May 8, 1951 A. W. KLOMP 2,552,284

GRINDING MACHINE

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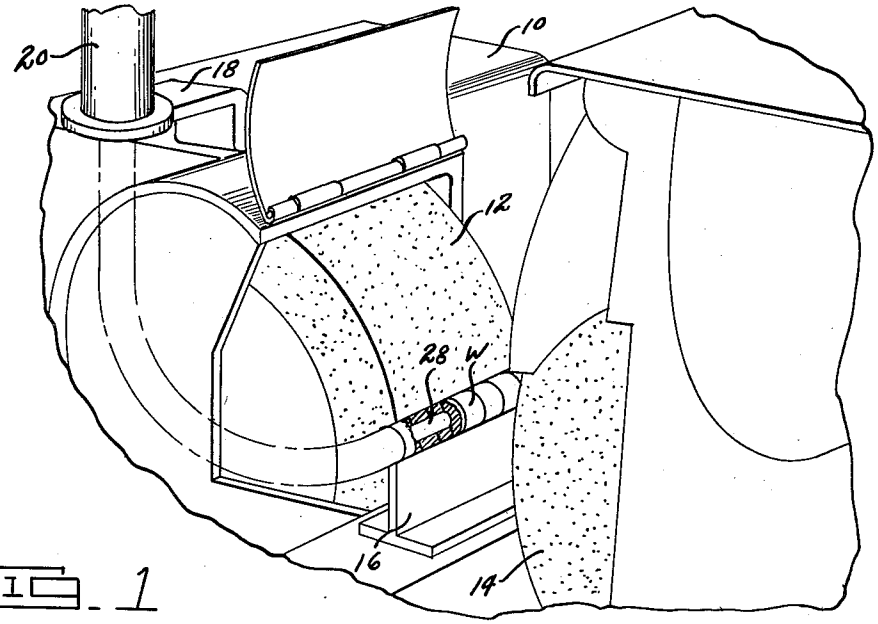

FIG. 1

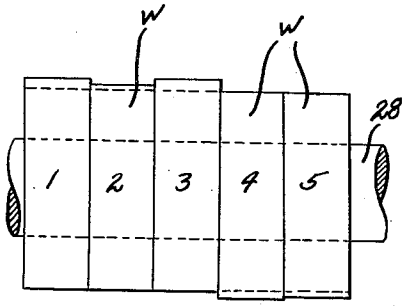

FIG. 2

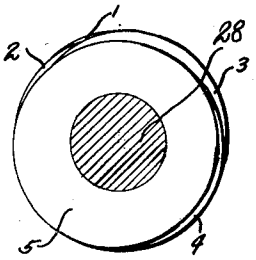

FIG. 3

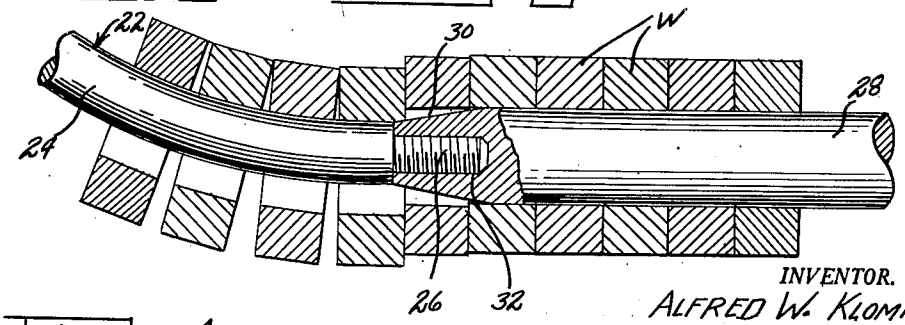

FIG. 4

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GRINDING MACHINE

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1 Claim. (Cl. 51—103)

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This invention relates to finish grinding and more particularly to centerless grinding of work pieces having concentric inner and outer surfaces which are finished to precision.

In the finish grinding of cylindrical objects it is common practice to pass the object between a rotating regulator wheel and a rotating grinding wheel with the object on a work rest. This operation grinds the outer periphery of the object to a finished diameter determined by the radial spacing of the regulator wheel with reference to the grinding wheel. This grinding is generally accepted for parts where the accuracy of the outer periphery and its diameter is of primary importance but by such a method slight importance is given to the outer periphery of the part with respect to its true location relative a predetermined axial dimension.

Often, it is required to grind cylindrical parts having a finished inner peripherial surface and a finished outer peripherial surface, which surfaces are to be concentric within great accuracy. This requires positioning one of the surfaces in a definite location with respect to the other surface during the grinding operation.

The present invention is directed primarily to a means and method of accomplishing a grinding operation which will produce accurately ground inner and outer cylindrical surfaces which are concentric with respect to each other by the centerless grinding method.

It is an object of the present invention to provide a machine, of the centerless grinding type, in which the parts progress through the grinder on a floating arbor during the grinding operation.

Another object of the invention is to progressively pass a plurality of parts through the machine in juxtaposition and to grind a multiplicity of the parts, simultaneously, on a single floating arbor.

A further object of the invention is to provide a sectional arbor which may be disassembled for replacing a portion of the arbor when it becomes worn, to maintain accuracy.

More specifically stated, the invention relates to a method of accurately finishing an inside diameter of a part, passing it over a floating arbor, which accurately fits the inner diameter, and grinding the outer periphery of the part, by the centerless grinding method.

Other objects and advantages of the invention will more fully appear from the following description, taken in connection with the accompanying drawings in which:

Fig. 1 is a perspective view of a fragmentary

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portion of a conventional centerless grinding machine showing a feeding means and the arbor for the work, parts of which are broken away and in section;

Fig. 2 is a fragmentary, side elevational view of an arbor, supporting a plurality of unfinished work pieces, the inaccuracies being exaggerated for the purpose of clarity;

Fig. 3 is an end view of Fig. 2; and

Fig. 4 is a fragmentary side view of the arbor at its point of separation, partly in section, with work pieces thereon shown in section.

In illustrating the invention I have shown a portion of a conventional centerless grinding machine having a body portion 10, regulating wheel 12, and grinding wheel 14; it being understood that the regulator wheel and grinding wheel are rotatably driven as is common in machines of the centerless grinding type. A rest 16 is shown between the two wheels, 12 and 14, for supporting and guiding the work during the grinding operation.

I have provided the body portion 10 with a bracket 18 which supports a hopper 20 into which the work pieces are arranged for continuously feeding into grinding position.

The parts which I have selected to be ground, as illustrating the invention, are shown as bushings, washers, sleeves, or the like, having a central opening through which extends an arbor or guide from the hopper 20 to and through the working position of the grinding operation. The hopper 20 is shown in a vertical position so that the parts may be fed, by gravity, from the hopper to the grinder, normally arranged to grind the parts while rotating on a horizontal axis. The path of travel is shown on a curved portion of the arbor, from a vertical plane to a horizontal plane.

The arbor 22 comprises two sections. One section 24 has a diameter less than the inner diameter of the work piece and is curved; this permits the pieces to freely travel along the arbor and to move from one plane to a plane at right angles thereto. The end of the section 24 is provided with a screw threaded stud 26 of less diameter than the diameter of the section 24 for receiving the arbor section 28. The section 28 has a diameter substantially equal to the inner diameter of the work piece but permitting a relative sliding fit. The end of the arbor section 28 adjacent the section 24 has its outer periphery tapered as at 30 to provide a smooth guide from the small diameter portion of the section 24 to the larger diameter section 26. The end of the

section 28 adjacent the section 24 is provided with a screw threaded opening 32 which is screw threaded on the stud 26. The opposite end of the section 28 is free and unsupported so that it is permitted to float.

The work pieces are rough finished and the inner periphery of the opening is finished to size. The pieces are then placed in the hopper 20 and threaded on the arbor 22 where they are guided to the arbor section 28 into the grinding position for the outer peripherial surface.

In Figs. 2 and 3 I have illustrated the work pieces W arranged on the arbor section 28. The outer peripheries of the pieces are shown eccentric to the inner peripheries of the pieces; the latter being concentric because they are held coaxial by the accurately fitting arbor section 28. I have designated these pieces as 1, 2, 3, 4 and 5 and have shown the eccentricity exaggerated. Also the pieces have not been shown true to size as, for example, piece 3 has a larger outer diameter than piece 2.

Since it would be practically impossible to arrange the eccentricity of the pieces uniformly on the arbor section 28, that is, so that the major axes of the eccentric portions were on the same side of the arbor axis, the axis of the arbor is concentric with a mean outer peripherial diameter of the several pieces.

As the pieces are passed between the grinding wheel and the regulator wheel along the floating arbor, the high points of the eccentric pieces are reduced to the mean diameter and since the arbor is floating the axis of the arbor, and consequently the axes of the inner diameters, is maintained concentric with the mean diameter or the finished diameter of the work piece.

From the above it will be apparent that I have provided a means and method of rapidly and accurately producing concentric diameters by the centerless grinding method.

While I have shown and described one specific embodiment of my invention, it is to be understood that various changes including the type of machine used in carrying out the invention, the size and arrangement of surfaces worked upon, may be made without departing from the spirit of my invention and it is not my intention to limit its scope other than by the terms of the appended claim.

I claim:

A grinding machine comprising a regulator wheel, a grinding wheel having its axis radially opposed to the axis of said regulator wheel, a hopper for receiving apertured work pieces, and an arbor associated with said hopper for receiving the work pieces from said hopper, said arbor extending from said hopper through a point between the axes of said wheels and having that portion between said wheels free for radial movement.

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