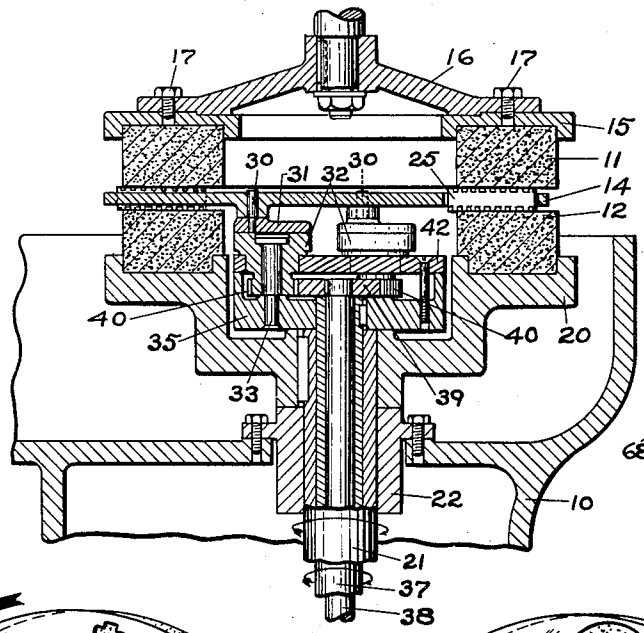
May 19, 1931. S. PLAYER ET AL 1,805,955

METHOD OF AND APPARATUS FOR DRESSING ABRASIVE LAPS

Filed March 29, 1929

Fig. 1



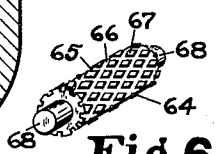


Fig. 6

Fig. 4

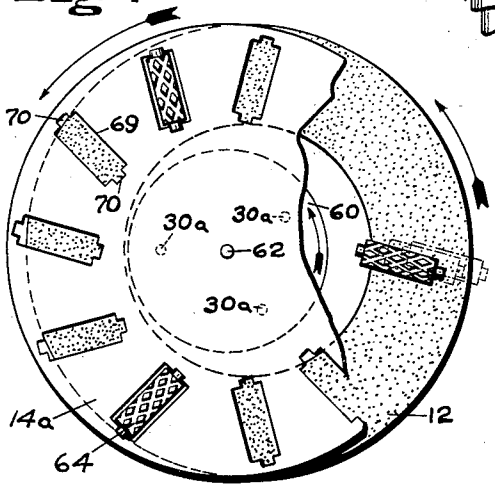
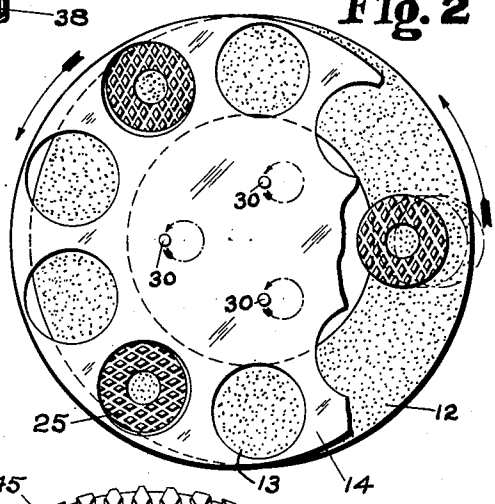


Fig. 2



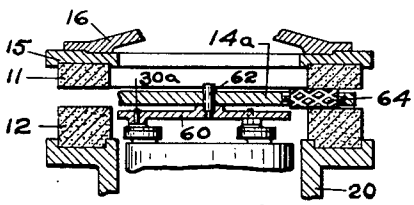


Fig. 5

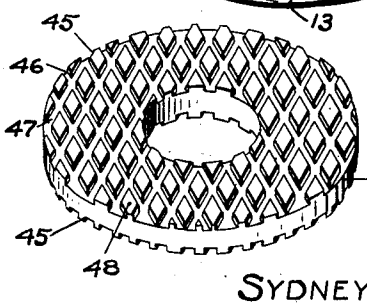


Fig. 3

WITNESSES

Edward H. Goodrich.

Daryl M. Kayt

Inventors

SYDNEY PLAYER

HERBERT S. INDGE

By Clayton R. Jenks

Attorney

Patented May 19, 1931 1,805,955

UNITED STATES PATENT OFFICE

SYDNEY PLAYER AND HERBERT S. INDGE, OF WESTBORO, MASSACHUSETTS, ASSIGNORS TO NORTON COMPANY, OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

METHOD OF AND APPARATUS FOR DRESSING ABRASIVE LAPS

Application filed March 29, 1929. Serial No. 350,966.

This invention relates to lapping machines and more particularly to a method of and an apparatus for dressing the laps of a lapping machine of the type which has two opposed plane faced abrasive laps and a revoluble work cage therebetween carrying a multiplicity of duplicate work pieces.

In the use of a lapping machine of the type shown in the patent to Indge No. 1,610,527 a considerable problem is involved in keeping the faces of the laps in proper condition for the lapping operation. These laps, for rapid production work, are often made, similar to a grinding wheel, of abrasive grains bonded together by a vitrified ceramic material. Such a body wears under the continued stresses of the lapping operations and the lapping faces lose their shape and become dull and glazed due to the abrasive grains upon the surface losing their cutting edges and the spaces between the adjacent grains becoming filled with foreign materials. Continued usage may also leave markings upon the laps or wear them out of a true plane as is required for the very exacting operation of lapping duplicate work pieces. Thus the necessity frequently arises for dressing or truing the surface of the abrasive laps.

In accordance with this invention, it has been found that the laps may be kept in satisfactory shape for a considerable time if the laps are periodically dressed by a small dressing tool having a cutting face capable of cutting away the operative faces of the laps to present new lapping surfaces and which is moved over the faces of the laps in such an irregular path that it will ultimately contact with every portion of their operative faces.

It is accordingly the primary object of this invention to provide a method of dressing the adjacent faces of two abrasive laps and to accomplish this simply and easily without necessitating the removal of the work cage from the machine or otherwise seriously interfering with the lapping operation which is being carried on.

A further object is to provide a dressing device which may be utilized with lapping machines of standard design and construction without the necessity of employing any other mechanism or of changing the operation of the machine other than that of removing the work pieces and inserting the dressing devices in their places.

With these and other objects in view as will be apparent to one skilled in the art, this invention resides in the steps of the method of dressing the lapping disks and in the combination of structural parts as herein set forth and as covered by the claims appended hereto.

Referring to the drawings, in which like reference numerals indicate like parts:

Fig. 1 is a fragmentary sectional view of a lapping machine showing a mechanism for creating a lapping motion and tools in position to dress the laps;

Fig. 2 is a fragmentary plan view showing the work cage containing several dressing tools positioned upon the lower lap;

Fig. 3 is a view in perspective, showing a disk-shaped dressing tool;

Fig. 4 is a fragmentary plan view of a modification showing the work cage containing several cylindrical shaped dressing tools positioned upon the lower lap;

Fig. 5 is a fragmentary sectional view showing a method for driving the work cage when a cylindrical dressing tool is used; and

Fig. 6 is a view showing the cylindrical dressing tool.

In accordance with this invention, it has been found feasible to dress the surfaces of two opposed abrasive laps by means of a dressing tool provided with a multiplicity of cutting faces or teeth which is so constructed that it may be placed between the laps and moved relative thereto. This tool is preferably so shaped that it may be loosely and rotatably mounted in a work receiving opening of the work cage and project therethrough into contact with the abrasive laps and thereby not requiring the aid of any extraneous mechanism for giving it a cutting motion. If the upper lap is freely floating, then three or more of the dressing tools are placed within the cage to support it. The dressing tool may be a flat metal plate which abrades by a sliding action or a cylindrical or other rotatable body which is arranged

to cut the laps as it slidably rotates therebetween. The work cage in a lapping machine of the type herein referred to is customarily given a non-repeating break up motion through a long cycle; that is, a piece of work travels from the outer peripheral edge of the laps to the inner edge as it revolves and does not return to exactly the same position until it has passed through a considerable number of revolutions, thereby insuring even wear on the abrasive laps. Similarly, when a dressing tool is placed in the work cage, replacing a piece of work, it will pass through the same cycle as would the piece of work and will gradually dress and true the entire surfaces of both laps due to the irregular motion through which it is carried.

Referring to the drawings, the application of this invention to a lapping machine of the type as shown in the patent to Indge No. 1,610,527 has been illustrated. This machine as shown in Figs. 1 and 2 is primarily intended for lapping flat work and comprises a base 10 suitably supporting two abrasive laps 11 and 12 which are arranged with their flat faces opposed to each other. The work pieces are mounted in openings 13 in a cage 14 and the lapping operation is caused by moving the work cage and the laps relative to one another. In machines of this type, either or both of the laps may be stationary or rotatable, and for certain types of lapping machines the cage may be loosely mounted between the laps if the latter are given a proper motion to cause a lapping operation. In the form illustrated, the upper lap may be either rotated or stationary and the lower lap is shown as rotated in the direction indicated by the arrow in Fig. 2 and the cage is given a peculiar motion of revolution as well as one of rotation about a center which moves in a path eccentric to the centers of the two opposed laps. The construction of one form of driving mechanism for these associated parts is fully set forth in said patent to Indge No. 1,610,527 but for the sake of clarity of illustration, certain features thereof are here shown.

As illustrated, the two laps each comprise abrasive bodies which may be composed of abrasive grains bonded together by vitrified ceramic material and these are suitably supported in driving heads. The upper abrasive lap 11, which is an annular body, may be suitably cemented in a plate 15 which is loosely suspended from the driving head 16 by means of the cap screws 17 which fasten into the plate 15 and pass loosely through holes in the driving head. The lower abrasive lap 12 is similarly an annular member of ceramic bonded abrasive material supported in the driving head 20 within which it may be suitably cemented or otherwise fastened. The driving head 20 is keyed to the sleeve 21 which is rotatably mounted in the bearing 22 suitably supported on the frame 10, and it is given a motion in the direction of the arrow by any suitable driving mechanism, such as shown in the above mentioned patent to Indge. The driving head 20 may rotate on the top of the bearing 22 and thus be supported in proper driving relation.

In order to give the cage the proper break up motion desired for moving the work pieces across the laps in a lapping operation, and in the present case for moving the drssing tools 25 in their desired path between the faces of the abrasive laps, the construction which has been described in said patent to Indge may be employed. The cage 14, which drives the dressing tools or the work pieces between the opposed laps, is loosely mounted on three pins 20 as shown in Figs. 1 and 2. Each of these pins is mounted in a plate 31 which is secured to a gear 32. Each gear is in turn mounted on a pin 33 fastened in the plate 35. It will be noted that the pins 30 are eccentric to the pins 33 and when the gears 32 revolve the pins will rotate and carry the work cage with an eccentric motion.

In order to rotate the gears 32 and at the same time carry the cage about the center of the laps, the driving plate 35 is keyed to and mounted upon a sleeve 37 located within and rotatable relative to the sleeve 21. This sleeve 37 is driven in the same direction as the sleeve 21 but at a slower rate, as shown in the patent to Indge. Within the sleeve 37 is a stationary post 38 suitably held in the base of the machine, and keyed to the top of this post is a stationary gear 39. This gear 39 is constantly in mesh with the teeth 40 of each of the three small gears 32. The gears 32 are journaled in the plate 42 as well as on the pins 33, this plate 42 being suitably bolted to and rotatable with the driving plate 35.

It will thus be seen that upon rotating the sleeve 37 in the direction as indicated by the arrow, the driving plate will likewise be rotated and revolve the pins 33 around the center post 38. The gears 32, which are constantly in mesh with the stationary gear 39, must necessarily rotate upon their respective pins 33, and through their eccentric pins 30 upon which the work cage is loosely mounted impart a composite curvilinear motion to the work pieces carried in the cage. It will be appreciated that various types of driving mechanisms may be utilized, depending on the type of work being lapped and the type of lapping machines employed, it being important, however, that the work cage and the laps be given a relative movement which carries the work through an irregular motion whereby each work piece travels over the entire operative face of each of the opposed laps in the course of a cycle of movement. This motion is a break up or non-repeating motion in

which the center of a piece of work or dressing tool will not reach exactly the same position on both of the laps until it has made a large number of revolutions about the lap center.

The faces of the abrasive bodies forming the laps necessarily become worn and periodically require renewal. It has been found in our experimentation that the abrasive faces may be dressed if subjected to the action of plates of suitable material having cutting faces which are inserted in the openings of the work cage and the work cage is given its customary motion as required for an ordinary lapping operation. A satisfactory dressing tool for this purpose, as shown in Fig. 3, may comprise a ring-shaped metal disk 25 having each of its opposed parallel plane faces 45 cut by two sets of grooves 46 and 47. The sets of grooves intersect at an angle and form substantially diamond or square-shaped projections 48 the sides of which are preferably perpendicular to each cutting face of the tool.

If as above explained the lap is freely floating, then at least three of these dressing tools should be inserted in such locations in the cage as to adequately support the upper lap peripherally at a distance from the lower lap during the dressing operation as shown in Fig. 2 of the drawings. Each of these plates is of the same thickness, which should be somewhat thicker than the cage so as to project on both sides thereof and engage the abrasive laps. It is preferred that these dressing tools be circular in shape and that the tools be loosely mounted within the openings of the cage so that they may be free to rotate as the cage revolves through its peculiar break up motion. This insures the dressing tool acting evenly upon the faces of the abrasive laps. It also will be understood that the pattern or nature of the cutting faces of the disks on the dressing tool may be widely varied but it is desired that a large number of cutting edges or teeth be provided in order to insure a rapid operation in dressing the abrasive laps. The dressing operation may be carried on in the presence of water or other suitable fluid and various expedients known to one skilled in the art may obviously be employed. It is also preferable that the dressing tools be of a diameter substantially or nearly as wide as the annular operating portion of the abrasive laps so that they will dress substantially all of the abrasive body as they make a single revolution, but it will be observed that the breakup motion caused by the laps between which the work cage is given an eccentric movement about their center will cause the dressing tool to traverse over the entire width of the laps whatever may be their relative dimensions and so produce a uniform cutting action.

When using this machine to lap conical or cylindrical work it is customary to have the work holder or cage free to rotate upon its own axis at a speed determined by the speed of the rolling of the work between the two opposed laps. To permit such rotation, a carrier plate 60 is inserted upon the driving pins 30*a* and below the work cage 14*a*. This carrier plate 60 has holes to receive the pins 30*a* and has a central stud 62 upon which the work cage 14*a* is rotatably mounted. The pins 30*a* do not project above the top surface of the carrier plate 60 and are short enough so that the work cage 14*a* may be properly positioned between the two opposed laps without contacting with them during the lapping operation. When thus mounted, the work cage 14*a* receives an eccentric movement from the pins 30*a* but is also free to rotate about its center upon the stud 62. The metal truing or dressing tool 64 which is shown in Fig. 6 is cylindrical in form and cut by a series of intersecting grooves 65 and 66 which form substantially diamond-shaped raised portions 67 upon its outer surface. This dressing tool has a hub 68 of smaller diameter upon each end. The work cage 14*a* has a multiplicity of slots 69 to receive the work pieces or dressing tools which are of such size as to loosely rotate therein. These slots are set at convenient angles to their corresponding radii to produce a proper lapping or cutting operation and have at each end small reduced portions 70 within which the ends of the dressing tools 64 may be inserted so that they may freely rotate during the dressing operation without contacting with the sides of the slots 69.

When it is desired to dress the laps after the operator has lapped a number of duplicate pieces and finds that the laps are losing their rapid cutting action, he may remove the work pieces and place in the openings of the work cage three or more duplicate dressing tools whereupon the upper lap is lowered and permitted to float freely thereon. The lapping machine is then started and used in accordance with the usual lapping operation with the dressing tools in contact with the laps. This operation, which does not ordinarily require more than half a minute, dresses the surfaces of the laps and keeps the truing tools sharp at the same time due to the abrading action. The tools may then be removed and fresh pieces of work inserted in the machine and the lapping operation resumed. This cycle of operations of lapping and dressing may be carried on for a considerable length of time until the operator finds it desirable to dress the wheel with a diamond or by other suitable means to make sure that the operative faces are in parallel planes and in the best of condition for this very delicate operation of finishing the surfaces of duplicate work pieces and bringing them to duplicate size.

Having thus described the invention, what is claimed as new is:

1. The method of dressing the opposed faces of the two abrasive laps of a lapping machine which comprises the steps of placing several work sized cutting tools, which are of equal thickness and have opposed cutting faces, between and in contact with the operative faces of the laps, said tools being arranged in such positions as to support one lap at a uniform distance from the other lap, and then imparting an irregular non-repeating motion to relatively move said tools and the laps and cause the tools to move in the path traveled by the work in a normal work lapping operation so as to dress the opposed abrasive faces of the laps.

2. The method of dressing the opposed faces of the abrasive laps in a lapping machine having a cage provided with work carrying openings revolvable between an upper and a lower abrasive lap, comprising the steps of selecting metal tools of equal thicknesses having cutting edges thereon which are of such size and shape as to loosely and rotatably fit within the cage openings and with the opposed lap faces, arranging the tools in the cage to support the upper lap peripherally at a uniform distance from the lower lap and thereafter moving the cage and the laps relatively as in a work lapping operation and thereby causing the tools to dress the faces of the laps.

3. In combination with a lapping machine having opposed abrasive laps and a work cage revolvable therebetween which has openings of a size and shape to hold work pieces in lapping contact with the laps, a dressing device comprising a metallic body shaped and sized to fit loosely in and project through said opening in the work cage and which has cutting teeth on its opposite sides capable of cutting the abrasive surfaces of both laps when revolved in contact therewith.

4. Apparatus for dressing the opposed faces of the lapping elements in a lapping machine having two abrasive laps and a work cage revolvable therebetween which has a plurality of work receiving openings adapted to hold work pieces in lapping contact with the laps, comprising several small metal cutting tools shaped and sized to fit loosely in and project through said openings in the work cage and having cutting teeth on its opposite sides capable of cutting the abrasive surfaces of both laps when revolved in contact therewith.

5. Apparatus for dressing the opposed faces of the lapping elements in a lapping machine having two abrasive laps and a work cage revolvable therebetween which has a plurality of work receiving openings adapted to hold work pieces in lapping contact with the laps, comprising several small cutting tools shaped and sized to fit loosely in and project through said openings in the work cage and having cutting faces on its opposite sides capable of cutting the abrasive surfaces of both laps and revolved in contact therewith.

Signed at Worcester, Mass., this 21st day of March, 1929.

SYDNEY PLAYER.
HERBERT S. INDGE.