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1,539,742

H. F. JOSEPH

METHOD OF GRINDING

Filed May 15, 1923

Fig. 1.

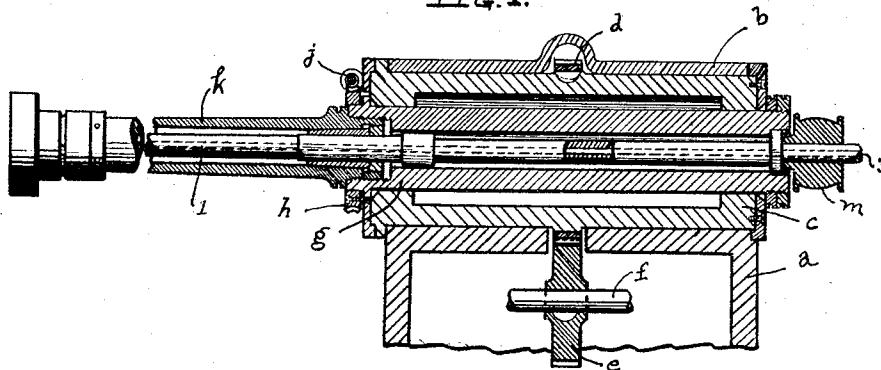


Fig. 2.

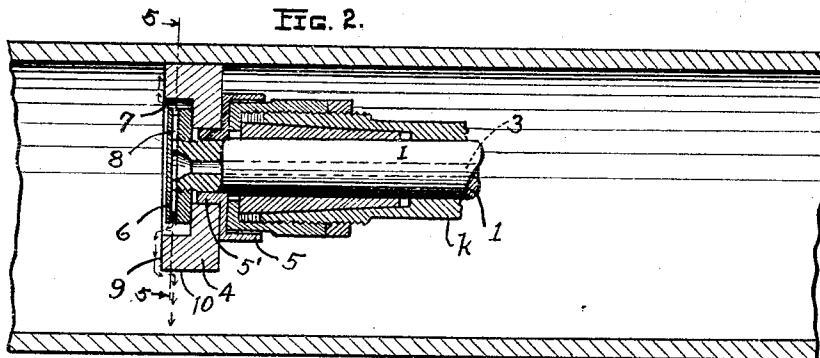


Fig. 3.

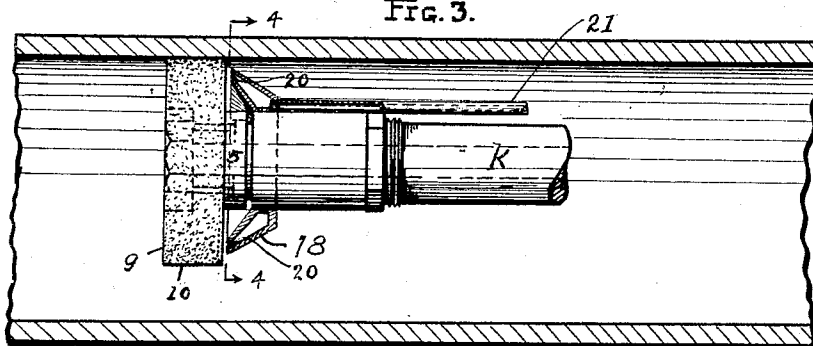


Fig. 4.

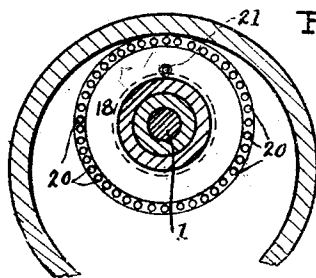
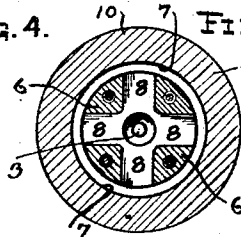


Fig. 5.



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METHOD OF GRINDING.

Application filed May 15, 1923. Serial No. 639,141.

To all whom it may concern:

Be it known that I, HARRY F. JOSEPH, a citizen of the United States, residing at Davenport, in the county of Scott and State of Iowa, have invented a certain new and useful Improvement in Methods of Grinding, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to a method of wet grinding and more particularly to a method for the internal grinding of cylinders and the like.

An object of the invention is to provide a process for grinding in which a liquid is used to forcibly wash the sediment and grindings from the sides of the cylinder and carry them out, so that a clean surface of the metal is always presented to the grinding wheel, and also to cool the surface to be ground.

A further object of the invention is to provide means whereby a continuous stream of liquid may be projected upon the surface being ground, whereby the usual advantages of wet grinding as practiced on grinding external surfaces may be obtained.

In the grinding of cylinders internally it is customary to rotate a suitable spindle carrying a grinding wheel at the proper speed so that the speed between the contacting portion of the wheel and the cylinder is suitable for the character of the work and wheel, as is well understood in the art. In addition, the wheel is smaller in diameter than the work and the spindle is mounted eccentrically in a drum to give it a movement in an orbital path around the work so that only a small portion of the wheel and work are in actual contact at any one instant and the contacting portion moves in a cylindrical path around the inside of the cylinder. In addition to these movements, the cylinder or the spindle is moved longitudinally one with respect to the other so that for a given setting a uniform amount of material may be removed throughout the length of the cylinder.

In carrying out my process it is desirable to project liquid against the cylindrical wall to be ground preferably in the circumferential path of the grinding wheel so that the surface of the metal just ahead of the contacting portion of the wheel and cylindrical wall will always be clean. Sufficient liquid

should also be used not only to clean progressively directly in front of the wheel but to flush out of the cylinder all of the sediment or material formed in the grinding operation so that there will be no tendency for the wheel to load by filling in the spaces between the grains of abrasive and thus prevent a good cutting action, which is desirable to obtain a substantially true cylindrical recess.

In the accompanying drawings are disclosed two embodiments of my invention for accomplishing these purposes.

In the drawings,

Figure 1 is a vertical longitudinal sectional view taken through the spindle and the operating mechanism.

Fig. 2 is a fragmentary section of the spindle mounted within a cylinder.

Fig. 3 is a similar view of a modified form in which the liquid is carried outside the spindle.

Fig. 4 is a section on line 4—4, Fig. 3.

Fig. 5 is a section on line 5—5, Fig. 2, showing the baffle construction.

The invention is shown in connection with a machine for internal grinding of the general type shown in my Patent No. 1,396,123. The machine frame or support *a* has a cylindrical portion *b* in which is rotatably mounted the drum *c*. The drum *c* has an external gear *d* in mesh with the gear *e* of the drive shaft *f* and is thereby constantly rotated. Journaled in the drum *c* is an eccentric sleeve member *g* having a worm wheel *h* fixed to one end which meshes with a worm *j* carried by the drum. A tubular spindle housing *k* is rigidly secured within an eccentric bore in the ends of the sleeve *g* and extends parallel with the axis thereof. The sleeve member *g* may be adjusted by the worm *j* to vary the eccentricity of the spindle housing *k* with respect to the drum. Within the spindle housing *k* is a tubular spindle *l* preferably composed of a plurality of sections independently mounted for rotation therein. The spindle *l* is driven through the pulley *m* by any suitable driving means, not shown.

With this mechanism the spindle housing is given an orbital movement and the spindle is independently rotated within the housing, as is commonly understood in the art.

It is also common to cause a relative longitudinal movement between the grinding

wheel and the work as by mounting the work upon a movable table which is reciprocated forward and backward with respect to the grinding wheel (an example of which is shown in my previously mentioned patent), or by mounting the grinding wheel spindle and its operating mechanism on reciprocating mechanism. My process may be carried out by either of these constructions (not shown), it being only necessary that there be a relative longitudinal movement between the work and the grinding wheel.

The spindle 7 is hollow, having a passage 3 therethrough for conducting liquid to the grinding wheel 4. The protective cap 5 is secured to turn with the spindle 7 and receives on its hub 5' the grinding wheel 4. The wheel is securely clamped to the spindle to turn therewith by a nut 6 which is located within the recessed portion of the wheel 7. The nut 6 has radial passages or ducts 8 therethrough, the inner ends of which are in communication with the spindle 3 so that liquid coming through the spindle is discharged into the ducts and radially outwardly against the walls of the recess in the grinding wheel. When the spindle is rotated at a suitable grinding speed, the centrifugal force imparted to the liquid discharged from the ducts 8 causes the liquid to be carried over the face 9 of the wheel and around to the cutting edge 10 of the wheel from which it is discharged radially outwardly against the work substantially in a plane through the wheel.

In Figure 3 is shown a device for carrying the water outside the spindle to project it against the cylindrical wall in or adjacent the plane of the grinding wheel so that the liquid is forced circumferentially around the cylinder wall and in the plane of the grinding wheel, thus keeping the cylinder wall clean continuously in front of the contacting portions of the grinding wheel and cylinder. A flaring nozzle 18 is carried by the housing 16 in which the spindle 15 rotates, the grinding wheel 17 being suitably secured thereto in any desired manner. The nozzle 18 has an annular series of perforations 20 around the periphery to project liquid against the work adjacent the plane of the wheel, the supply pipe being indicated at 21.

It will thus be seen that in either of the above methods for projecting liquid against the surface of the cylinder the grinding wheel itself and the surface of the cylindrical wall are continuously washed progressively ahead of the portion of the grinding wheel in contact with the wall, freeing it of all sediment and loose material. In addition, the presence of the liquid during the grinding operation produces a relatively smoother, polished surface, which is of course very desirable for cylinders in internal combustion

engines in that there is less friction and less wear between the pistons and cylinder walls.

The subject matter of the process common to both the forms of construction shown in Figs. 2 and 3 for conducting liquid to the grinding wheel and projecting it outwardly against the wall of the cylinder is broadly claimed in my divisional application Serial No. 657,891, filed Aug. 17th, 1923, which application also includes claims involving the process carried out by the construction shown in Fig. 2.

In normal cylinder grinding the velocity of the grinding wheel is relatively so high compared to the orbital movement of the wheel that the liquid is caused to flow around the surface of the cylinder at a velocity many times greater than the orbital movement of the wheel. The surface, therefore, of the work just in front of the path of the contacting portion of the wheel and work is thoroughly washed clean. Also, fresh, clean liquid is present just behind the wheel ready to be carried by the cutting surface of the wheel across the work, thus enabling the wheel to produce the improved quality of surface generally known to be obtained by wet grinding as frequently used for grinding the outside or external surfaces of objects.

As the liquid is projected with such force and velocity against the surface of the work, it continually forms a rotating layer of liquid which rotates around the cylinder in the same direction as the orbital movement of the wheel. The incoming stream of liquid at high velocity spreads and flows outwardly along the cylinder wall and transversely across the spiral path of the contacting operation of the grinding wheel and cylinder wall keeping the cylinder wall clean for the grinding action of the wheel.

It will also be noticed that the liquid may be projected in any suitable manner so that it hits the wall of the cylinder and spreads and flows therein transversely across the path of the wheel to clean the surface.

While it seems preferable to project the water in the plane of the grinding wheel and progressively in front of it as relative movement between the work and wheel occurs, it is obvious that the liquid may be projected against the surface of the cylinder adjacent the wheel either forwardly or rearwardly and in any sufficient quantity to continuously flow across the path of the wheel, thus keeping the surface of the cylinder and wheel relatively clean progressively in front of the contacting portions, my purpose will be accomplished.

Any suitable liquid such as water or cutting compounds may be used, it being desirable of course to choose a liquid which will preserve the cutting qualities of the wheel

and prevent glazing or dulling of the abrasive particles in the wheel.

Attention is also directed to the fact that the presence of the liquid in the cylinder, as above described, does more than to simply keep the work cool during the grinding operation. It seems to act as a lubricant and produces a relatively smooth surface which is substantially true and which is highly desirable for cylinders for internal combustion engines and the like.

Furthermore, it is to be understood that the particular forms of apparatus shown and described, and the particular procedure set forth, are presented for purposes of explanation and illustration and that various modifications of said apparatus and procedure can be made without departing from my invention as defined in the appended claims.

What I claim is:

1. The process of grinding cylinders, which comprises rotating the spindle carrying a grinding wheel, at relatively high speed in said cylinder, causing a relative orbital and longitudinal movement between the wheel and the cylinder, conducting liquid into the cylinder and outside the grinding wheel spindle and delivering it at a plurality of points against the face of the grinding wheel, thereby causing the liquid to be projected against the surface of the cylinder continuously in the same direction as the rotation of the grinding wheel and at a relatively higher speed than said orbital movement, and causing said liquid to spread transversely across the orbital path of the wheel.

2. The process of grinding cylinders, which comprises rotating the spindle carrying a grinding wheel, at relatively high speed in said cylinder, causing a relative orbital and longitudinal movement between the wheel and the cylinder, conducting liquid through a duct outside the spindle and forcibly projecting the liquid against the internal surface of the cylinder at a velocity relatively higher than the said orbital movement of the spindle and in a plane substantially parallel to the plane of the grinding wheel, and thereby causing said liquid to continuously spread transversely across the path of the contacting portion of the grinding wheel and the wall of the recess.

3. The process of grinding cylinders which comprises rotating a spindle carrying a grinding wheel at a relatively high speed in said cylinder, causing a relative orbital and longitudinal movement between the wheel and cylinder, conducting liquid through a duct outside the spindle and forcibly projecting the liquid against the internal surface of the cylinder at a velocity relatively higher than said orbital movement of the spindle in such manner as to cause the liquid to rotate around said cylinder in the same direction as the orbital movement of the spindle and continuously spread transversely across the path of the contacting portion of the grinding wheel and the wall of the recess.

In testimony whereof, I hereunto affix my signature.

HARRY F. JOSEPH.