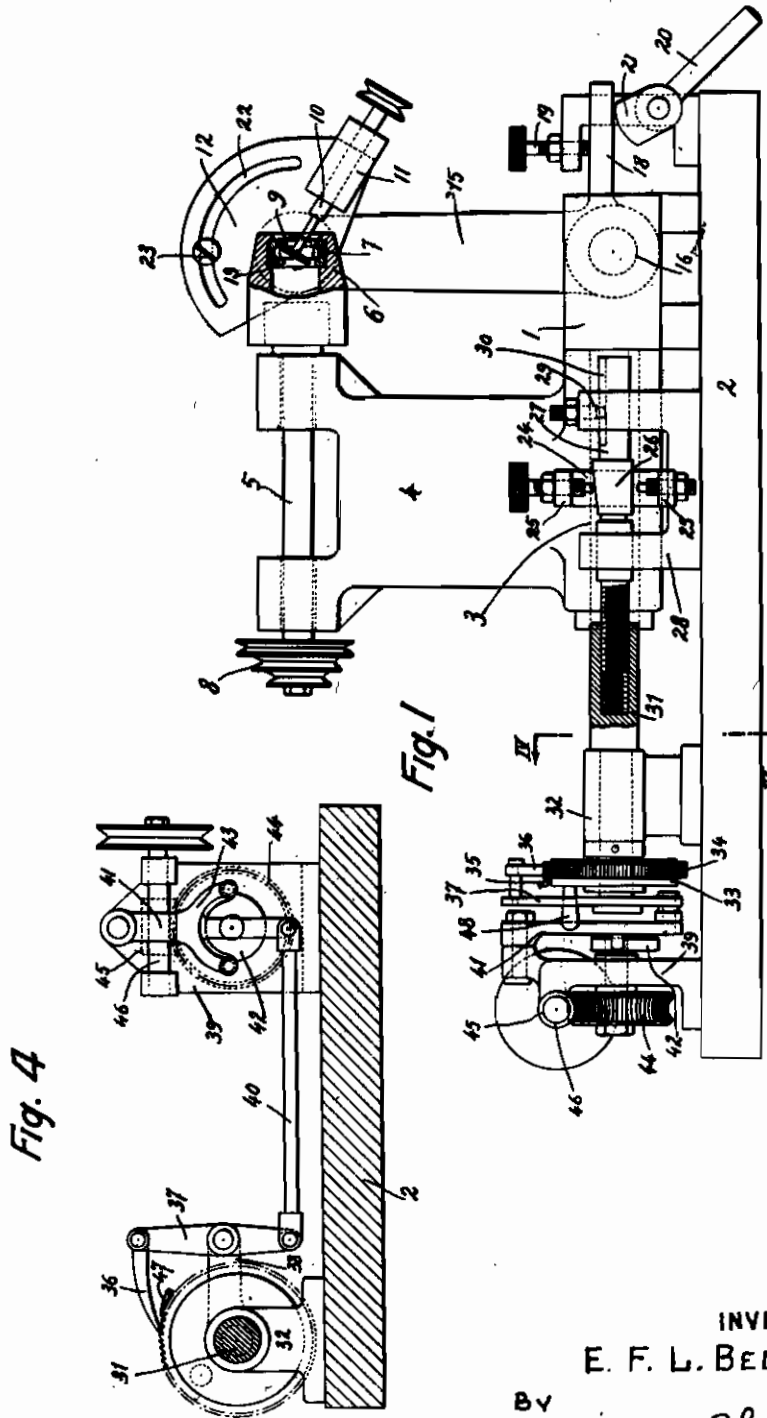


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E. F. L. BEDUNEAU  
 SEMI-AUTOMATIC MACHINE INTENDED  
 FOR FINISHING THE GROOVES  
 OF BALL BEARING RINGS  
 Filed Jan. 2, 1942

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3 Sheets-Sheet 1



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 E. F. L. BEDUNEAU

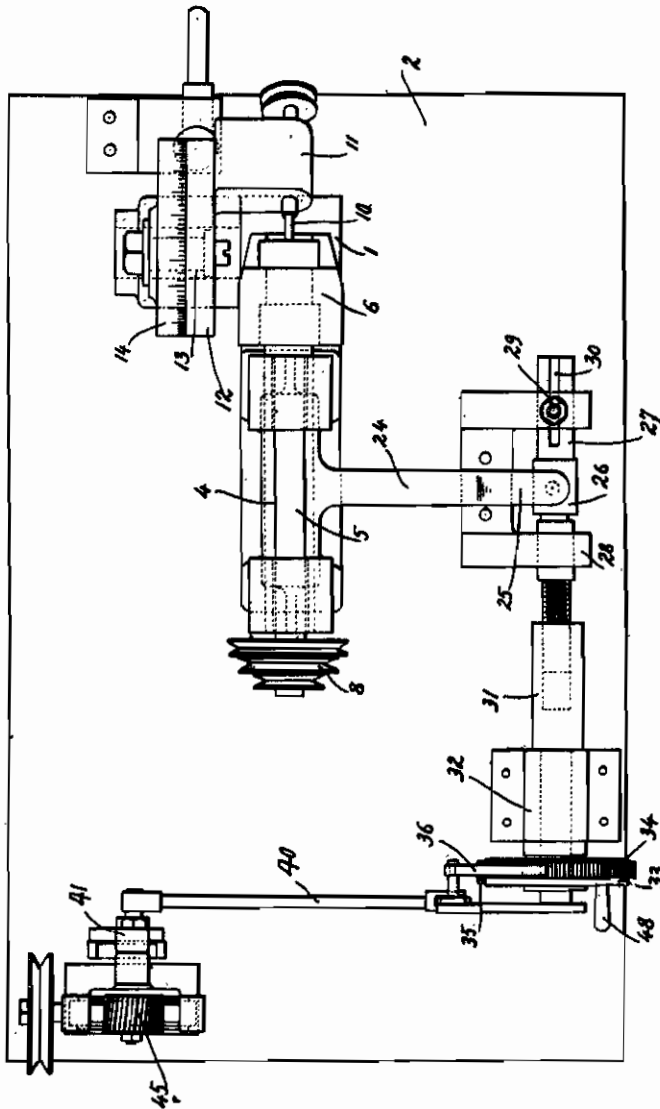
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Fig. 2



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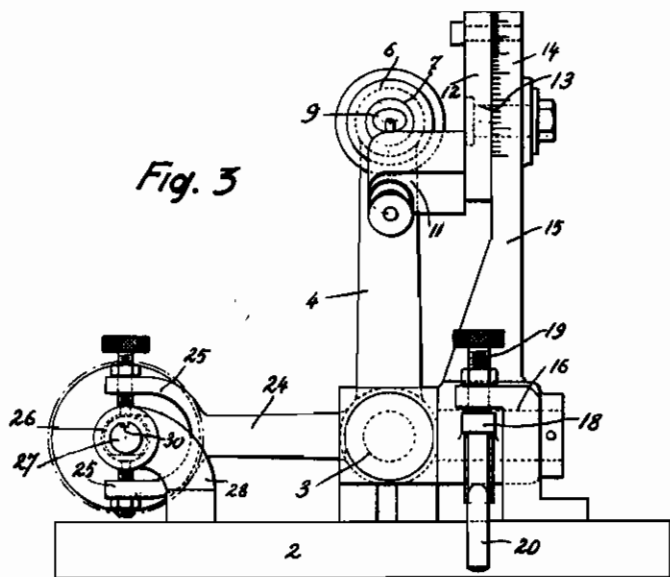


Fig. 3

Fig. 5

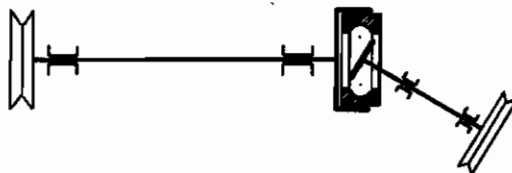


Fig. 6

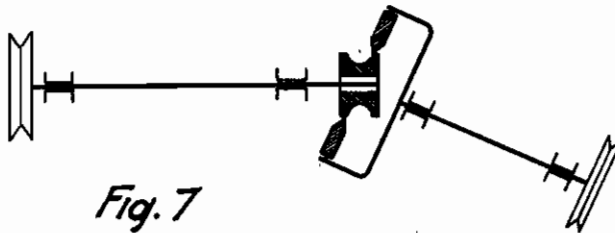
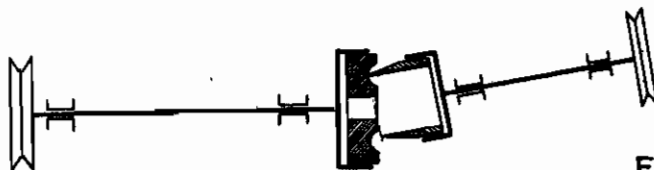


Fig. 7



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# ALIEN PROPERTY CUSTODIAN

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

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Application filed January 2, 1942

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 the torus along the bi-tangential plane gives two circles. It results therefrom that after materializing one of these circles with the aid of one or a plurality of cutting tools, one may generate a torus by imparting to the work-piece both a rotatory 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 place across each other the tool paths on the torus surface and, in case of materializing the said tools by means of finer and finer grindstones, to realize at each operation a crossing of the tool paths on those 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 general view of the whole machine.

Fig. 2 is a plane view.

Fig. 3 is an end view.

Fig. 4 is a section along the line IV—IV, Fig. 2.

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 forwarding this work-piece along the tool and means for putting this tool 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 puppet 4 is loosely mounted. At the top of this puppet 4 may rotate the shaft 5 of the jaws 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 speed pulley 8 which permits of imparting the 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 rotating in the bush 11, under the action of a suitable control, which puts it in a very quick rotation. This bush 11 is rigid with a sector 12, which may turn about a pivot 13 corresponding to the center of the torus surface which is to be finished on the work-piece 7. This pivot is provided with a plate 14, against which may slide a sector 12. The plate 14 is formed by the upper part of a column 15, the lower end of which is pivotally mounted or linked at 16 on the fixed support 1. A finger 18 projecting laterally from the column 15 permits of regulating the position of this column by means of the adjusting screw 19, and its locking is effected by means of the handle 20 provided with the 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, engaged within a semi-circular groove 22 of the sector 12.

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

The puppet 4, on which the work-piece 7 is mounted and which, as previously stated, may pivot on the fixed shaft 3, carries at its basis 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 the support 28 and capable of longitudinally sliding without any rotation. A snug 29 provided on the support 26 engages with a longitudinal groove 30 of the rod 27. The end of this rod 27 is provided with threads and this threaded portion is engaged with the corresponding interior thread of the hollow rod 31, placed in alignment with the rod 27. The hollow rod 31 is rotatably mounted in the support 32, without being able of any 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 the embodiment shown, the fork 25 is raised up and thus the arm 24 pivots upwards, imparting to the puppet 4 the corresponding inclination and consequently a progressive movement of the work-piece towards the tool. The displacement of the ramp 26 which is rigid with 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 the means described hereafter.

On the other end of the rod 31, a disc 33 is keyed and rigid with a ratchet wheel 34, which on its 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 linked on the end of a lever 37, pivoting on a horizontal arm 38 of the fixed support 38. 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 control. Thus, a rotatory movement is imparted to the hollow shaft 31.

The machine described hereinbefore works in the following manner:

The tool-holder 11 being fixed on the plate 14 by the said means and with the suitable inclination so as to give to the tool the position, which corresponds to one of the circles of the bi-tangential section, the work-piece 7 and the tool 9 are put in rotation by their respective control. At the same time, the control 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 puppet 4 in the said manner and causes the automatic displacement of the work-piece upon the tool. A cover

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 the tightening button 35. The different parts of the machine may be brought back to their starting position by means of the 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 to be employed must then work along the outside of the circle (section of the torus through the bi-tangential plane, this tool being materialized by the exterior of a disc, for a example.

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 the inner bearing ring, Fig. 6). The tool to be employed must then work from the inside of the section circle and will be materialized by the interior of a washer, for example.

(b) The surface to be obtained is overlapping the said cylinder (case of the groove of a ball abutment ring, Fig. 7). The tool must then work laterally to the section circle and may be materialized by a tube or pipe, working by its end.

This invention is not limited to the embodiment described and represented on the accompanying drawings. Instead of a pivoting movement, for example, the displacement of the different parts may be realized by a sliding movement.

EMILE FRANÇOIS LOUIS BEDUNEAU.