F. M. DAVIS.

UNIVERSAL DUPLEX MILLING MACHINE.

APPLICATION FILED JULY 25, 1918.

1,376,861.

Patented May 3, 1921.

5 SHEETS—SHEET 1.

FIG. 1.

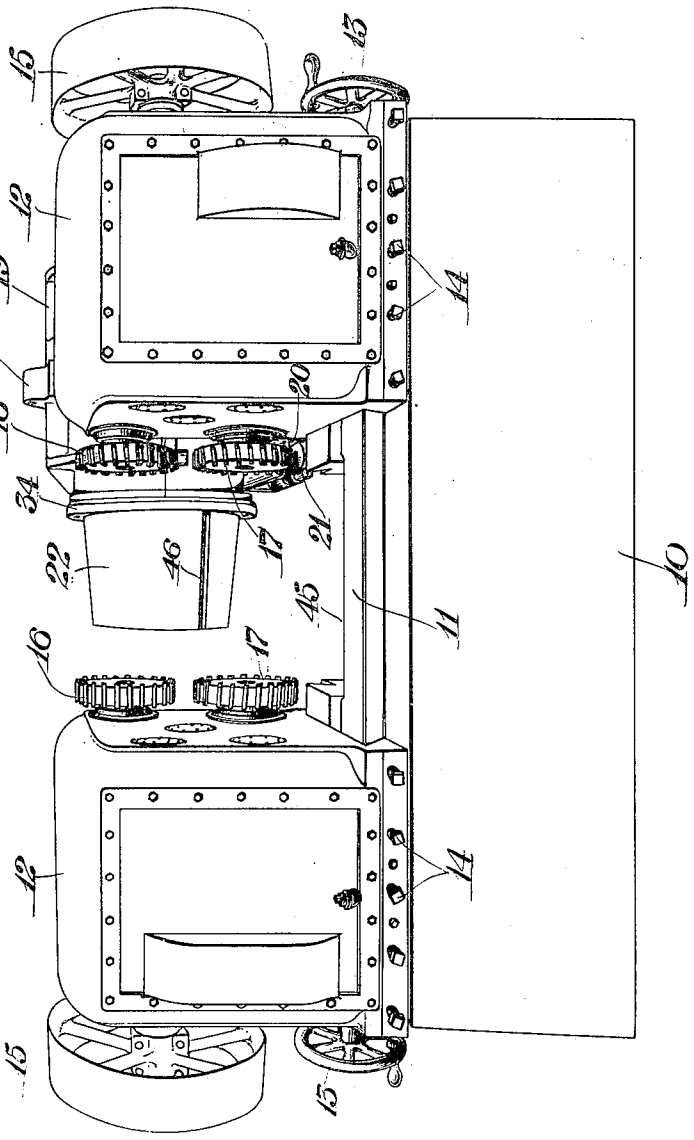
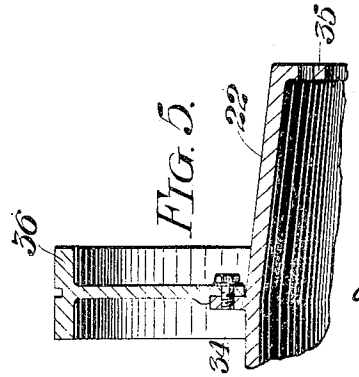


FIG. 5.



WITNESSES.

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5 SHEETS—SHEET 2.

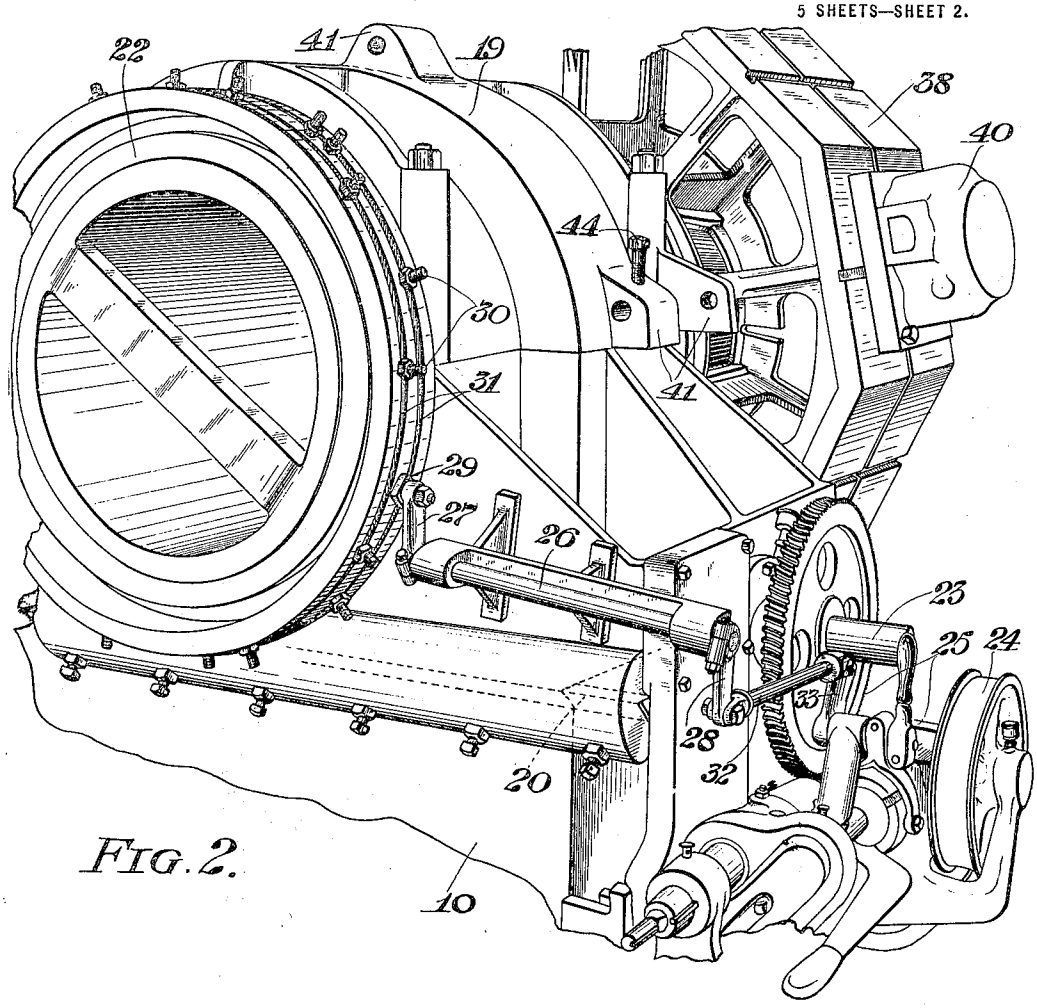
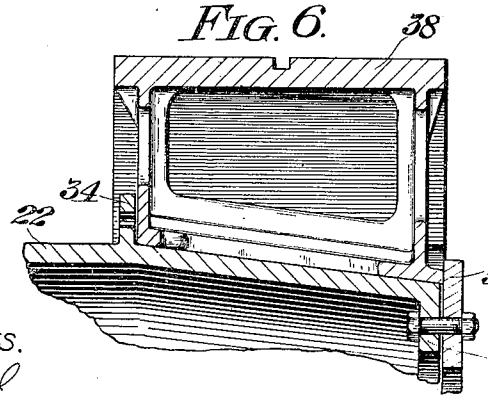


FIG. 2.

FIG. 6.



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5 SHEETS—SHEET 3.

FIG. 3.

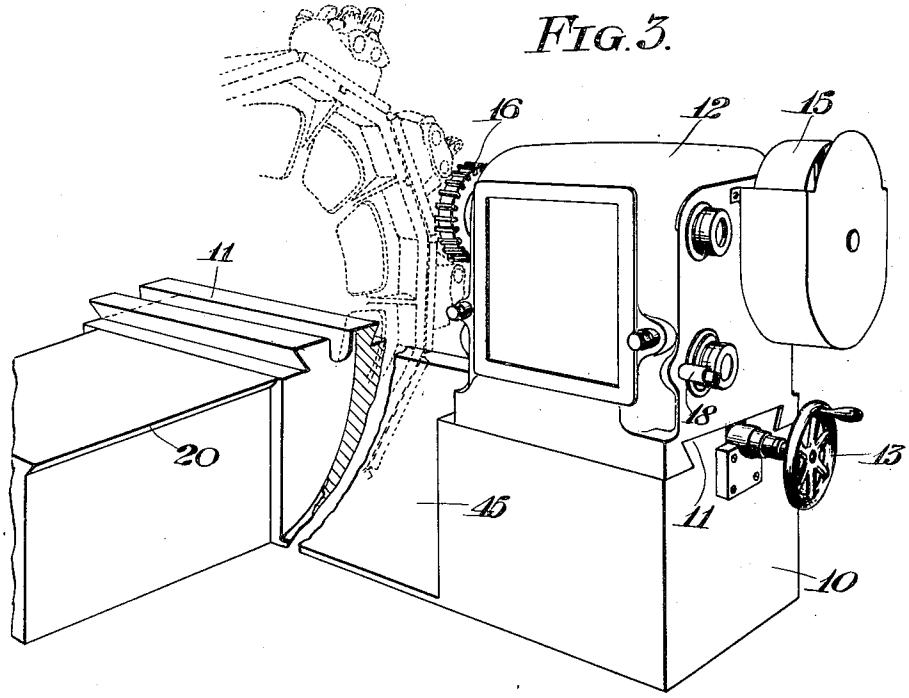
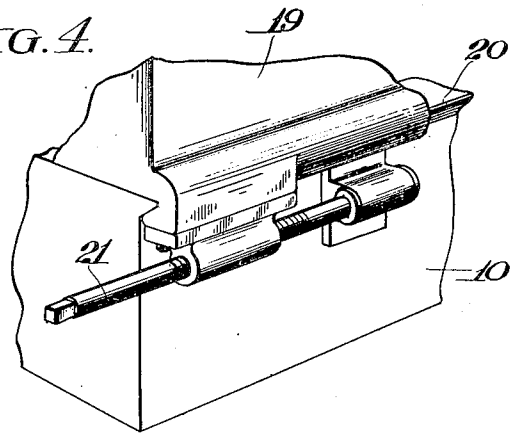


FIG. 4.



WITNESSES

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5 SHEETS—SHEET 4.

FIG. 7.

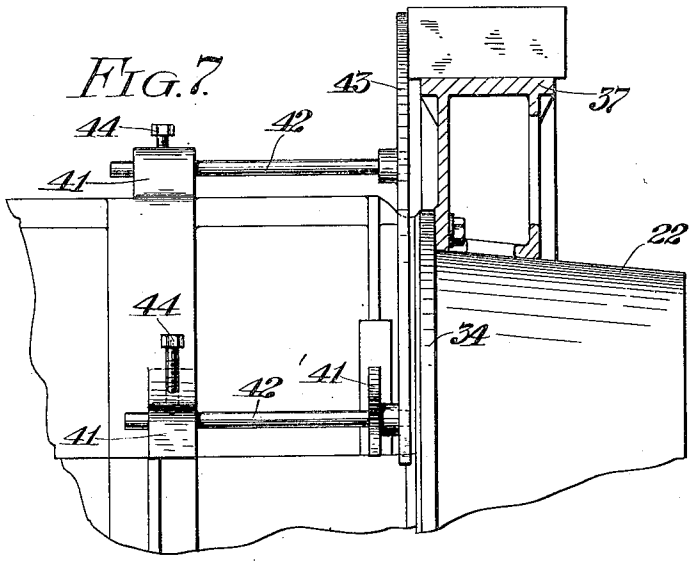
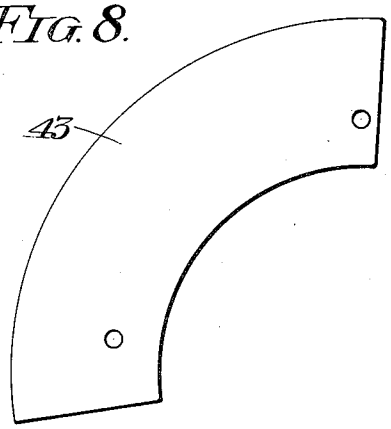


FIG. 8.



WITNESSES

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5 SHEETS—SHEET 5.

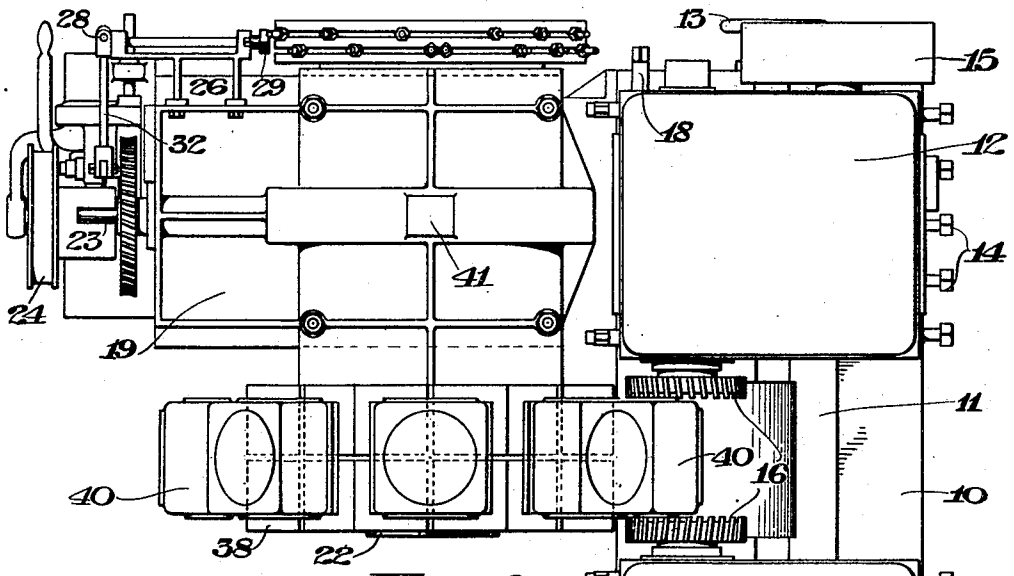
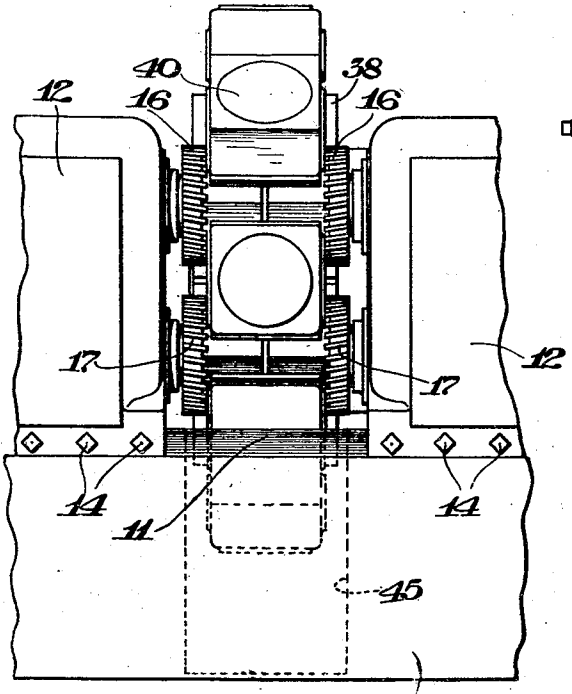


FIG. 9

FIG. 10



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UNITED STATES PATENT OFFICE.

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UNIVERSAL DUPLEX MILLING-MACHINE.

1,376,861. Specification of Letters Patent. Patented May 3, 1921.

Application filed July 25, 1918. Serial No. 246,700.

To all whom it may concern:

Be it known that I, FRANK M. DAVIS, a citizen of the United States, and resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Universal Duplex Milling-Machines, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

This invention relates to duplex milling machines operating simultaneously on opposite faces of the work as the latter is carried between the cutters on a rotating table, and has for its object to provide such a machine adapted for universal use or for the varying requirements of large machine shops engaged in quantity production of parts of different sizes and shapes.

One of the principal objects of the invention is to expedite the operation of facing the work on opposite sides by the continuous turning of the feed table, keeping the attendant busy removing the finished work and replacing it with new work, and permitting the cutters to run continuously.

Another object of the invention is to improve upon the duplex milling machine covered by my United States Letters Patent No. 1,279,286, dated September 17, 1918, by providing a speed change gear automatically operated by the arbor which supports the work table so as to increase the speed of travel of the work when it is not engaged by the cutters.

Another object of the invention is to provide a stationary gage against which the work may bear while it is being clamped to the table in order to give it a predetermined position and in order that all pieces of work will be uniformly operated upon.

Another object of the invention is to provide the machine with a conical arbor adapted to receive tables of different widths for accommodating work of different sizes.

Another object of the invention is to perfect details of construction of duplex milling machines of this type.

With the above and other objects in view the invention consists in the duplex milling machine, its parts and combinations of parts as herein claimed and all equivalents.

Referring to the accompanying drawings, in which like characters of reference indicate the same parts in different views:

Figure 1 is a perspective view of a duplex milling machine constructed in accordance with this invention;

Fig. 2 is a perspective view of the variable speed drive gear for the work feeding table;

Fig. 3 is a perspective view of one of the cutter gear housings;

Fig. 4 is a perspective view of the table adjusting means;

Fig. 5 is a sectional view showing the arbor connection with a narrow table;

Fig. 6 is a sectional view showing the arbor connection with a broad table;

Fig. 7 is a view showing the use of the stationary gage for assisting in the positioning of the work on the table; and,

Fig. 8 is a face view of the gage.

Fig. 9 is a plan view of the machine;

Fig. 10 is a detail front view of the machine.

In these drawings 10 indicates a base which is of a general L-shape as shown in Fig. 3. A dove-tailed guide way 11 extends the full length of one leg of the base and adjustably mounted on it are two gear housings 12 which may be adjusted in position by the usual handwheel operated adjusting screws 13, similar to the screw 21, and may be clamped in their adjustments by set screws 14. Each gear housing 12 contains suitable shafting and gearing operating in an oil bath and driven by a belt pulley 15 for turning a pair of milling cutters 16 and 17, the former for producing the roughing cut and the latter the finishing cut. The spindle carrying the cutter head 17 for the finishing cut is longitudinally adjustable in the gear housing 12 by means of a projecting screw 18 similar to the screw 21 in a manner well understood by those skilled in this art in order that the cutter head 17 may be moved laterally the required distance for producing the finishing cut after the gear housings 12 have been adjusted to properly position the roughing cutter 16.

On the lateral extension of the base 10 is slidably mounted a large bearing 19 on guide ways 20 and this bearing member, as shown in Fig. 4, is adjustable nearer to or farther from the cutters by means of a screw 21.

Rotatably mounted in the bearing 19 is a large arbor 22 turned by a gearing connec-

tion (not shown) between it and a shaft 23 which is driven from a belt pulley 24 by means of a variable speed mechanism including a driving gear 25.

A rock shaft 26 is journaled in suitable bearings on the frame of bearing 19 and has crank arms 27 and 28 at its ends, the former carrying an angular head 29 to be engaged by screw studs 30 adjustably clamped in grooves 31 of the arbor to cause the rock shaft to turn back and forth. A connecting rod 32 connects the arm 28 of the rock shaft with a clutch operating arm 33 of the variable speed drive gear so that, as the rock shaft 26 is swung back and forth by the engagement of its head 29 with the pins 30, the variable speed drive gear is alternately thrown into high gear and low gear for driving the arbor at a faster speed between milling operations and at a reduced speed during such operations. I have not shown the variable speed gear drive in detail as my invention does not reside in the particular construction of this gear. My invention resides in the combination of any suitable variable speed drive mechanism with the control means above described.

At its other end the arbor is provided with a conical or tapered bearing surface with an outwardly extending securing flange 34 at its part of larger diameter and an inwardly extending securing flange 35 at its end.

Work tables of various sizes and shapes suitable for the support of the different articles of work, are adapted to be attached to the arbor, a narrow table 36 for narrow work being shown in Fig. 5 as bolted direct to the flange 34 and centered by means thereof; an intermediate size table 37 being shown in Fig. 7 as similarly bolted to the flange 34, but centered by its fit on the conical bearing surface of the arbor 22; and a wide table 38 being shown in Fig. 6 as centered by its fit on the conical bearing surface of the arbor 22 and clamped thereon by means of a ring 39 bolted to the securing flange 35.

These various tables are preferably provided with a series of flat faces so that they are of polygon shape and are adapted to have the work 40 secured to their faces either directly or by means of jigs.

In order to assist in accurately positioning the work on the faces of the table while the table is in motion, an adjustable gage is provided against which the work is held while being clamped. For this purpose the bearing frame 19 is provided with lugs 41 with openings through which rods 42 are slidably passed. An arc-shaped gage plate 43 is mounted on the ends of rods 42 and when the rods are properly adjusted and clamped in their adjustments by means of set screws 44 in the lugs 41 the gage plate 43 stands alongside of the path of travel of the work on the table so that the work may be properly positioned by holding it in contact therewith while it is being clamped to the table. This insures uniformity in the operation so that the cutters remove the same amount of metal from the opposite faces of each piece of work.

In operation the work is clamped on the faces of the table and is carried thereby to the milling cutters where its opposite faces are first reduced by the roughing cutters 16 and are then finished by the finishing cutters 17. It is then continued through its circular path of travel, passing from between the cutters through a recess 45 in the base and returning to the loading position where it is removed and replaced by another piece of work.

The operation is continuous, though the speed of travel of the work is accelerated intermittently in order to quickly move the table from the position in which one piece of work leaves the cutters to the position in which the next piece of work enters between the cutters. The strike pins 30 may readily be adjusted in the slots 31 to effect the change in the speed of travel of the work table to avoid waste of time.

The conical bearing end with its flanges 34 and 35 adapts the arbor for use with the tables of various widths according to the size of the work. It is frequently necessary that the edge of the table should pass between the cutters. It is obvious then that the width of the table must be less than the distance between the cutters and still it is desirable that it should be as wide as possible in order to afford rigid support for the work. It is also necessary that the table should be concentrically positioned on the arbor and the present arrangement for fitting narrow tables to the flange 34 and the broader tables on the conical end of the arbor assures the accomplishment of this purpose.

A key groove 46 is formed in the conical end of the arbor in which a feather key may be placed to engage a key groove in the table for producing a firm driving connection.

The adjustability of the gear housings 12 and of the arbor bearing 19 and the interchangeability of the various tables, makes the machine capable of general use for work of different sizes.

In accordance with the provisions of the patent statutes I have described the principle of operation of my invention together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means within the scope of my claims.

What I claim as new and desire to secure by Letters Patent is:

1. A duplex milling machine comprising

oppositely positioned cutters independently mounted and spaced apart, a suitably driven arbor adjustable toward and away from the cutters and having a flanged conical end whereby work supporting tables of different widths may be interchangeably fitted onto the conical end of the arbor and against the flange thereof, a work supporting table on said arbor and means for clamping the work to the periphery of said table to be carried thereby between the cutters.

2. A duplex milling machine comprising oppositely positioned cutters spaced apart, a suitably driven arbor adjustable with relation to the cutters and provided with a conical end whereby work supporting tables of different widths may be fitted onto the conical end of the arbor and keyed thereto, a work supporting table on said arbor, and means for clamping work to the periphery of said table to be carried thereby between the cutters.

3. A duplex milling machine, comprising oppositely positioned cutters spaced apart, an arbor adjustable with relation to the cutters, a table mounted on the arbor, means for securing the work on the table, a grooved ring secured to the arbor, screw studs adjustably mounted in the grooves of the ring, and a variable speed drive mechanism for turning the arbor having means engaged by the screw studs for shifting the drive to accelerate the speed of the table between the cutting operations.

4. A duplex milling machine comprising oppositely positioned cutters spaced apart, a suitably driven rotary table, clamping means for securing work to the table, and a stationary gage against which a face of the work abuts while clamping it on the table while the table is in motion.

5. A duplex milling machine, comprising oppositely positioned cutters spaced apart, a bearing frame, a suitably operated rotary table mounted in the bearing frame, means for securing the work on the table, rods slidable in the bearing frame, an arc-shaped plate carried by the rods and forming a gage against which the work may be placed while it is being clamped on the moving table, and means for clamping the rods in their adjustments.

In testimony whereof I affix my signature.

FRANK M. DAVIS.

Witness:

R. S. C. CALDWELL.