and each of said arms is, in cross section, of the form shown in Fig. 10, having two beveled faces *s s'* against one of which, *s'*, is adapted to bear two rollers *t* carried at the lower edge of each of the carriages T and adapted to receive the upward and rearward thrust of the cutting tool, while against the upper beveled edge *s* bears an adjustable friction block *u* which may be adjusted by set screws *u'*. Each of the carriages is adapted to receive a tool post K of the character previously described, each tool post being provided with the guiding wheels *m m'* and a cutting tool *x* so that as the shaft C is rotated these guiding wheels will traverse the cam *o* shown by dotted lines in Fig. 9, and will be moved gradually along the cam and to and fro from the center of rotation of the shaft. The tools are preferably placed equi-distantly and so set as to make gradually deeper cuts, acting much more effectively than where only one tool is employed as previously described. It will be observed that the carriages T are so shaped as to permit a very close approach to the shaft C and the arms S, S', S^2 have their guiding surfaces so arranged that the work performed can be done on as small a scale as is the case with a tool of the character shown in the figgures previously described.

In Fig. 12, I have shown a further modification by which my invention may also be carried into effect, the shaft C in this case carrying a recessed hub and the shaft itself having a transverse groove to permit of the passage of a radially sliding arm Z carrying at its outer end a tool post of the character shown in Fig. 7, the whole being so arranged that as the shaft rotates, the tool post, being guided by the cam groove, will effect the radial movement of the arm Z and the tool will follow the exact contour of the cam groove.

I have found in practice that it is desirable to provide a lower bearing for the shaft C and such bearing when cutting through a boiler head may be provided by drilling through the boiler head a hole of a diameter sufficient to permit the entrance of a lead pin, such for instance as that shown in Figs. 4 and 8, in which *v* represents a lead pin concentric with the

shaft C and held in place by a set screw V, the pin being so arranged as to slide vertically within the hub of the arm I and if necessary for some distance within the end of the shaft C which may be recessed for this purpose, but where an opening has been flanged and it is desired to plane the edge of the flange, as illustrated in Fig. 4, I provide a suitable plate R, (shown more clearly in Fig. 8) the ends and sides of which are provided with a series of lugs *t*, to which are adapted bolts *u* having pointed ends so that by turning the bolts the plate R may be centered and securely held within the flanged opening and the center of the plate being provided with an opening *r* to form a bearing for the lead pin.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. In a metal cutting machine, the combination of a shaft, a tool carrier driven by and rotated around said shaft, and a guide for controlling the movement of said tool carrier, substantially as specified.

2. In a metal cutting machine, the combination of a shaft, an arm or arms rotated by said shaft, a tool post carrier, a tool post and a device for guiding said tool post carrier, substantially as specified.

3. In a metal cutting machine, the combination of a rotated shaft, an arm or arms secured thereto, a tool post carrier carried by said arm or arms, a tool post, a tool and a cam adapted to act upon the upper end of said tool post, substantially as specified.

4. In a metal cutting machine, the combination of a shaft, an arm or arms rotated by said shaft, a tool post carrier, carried by said arm, a tool post carried by said carrier, a guide carried by said tool post and a cam adapted to act on said guide, substantially as specified.

5. In a metal cutting machine, the combination of a shaft an arm or arms rotated by said shaft, a tool post carrier, carried by said arm, a tool post carried by said carrier, guiding rollers carried by said tool post and a cam adapted to act on said rollers, substantially as specified.

6. In a metal cutting machine, the combination with a rotated shaft, of a rotated arm, a segmental guideway secured to or forming part of said arm, an arm J pivoted at one end to the rotated arm and having its opposite end adapted to said guideway, a tool post carried by said arm J, a tool and a cam adapted to act upon said tool post, substantially as specified

7. The combination of the rotated shaft, an arm I secured thereto, a guideway secured to or forming part of said arm I, an arm J pivoted at one end to said arm I, antifriction rollers mounted upon the opposite end of said arm J and adapted to the guideway, a tool post carried by said arm J, a tool secured therein and a cam adapted to act upon said tool post, substantially as specified.

8. The combination of the rotated shaft, an arm I secured thereto, a guideway secured to or forming part of said arm I, an arm J, pivoted at one end to said arm I and having its opposite end adapted to said guideway, a tool post carried by said arm J, a grooved cam plate, and antifriction rollers carried by said tool post and adapted to said grooved cam plate, substantially as specified.

9. The combination of the rotated shaft, an arm I secured thereto, an arm J pivoted to said arm I, a tool post carried by said arm J, a tool mounted in said tool post, a cranked arm carried by the upper end of said tool post, an antifriction roller carried thereby and a grooved cam plate in which said antifriction roller is adapted to travel, substantially as specified.

10. The combination of the rotated shaft, an arm I secured thereto, an arm J pivoted at one end to said arm I, the tool post carried by said arm J, an antifriction roller mounted on the upper end of said tool post, a cranked arm carried by said tool post, an antifriction roller mounted on said cranked arm, and a grooved cam plate in which said antifriction rollers are adapted to travel, substantially as specified.

11. The combination of the vertically adjustable shaft C, devices for rotating the same, an arm I secured to said shaft, an arm J pivoted to said arm I, tool post carried by said arm J, a tool carried thereby, and a vertically adjustable cam plate adapted to act upon said tool post, substantially as specified.

12. The combination of the vertically adjustable shaft C, devices for rotating the same, an arm I secured thereto, an arm J pivoted to said arm I, a tool post carried by said arm J, a tool carried thereby, a cam plate adapted to act upon the upper end of said tool post, and a removable bearing piece R, with a vertically adjustable lead pin adapted to said bearing piece, substantially as specified.

13. The combination of the rotated shaft, the arm I carried thereby, an arm J pivoted to said arm I, a tool post and cutting tool, a cam adapted to act upon the tool post, a bearing piece, securing screws *u* carried thereby, and a vertically adjustable lead pin adapted to said bearing piece, substantially as specified.

14. The combination of the vertically adjustable shaft C, an arm I secured thereto, a grooved cam plate mounted upon the hub of said arm I, a bearing strip carrying said cam plate, an arm J pivoted to said arm I, a tool post carried thereby and adapted to be acted upon by said grooved cam, substantially as specified.

15. The combination of the shaft C, collars *e* thereon, a loose sleeve *e'* mounted between said collars, a fulcrumed lever E connected to said sleeve, a swiveled nut *g* carried by the opposite end of said lever, a screw rod adapted to said nut, an arm I secured to the shaft

C, a grooved guideway secured to or forming part of said arm I, an arm J pivoted to said arm I, a tool post carried by said arm J, a grooved cam plate adapted to act upon the upper end of said tool post, and a tool carried by said tool post, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHAS. L. HUSTON.

Witnesses:
JNO. E. PARKER,
JOSEPH H. KLEIN.