

Aug. 22, 1944.

E. F. L. BEDUNEAU
SEMI-AUTOMATIC MACHINE INTENDED FOR FINISHING THE
GROOVES OF BALL BEARING RINGS
Filed Jan. 2, 1942

2,356,499

3 Sheets-Sheet 1

Fig. 4

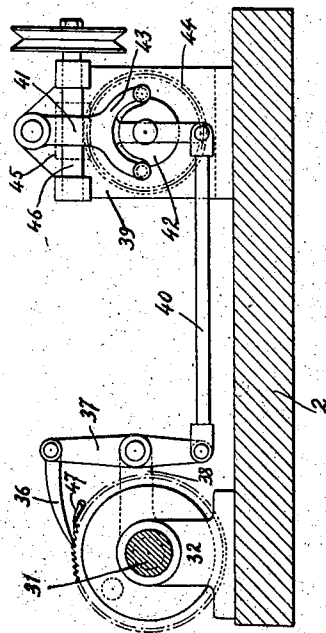
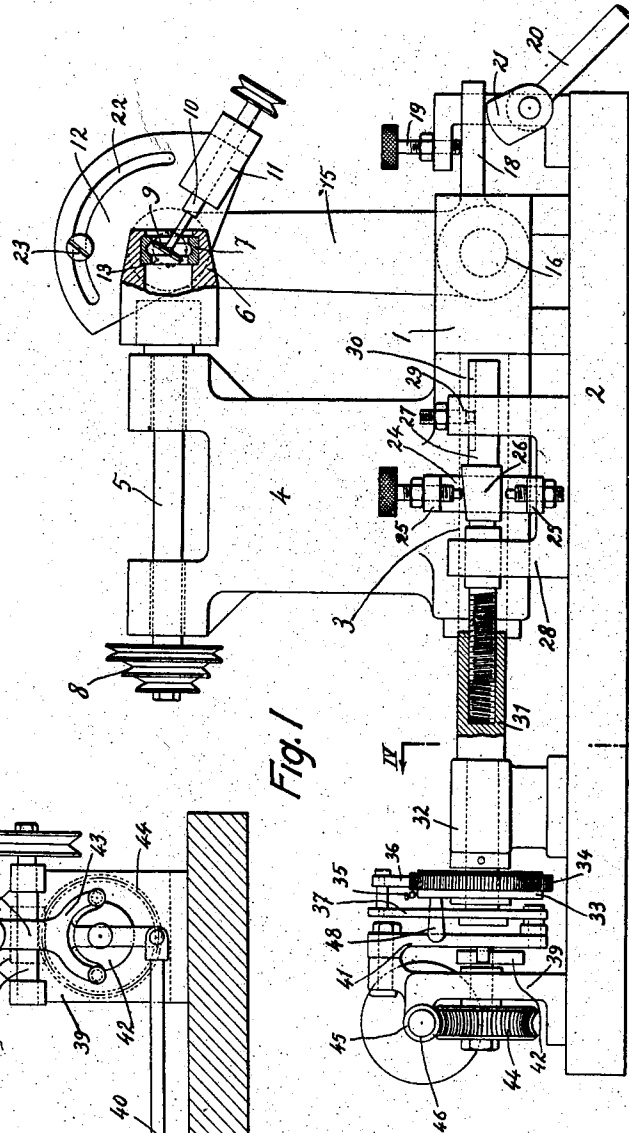


Fig. 1



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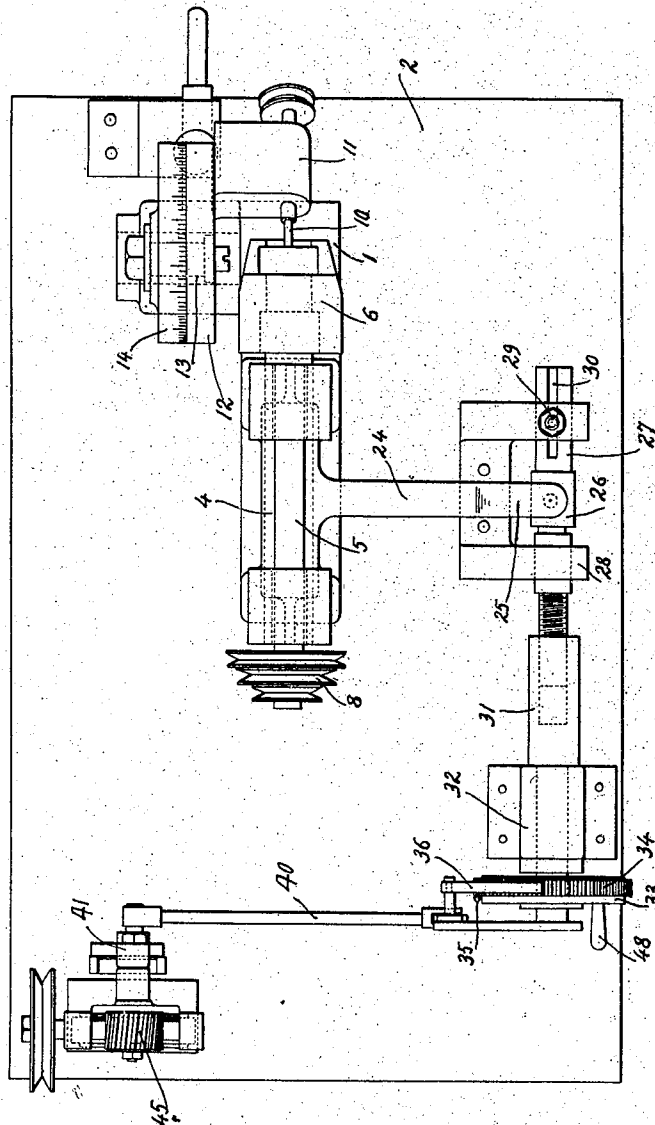
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3 Sheets-Sheet 2

Fig. 2



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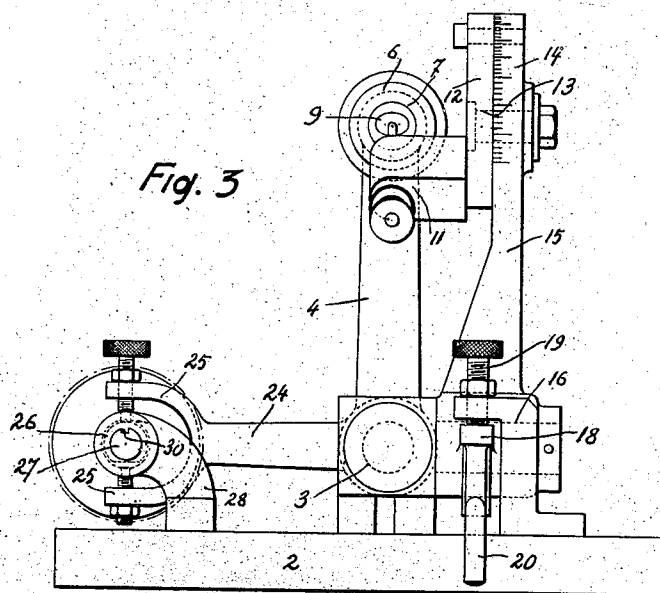
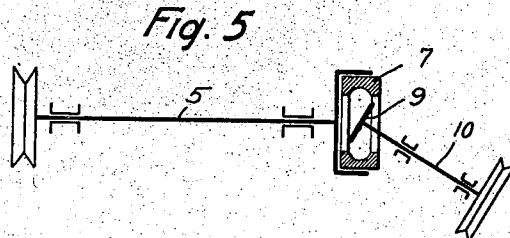
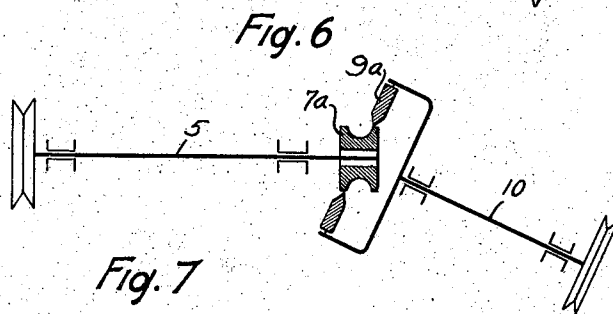
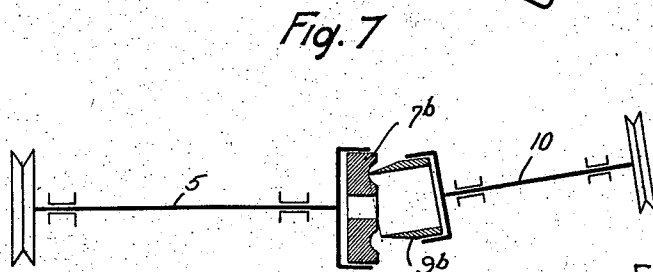
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,356,499

SEMI-AUTOMATIC MACHINE INTENDED FOR FINISHING THE GROOVES OF BALL BEARING RINGS

Emile François Louis Beduneau, Thomery, France; vested in the Alien Property Custodian

Application January 2, 1942, Serial No. 425,448
In France December 4, 1940

5 Claims. (Cl. 51-105)

My invention relates to a semi-automatic machine intended for finishing the grooves of ball bearing rings, the construction of this machine being based upon the application of Yvon Villarceau's theory.

This theory teaches that the flat section of a torus along the bi-tangential plane gives two circles. It results therefrom that with the aid of one or a plurality of cutting tools operative in said circles, one may generate a torus by imparting to the work-piece both a rotary movement and a progressive movement along the tool. Utilizing one of the said circles, one may obtain tool paths of determined inclination, and by displacing the tool on the bi-tangential plane so as to place it on the second circle, the inclination of the tool paths will be reverse from the preceding one.

By effecting the necessary adjustments in a sufficient manner, it will therefore be possible to dispose the tool paths across each other on the torus surface and, when the said tools consist of finer and finer grindstones, each operation may be with the tool path crossing the tool paths of the preceding operation until the surface will take the desired smoothness.

A machine comprising the application of the foregoing features will now be described by way of example with reference to the accompanying drawings which illustrate one embodiment of the present invention intended for finishing the grooves of outer bearing rings.

Fig. 1 is a side elevation view of the whole machine.

Fig. 2 is a plan view thereof.

Fig. 3 is an end view.

Fig. 4 is a section along the line IV-IV, Fig. 1.

Figs. 5, 6 and 7 represent diagrams pertaining to the different cases of application of the machine.

According to the above mentioned features of my invention, the machine comprises in combination: means for rotating the work-piece on its axis, means for advancing this work-piece along the tool, and means for setting the tool to operate on one or the other of the two circles of the bi-tangential section.

These different means consist of the following arrangements:

A support 1, fixed on the base plate 2, carries a shaft 3, on which a carriage 4 is loosely mounted. At the top of this carriage 4 is journaled the shaft 5 of a chuck 6, wherein the work-piece 7, in the embodiment shown the outer ring of a ball bearing, is clamped. At its other end, the shaft 5 is provided with a change speed pulley 8 which permits imparting a suitable rotation speed to the work-piece 7.

Opposite this piece 7, there is a tool 9, mounted on the end of a shaft 10 capable of rapidly ro-

tating in a bush 11. This bush 11 is rigid with a sector 12, which may turn about a pivot 13 coaxial with the center of the torus surface which is to be finished on the work-piece 7. This pivot is carried by a plate 14, against which the sector 12 may slide. The plate 14 is on the upper part of a column 15, the lower end of which is pivotally mounted or jointed at 16 on the fixed support 1. A finger 18 projecting laterally from the column 15 permits regulation of the position of this column by means of an adjusting screw 19, and its locking is effected by means of a handle 20, provided with a cam 21.

The inclination of the tool-holder 11 is easily determined with the aid of a graduation engraved upon the edge of the plate 14 and the position of the tool-holder is maintained by means of a fixed screw 23, engaging a semi-circular slot 22 of the sector 12.

The automatic advance of the work-piece 7 towards the tool is obtained by the following means:

The carriage 4, on which the chuck 6 and work-piece 7 are mounted and which, as previously stated, can pivot on the fixed shaft 3, carries at its base an arm 24 extending laterally and ending in a fork 25; the branches of this fork embrace a ramp 26 provided on a rod 27 which is guided in a support 28 and is capable of longitudinally sliding therein without rotation. A stop 29 provided on the support 28 engages a longitudinal groove 30 of the rod 27 for this purpose. One end of this rod 27 is provided with screw threads and this threaded portion engages a corresponding interior thread of a hollow rod 31, journaled in alignment with the rod 27. The hollow rod 31 is rotatably mounted in the support 32, without capacity for longitudinal displacement.

The upper surface of the ramp 26 is inclined in such a manner that during the displacement of the ramp in the direction of its inclination, i. e., from right to left in Fig. 1, the fork 25 is raised and thus the arm 24 pivots upwards, imparting to the carriage 4 a corresponding inclination and consequently a progressive movement of the work-piece towards the tool. The displacement of the ramp 26 which is fast on the rod 27, is caused by the action exerted on this rod 27 by the hollow rod 31, which works like a nut on the threaded end of the rod 27, and displaces it longitudinally, when put in rotation by means described hereafter.

On the other end of the rod 31, a disc 33 is keyed and fast on a ratchet wheel 34, which in turn is rigid with the nut 31 of the rod 27, provided with the ramp 26.

The teeth of the ratchet wheel 34 cooperate with a pawl 36, which is pivoted on the end of a lever 37, pivoting on a horizontal arm 38 of a fixed support 39. The other end of the lever 37

is connected with a rod 40, which on its turn is hinged on a two-arm lever 41, oscillating from one side of the vertical to the other under the action of a cam 42. This cam, acting upon the branches of a fork 43 rigid with the two-arm lever 41, is mounted on the shaft of a helicoidal wheel 44, driven by the worm 45, whose shaft 46 is actuated by a suitable drive. Thus, a step by step rotatory movement is imparted to the hollow shaft 31.

The machine described hereinbefore works in the following manner:

The tool-holder 11 fixed on the plate 14 is given a suitable inclination so as to set to the tool the position to operate in one of the circles of the bi-tangential section, and the work-piece 7 and the tool 9 are put in rotation by their respective drives. At the same time, the drive consisting of the helicoidal gears 44-45, the disc 33 and the ratchet wheel 34, puts in rotation the hollow rod 31 and imparts a longitudinal movement to the ramp 26, which acts upon the carriage 4 in the aforesaid manner and causes automatic displacement of the work-piece relatively to the tool. A shield 47 which can be swung over the teeth of the ratchet wheel 34, serves to limit the actual stroke and stops the advance. The cover 47 is adjusted in position and locked by means of a tightening button 35. The different parts of the machine may be brought back to their starting position by means of a handle 48, fixed on the disc 33 and actuated in a suitable direction.

The foregoing description pertains to the case (see Fig. 5) in which the surface to be obtained is outside the cylinder which corresponds to the average diameter of the torus (case of the inner groove of the outer ring of a ball bearing). The tool 9 to be employed must then work along the outside of the circle (section of the torus through the bi-tangential plane), this tool being, for example, a disc with its circumference as the operative surface.

Two further cases are to be taken in consideration:

(a) The surface to be obtained is inside of the said cylinder (case of the outer groove of an inner bearing ring 7a, Fig. 6). The tool 9a to be employed must then work from the inside of the section circle and its operative surface may be the interior periphery of a washer, for example.

(b) The surface to be obtained overlaps the said cylinder (case of the groove of a ball thrust ring 7b, Fig. 7). The tool 9b must then work laterally to the section circle and its operative surface may be the end of a tube or pipe.

This invention is not limited to the embodiment described and represented on the accompanying drawings.

I claim:

1. A machine for finishing the torus-surfaces of grooves of ball bearing rings comprising a frame, a carriage mounted in said frame for limited tilting movement about an axis extending longitudinally of the frame, means in said carriage for supporting a rotary chuck shaft the axis whereof is parallel to the axis of tilting of said carriage, a chuck on said shaft for holding the ring to be machined with the main axis of the torus surface concentric with the axis of the chuck shaft, a column on said frame adjacent said chuck, means on said column for supporting

a rotary tool shaft, a tool driven by said tool shaft with its cutting edge operative in a circle lying in a bi-tangential plane of the torus surface, means for setting said tool and tool shaft to bring the cutting edge of said tool into any desired bi-tangential plane, means for holding said tool and tool shaft in such set position, and mechanism for intermittently progressing the tilting of said carriage.

2. A semi-automatic machine for finishing the torus surfaces of grooves of ball bearing rings, comprising a carriage, a shaft on which said carriage can tilt, another shaft rotatably mounted in said carriage, a chuck for the work-piece on said shaft, a rotary tool adapted to machine a torus surface, means for rotating the cutting edge of the tool in the torus surface of the groove, means for step-by-step tilting said carriage to move the work-piece along the tool, and means for setting said tool with the path of its cutting edge in one of the two circles formed by the flat section of the torus along the bi-tangential plane.

3. A semi-automatic machine for finishing the torus surfaces of grooves of ball bearing rings, comprising a carriage, a shaft on which said carriage can tilt, another shaft rotatably mounted in said carriage, a chuck for the work piece on said shaft, a rotary tool adapted to machine a torus surface, means for rotating the cutting edge of the tool in the torus surface of the groove, a fixed support, a rod slidably and non-rotatably mounted in said support, a second fixed support, another rod rotatably and non-slidably mounted in said second support, screw thread means on said rods whereby rotation of the non-slidable rod produces sliding of the non-rotatable rod, a ramp member on said non-rotatable rod, an arm extending from said carriage, a fork at the end of said arm, and engaging said ramp member, and means for setting the tool with the path of its cutting edge in one of the two circles formed by the flat section of the torus along the bi-tangential plane.

4. A semi-automatic machine according to claim 2 in which the tool setting means include a column pivotally mounted at its lower end, a plate on said column parallel to the axis of the chuck shaft, a pivot coaxial with the center of the torus surface to be machined and fixed on the said plate, a sector movable on said plate about said pivot, a bush rigid with said sector, a tool shaft rotatably mounted in the said bush, and means for locking the column in a desired position relatively to its pivot.

5. A semi-automatic machine according to claim 2 in which the tool setting means include a column pivotally mounted at its lower end, a plate on said column parallel to the axis of the chuck shaft, a pivot coaxial with the center of the torus surface to be machined and fixed on the said plate, a sector movable on said plate about said pivot, a bush rigid with said sector, a tool shaft rotatably mounted in the said bush, and means for locking the column in a desired position relatively to its pivot, and wherein indicating means are provided on said plate and sector to enable the tool to be set with its cutting edge operative in either bi-tangential plane of the torus, and wherein means are provided for clamping the sector to the plate.

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