

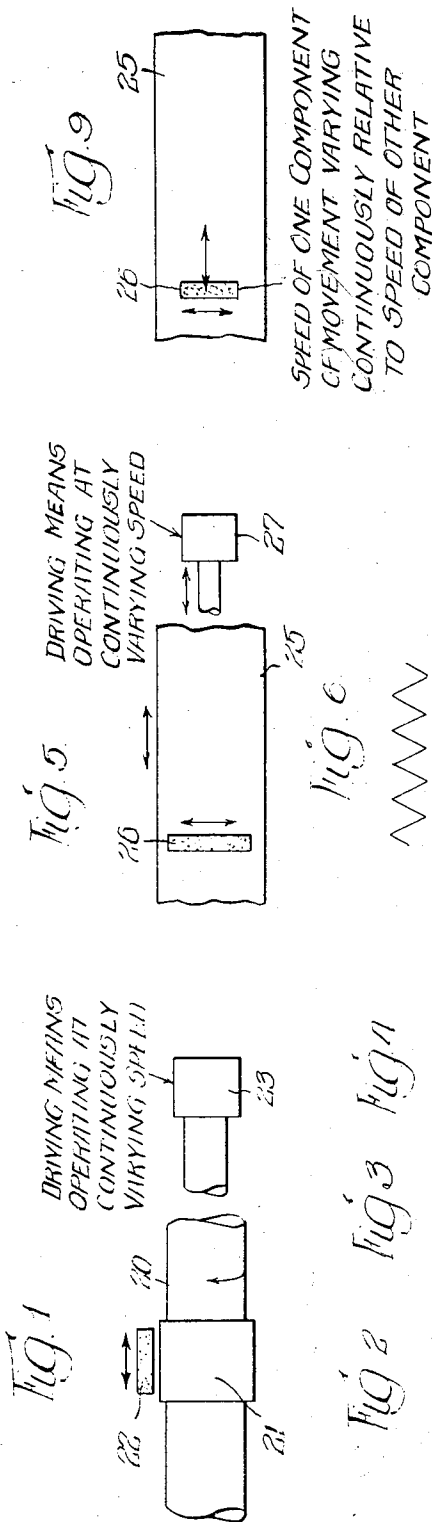
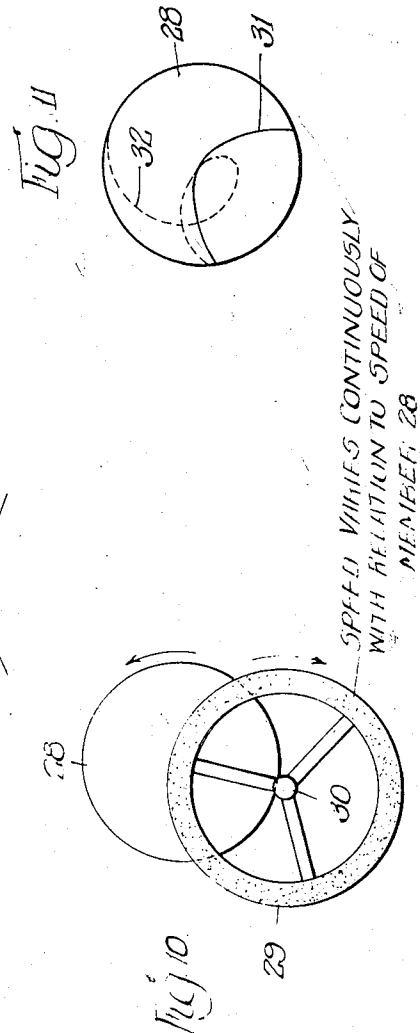
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W. H. FOSTER ET AL

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SURFACE FINISHING

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Inventors:
William H Foster,
Levi D Tyson,

By Wilkinson, Hargreaves, Byron & Knight,
ATTORNEYS

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SURFACE FINISHING

William H. Foster and Levi D. Tyson, Elkhart, Ind., assignors to Foster Machine Company, Elkhart, Ind., a corporation of Indiana

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The present invention relates to improvements in surface finishing.

According to certain modern methods which are in use for finishing surfaces, a finishing stone or the like is applied to the surface of the member to be finished, relative movement being provided between said members. By way of example, if a rotary movement is communicated to the member to be finished, a reciprocatory movement might be communicated to the finishing stone, the direction of reciprocation of said stone being different from the direction of surface movement of the member to be finished. Citing a simple example: If a cylindrical surface is to be finished, the finishing stone might be given a movement of reciprocation in a direction parallel with the axis of said cylindrical surface. If the member to be finished is of a nature such that it may not be conveniently moved, the movements of the finishing stone are controlled in such a manner that they have components in a plurality of directions out of parallelism with each other. In other words, the abrasive action of the stone should be such that the abrasions criss-cross each other at a multiplicity of points, reducing the possibility of grooving. It is desirable in producing the finish above referred to, considering any particular particle on the surface of the finishing stone, that said particle shall not retrace its path over the surface to be finished, or at least that the number of such retracings shall be minimized.

An object of the present invention is to provide improved means and an improved method for finishing surfaces, whether they be flats or curved surfaces of constant radii or of variable radii, which finishing will be accomplished without retracing the path of the finishing stone with respect to the surface being finished.

A further object is to provide a means and a method for finishing surfaces which is simple and expeditious.

A further object is to provide a means and method for finishing surfaces in which the ratio of relative speeds of movement between the finishing stone and the surface to be finished is continuously varied, to the end that the retracing of any portion of the path of the finishing member with respect to the surface to be finished will be avoided.

A further object is to provide a means and a method for finishing surfaces well adapted to meet the needs of commercial service.

Further objects will appear as the description proceeds.

Referring to the drawing, certain sketches are embodied therein illustrating the principles of the present invention as applied to certain types of surface which have been chosen by way of example. In said drawing—

Figure 1 shows a cylindrical member having a finishing stone in cooperative relationship with the exterior surface thereof, together with means for driving said cylindrical member at a continuously varying speed;

Figure 2 is a plat illustrating the path of a particle on the contacting surface of the finishing stone with respect to the surface of the cylindrical member at a certain speed of rotation of said cylindrical member;

Figure 3 shows a corresponding plat for a higher speed of rotation for said cylindrical member;

Figure 4 shows a corresponding plat for a still higher speed of rotation of said cylindrical member;

Figure 5 illustrates a member to be finished having a flat surface, and a stone for finishing said flat surface, said member and said stone having reciprocatory movements, together with means for continuously varying the speed of reciprocation of the member to be finished.

Figures 6, 7 and 8 are plats in connection with the structure of Figure 5, representing the path taken by a particle on the surface of the finishing stone with respect to the surface to be finished at different ratios of relative speed between said stone and said surface;

Figure 9 is a figure illustrating the applicability of the present invention to a stationary surface, the finishing stone being provided with compound movements of reciprocation, the speed of one of the components of said movement being continuously varied relative to the speed of the other of said components;

Figure 10 illustrates a member having a surface which may be the crowned face of a valve tappet, together with an annular stone for finishing said surface; and

Figure 11 shows the surface of the valve tappet of Figure 10 with two curves traced thereon, one in full lines and one in broken lines, illustrating the paths of a particular particle on the surface of the finishing stone with respect to the corresponding surface of the valve tappet at two different ratios of rotative speeds of said stone and said tappet.

Referring first to Figures 1 and 2 inclusive, the numeral 20 indicates a rotating cylindrical member having the cylindrical surface 21 which is to

be finished. The numeral 22 indicates a finishing stone which in practice will be spring-pressed toward the cylindrical surface 21, the face of the stone 22 being shaped to conform to said cylindrical surface 21. As indicated by the double-pointed arrow adjacent to the member 22, said member 22 is adapted to have a reciprocatory movement in a direction parallel with the axis of the rotating cylinder member 20. The numeral 23 indicates a driving means for the cylindrical member 20, which driving means is adapted to drive said cylindrical member 20 at continuously progressively varying speeds. In other words, according to the present invention, the ratio between the surface speed of the reciprocating member 22 and the speed of the surface 21 is continually and progressively varied during the finishing operation. Assuming a constant speed of reciprocation of the stone 22 and a predetermined speed of the surface 21, a particular particle on the surface of the stone 22 will trace a path on the surface 21 approximating the plat appearing in Figure 2. Assuming that the speed of rotation of the cylindrical member 20 is continuously progressively varied, the path of travel of any particle on the contacting surface of the stone 22 will vary with respect to the surface 21. Figures 3 and 4 show plats at different surface speed ratios between the stone 22 and the surface 21. It will be clear that by reason of the continuous progressive variation in the ratio between the speeds of the stone 22 and the surface 21, there will be no retracing of the path of contact therebetween while this variation in relative speeds is progressing in one direction. Accordingly, the finishing of the surface 21 will be accomplished simply and expeditiously.

Referring now to Figures 5, 6, 7 and 8, the applicability of the present invention is illustrated in connection with a flat surface to be finished. A member having a flat surface is indicated by the numeral 25, and a stone for finishing said surface is indicated by the numeral 26. Said member 25 may be given a reciprocatory movement, say—in a horizontal direction as the parts are viewed in the drawing, whereas the stone 26 may be given a reciprocatory movement in a vertical direction. The numeral 27 indicates a driving means for the member 25, which operates at continuously progressively varying speeds. At a certain ratio of surface speeds the path of any particle on the stone 26 with respect to the surface of the member 25 may be represented by the plat appearing in Figure 6. According to the present invention this ratio of surface speeds is continuously and progressively changed. Figure 7 represents the path at a higher relative speed, and Figure 8 represents the path at a still higher relative speed.

In Figure 9 the member 25 to be finished may be held stationary, and the finishing stone 26 will be given a compound movement which has components of reciprocation both vertically and horizontally as the parts are viewed in the drawing. According to the present invention, the ratio of speeds between the vertical component and the horizontal component will be continuously and progressively varied, whereby the path of relative movement between the finishing stone 26 and the surface of the member 25 will be continually varied and no portion of the path of the finishing stone relative to the member 25 will be retraced.

Referring to Figures 10 and 11, the numeral 28 indicates a rotating member having a surface

generally normal to the axis of rotation. The member 28 may be a valve tappet such as used in motor cars, and may have a crowned surface. The numeral 29 indicates an annular stone which overlies a portion of the surface of the tappet 28. As indicated by the arrows, the tappet 28 and the stone 29 may rotate in opposite directions. The shaft 30 of the rotating stone 29 will be provided with driving means, the speed of which may be continuously and progressively varied. Considering a particle on the finishing surface of the annular stone 29, the full line 31 may be said to approximate the path of such a particle at a certain ratio between the speed of rotation of the tappet 28 and the speed of rotation of the annular stone 29. The broken line 32 may be said to approximate the path of such a particle at a higher speed of rotation of the tappet with respect to the speed of rotation of the stone 29.

It will be understood, of course, that instead of progressively and continuously varying the speed of the surface to be finished, the speed of the finishing stone may be continuously and progressively varied. A few examples of the applicability of the present invention have been chosen for illustration, and they will, it is thought, be sufficient to indicate to those skilled in the art the principles of the present invention. There are, of course, many other applications, too numerous to recite. However, the examples chosen illustrate the advantages of continually and progressively varying the ratio between the surface speed of the member to be finished and the speed of the finishing stone during the finishing operation, to the end that criss-cross abrasive action is had between the finishing stone and the surface to be finished without the retracing of any portion of the path of contact. It is preferred, according to the present invention, to vary the relative speeds increasingly, so that the stone, while operating at the lower relative speeds, will remove a portion of the stock, and as the relative speed of the stone with respect to the surface to be finished is increased, the finish is improved and the stock removal becomes infinitesimal. It will be understood, of course, that if for any specific purpose it is desired to modify the progression in the ratios of speed between the member to be finished and the finishing stone, it may be done without departing from the present invention. For example, the variations in the speed ratios may be uniformly continuous or non-uniformly continuous.

Though the present invention has been described in connection with the finishing of a plurality of types of surface, its applicability to other types of surface will be appreciated by those skilled in the art. It is intended to cover all modifications that fall within the scope of the appended claims.

What is claimed is—

1. The method of finishing a surface of a member with a finishing utensil which consists in communicating positive movements to said member and to said utensil, the direction of contact surface movement of said utensil being continually different from the direction of contact surface movement of said member, the ratio between the speeds of surface movements of said member and said utensil being continually and progressively varied.

2. The method of finishing a surface of a member which consists in applying a finishing utensil thereto, providing relative movement between said utensil and said member, which move-

ment has reciprocatory components in at least two directions, and continuously progressively varying the ratio of speed between said components during the finishing operation.

3. The method of finishing a surface which consists in applying a finishing utensil to said surface and providing a continuously progressively varying ratio of relative speeds between said surface and said utensil in a criss-cross path.

4. The method of finishing a surface of a member with a finishing utensil which consists in communicating positive movements to said member and to said utensil, the direction of contact surface movement of said utensil being continually different from the direction of contact surface movement of said member, the ratio between the speeds of surface movements of said

member and said utensil being continually and progressively increased.

5. The method of finishing a surface of a member which consists in applying a finishing utensil thereto, providing relative movement between said utensil and said member, which movement has reciprocatory components in at least two directions, and continuously progressively increasing the ratio of speed between said components during the finishing operation.

6. The method of finishing a surface which consists in applying a finishing utensil to said surface and providing a continuously progressively increasing ratio of relative speeds between said surface and said utensil in a criss-cross path.

WILLIAM H. FOSTER.
LEVI D. TYSON.