Feb. 27, 1945. L. A. PATT 2,370,323

SURFACING APPARATUS

Filed Oct. 28, 1943

Fig. 1.

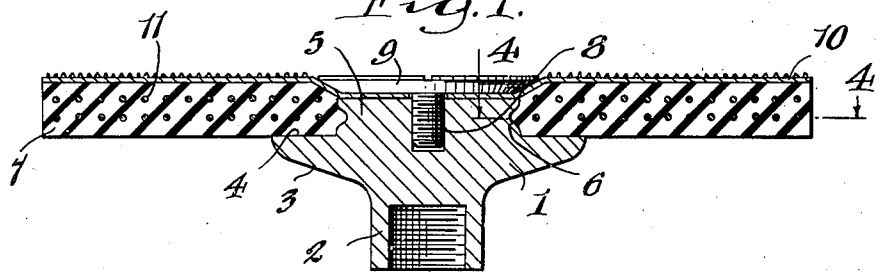


Fig. 2

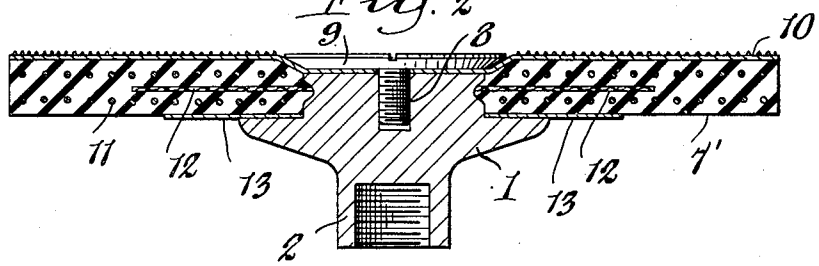


Fig. 3

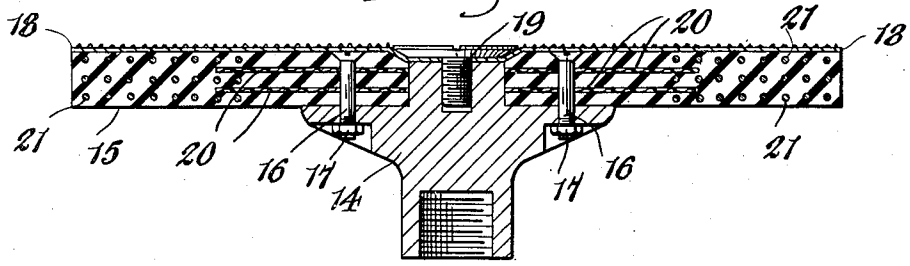
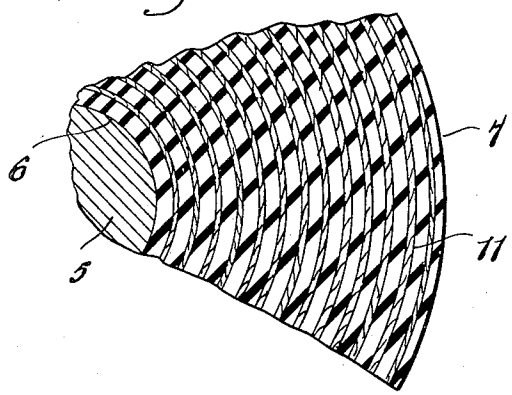


Fig. 4.



Inventor
LEON A. PATT
by W. F. Daley
Attorney

Patented Feb. 27, 1945 2,370,323

UNITED STATES PATENT OFFICE

2,370,323

SURFACING APPARATUS

Leon A. Patt, Niagara Falls, Ontario, Canada, assignor to The Carborundum Company, Niagara Falls, N. Y., a corporation of Delaware

Application October 28, 1943, Serial No. 508,021

8 Claims. (Cl. 51—197)

This invention relates to surfacing apparatus and more particularly to an improved supporting pad for use in surfacing apparatus of the type employing flexible coated abrasive discs. One object of this invention is to provide an improved pad of the kind indicated which is flexible enough to conform to curved surfaces of short radii and yet which is strong enough to withstand centrifugal and torsional stresses encountered during high speed operation. Another object of the invention is to provide a supporting pad which while flexible and strong is light in weight and does not have an undue liveliness which would cause it to bounce as the surfacing disc contacts the work surface. These and other objects will appear as the description proceeds.

Surfacing apparatus of the type employing flexible abrasive discs is now commonly used for operations involving polishing and buffing of smooth surfaces such as panels of wood, metal, and other material and also in the rough grinding of hard, irregular surfaces such as weld ridges which are frequently encountered in welded structures. Whether used for final smoothing and finishing or rough grinding, the abrasive disc and its supporting flexible pad, which are rotated either directly from an air or electric motor or by such motor through a flexible shaft, are subjected to repeated flexing at high speed, torsional stresses as a result of the friction between the abrasive disc and the work piece, on the one hand, and between the supporting pad and the abrasive, on the other hand, and also to severe centrifugal forces because of the high speed of rotation of the disc and pad.

Prior art supporting pads for surfacing apparatus of this type have been constructed, in some instances, primarily of rubber. Where such pads have not proved to be sufficiently stiff to exert the desired amount of pressure upon the work piece, or stable enough to be used at high speeds without swelling due to the centrifugal force, they have been provided with one or more layers of fabric incorporated therein, such fabric being of disc shape and lying roughly parallel to the front or abrasive disc engaging face of the pad. Such fabric layers provide additional strength in a radial direction and thus strengthen the pad against centrifugal forces. The prior art reinforcing fabric is a woven material with two or more sets of strands running at right angles to each other. A pad employing such fabric reinforcing layer or layers thus is not uniform in its action around its entire periphery, since the resistance to flexing and stretching exerted by each thread of the embedded fabric varies with the angle between the various threads making up the fabric and the particular diameter of the pad at which the work is contacted at any instant. Such angle is constantly changing as the pad rotates. Furthermore, each particular thread in the fabric is constantly subjected to alternate flexing and tension, the tension being high as indicated by the resistance to flexure of the fabric reinforced pad, and thus the fabric is prone to failure in a relatively short time. It has also been found that when such fabric is used in a sufficient number of layers to give the pad radial strength enough to make it safe for high speed operation, the pad becomes too stiff and unyielding to allow it to be used on work having curved surfaces of short radii.

The present invention overcomes the above-mentioned difficulty encountered in trying to produce a disc which is strong in a radial direction but which will yield and flex readily in a direction parallel to its axis. The pad of my invention employs one or more layers of reinforcing cords which lie in successive loops generally concentric and parallel to the periphery. All the portions of each cord are subjected to tension which arises almost solely as a result of centrifugal force acting on the pad. The flexing of the pads does not increase the tension in the cords materially, and therefore such construction removes the possibility of premature failure in the cords. In addition, the pad of the present invention is substantially uniform in its action over the entire peripheral or working portion. The invention will be more readily understood by reference to the accompanying drawing in which:

Figure 1 is a view in cross section through the axis of the combination of a supporting hub, a flexible pad and an abrasive disc mounted thereon;

Figure 2 is a similar view in cross section, the pad there shown being a modification of that of Figure 1;

Figure 3 is a similar view in cross section of still another modification of the pad of my invention; and

Figure 4 is a fragmentary view in cross section taken through the line 4—4 in Figure 1.

The apparatus shown in Figure 1 consists of a hub 1 which is provided with a centrally located screw threaded portion 2 on the lower end thereof for the reception of the driving shaft either of the motor, in cases where the surfacing apparatus is driven directly, or of the driven end of a flexible shaft. Hub 1 flares outwardly at part 3, providing as shown a disc shaped surface 4 at right angles to the axis of the hub. Above

surface 4 the hub has an upstanding coaxial portion 5 having, approximately mid-way of its height, an annular recess 6 for the reception of a correspondingly shaped projection on the flexible pad member 7. Pad 7 is snapped into place on hub 1 and is retained thereon by screw 8 and also partially by reason of the interlocking between the projection on the pad and the angular recess 6. Screw 8 has a large head 9 which overlies the central portion of abrasive disc 10 mounted on the pad and holds it in place.

Flexible pad 7 is composed primarily of a tough flexible compressible substance such as vulcanized natural or synthetic rubber, such class of substances being referred to hereinafter as elastomers. Among the various synthetic rubber-like materials which may be used are copolymers of butadiene with other polymerizable compounds such as acrylic acid nitrile or styrene. Copolymers of chloroprene may also be used within the scope of this invention. Such elastomer is shown as composing the body of the flexible pad 7. Embedded in the pad are cords 11, such cords being distributed in one or more layers, generally parallel to the face of the pad. In each such one or more layers the cords are arranged at substantially equal distances from each other adjacent cord and lie substantially parallel to the periphery of the pad and to each other. The cord may consist of one continuous piece or one or more jointed pieces which lie in a spiral configuration, or it may consist of separate endless cords, or cords whose ends have been joined to form circles of the required varying diameters. Where two or more spirally wound cords are employed, successive layers of cords are wound in the opposite direction to remove any creeping in the pad face due to any unwinding effect of the reinforcing cords.

Cords 11 may be made of cotton, wool, silk or other strong textiles. As a variation, a flexible wire covered with a suitable strong textile may be employed. The word "cords" used hereinafter is meant to comprehend flexible elongated members made of the above material or materials similar to them. The location of strengthening cords 11 in the manner above described provides greatly improved strength in the pad in a radial direction thereby rendering it safe to use at high speeds, but at the same time increases very little if at all, the stiffness of the pad in a direction parallel to its axis. A pad reinforced with cords in accordance with the present invention is less lively than a pad without them and is much less prone to bounce or whip during operation. Strengthening cords 11 maintain the diameter of the central hole in the pad at about the same size, regardless of stresses on the pad. Thus the interlock between recess 6 of the hub and the correspondingly shaped projection on the pad remains undisturbed during use of the device.

In the modification shown in Figure 2 the elements are in general similar to those in Figure 1. The pad 7' shown in this figure employs, besides the strengthening cords 11, an embedded layer of fabric 12 of materially smaller diameter than the pad and which in the modification shown in the figure lies between the two layers of cords. Fabric layer 12 provides the pad with greater stiffness in its central portion in the direction parallel to its axis. Such greater stiffness in the central part of the pad is desired in some types of work where the curves of the surface to be ground have relatively large radii, and where the required grinding pressures are high. Further resistance to flexing of the pad may be provided as desired by the use of a thin flexible member such as 13, which may be made of metal, which backs up the inner portion of pad 7' allowing it to flex but only after the application of an appreciable pressure. The periphery of the pad is more flexible than the center, being reinforced only by the successive loops of reinforcing cord. The pad shown in Figure 2 is illustrative only; within the scope of the invention the cords 11 and fabric layer 12 may be located in other positions within the pad as required to meet particular operating conditions. In some instances where a pad which has a high resistance to flexure in the working portion is desired the fabric reinforcing layer or layers in the pad shown in Figure 2 may extend outwardly to or at least substantially to the periphery of the pad.

The apparatus shown in Figure 3 is somewhat similar to those shown in Figures 1 and 2, but is modified as to the manner in which the flexible pad is retained on the supporting and driving hub. In this instance also the central portion of the flexible pad is made less flexible than the outer peripheral portion. This is accomplished in the modification shown in Figure 3 by using fabric reinforcing layers in the central portion and reinforcing cords with loops arranged either circularly or spirally, as in the pads shown in Figures 1 and 2, in the outer portion of the pad. In Figure 3 pad supporting hub 14 retains flexible pad 15 thereon by means of a plurality of bolts 16 arranged about the axis of the hub and extending through the central portion of the pad as shown. Bolts 16 are retained in hub 14 by nuts 17 which are held from rotation by the recesses in the hub into which they fit. Pad 15 is additionally retained on the hub and flexible coated abrasive disc is held on the pad by means of screw 19 which screws into the upper end of the hub, the enlarged head of which engages the abrasive disc at its central portion.

Pad 15 is shown with two reinforcing layers of fabric 20 located at the central portion of the pad, and three layers of reinforcing cord 21 at the outer portion of the pad. The cord and fabric reinforcements overlap in a radial direction so that the pad is adequately reinforced over its entire area. Whereas there are shown two fabric layers and three cord layers in the pad in Figure 3, it is to be understood that different numbers of fabric and cord layers and different arrangements of them vertically in the pad from those shown in Figure 3 may be used.

The pads shown in Figures 1, 2, and 3 may readily be made by assembling layers of an elastomer of the thickness corresponding to the distance it is desired to have the reinforcing cords or fabric from a face of the pad, or from an adjacent layer of cords or fabric, and assembling a plurality of such layers with interposed reinforcing layers positioned in the correct relationship. If continuous cords are employed, the cords may be treated with latex, as by dipping them into the latex, and then wound on a layer of elastomer with the successive loops in the correct relationship. The latex adheres to the elastomer sufficiently to maintain the cord in place. Alternatively, a continuous cord may be wound as desired and then lightly sewed to maintain the coils in place, after which the reinforcing layer of cord is placed between layers of elastomer. If separate complete circles of cord are employed as the reinforcement, they may be latex treated and adhered to a layer of elastomer in the correct position.

The assembly is then mounted in a mold in a press and subjected to heat and pressure for a sufficient length of time to cause adjacent layers of elastomers to bond together into a homogeneous unitary structure with the reinforcing cord or fabric or both embedded therein.

Having thus fully described the invention, I desire to claim as new the following:

1. A pad for use on a rotary surfacing machine and adapted to operatively support a sheet of surfacing material, the pad being in the form of a disc of substantial thickness, the disc being composed essentially of a tough flexible elastomer and having embedded therein a plurality of reinforcing means lying substantially in spaced parallel planes which lie substantially parallel to and between the faces of the disc, at least one of said reinforcing means being fabric and at least one other of said reinforcing means being in the form of strong and flexible cords disposed in a plurality of loops substantially parallel to the periphery of the disc, the cord in each of said loops being located at substantially equal distances from that in each adjacent loop, said latter reinforcing means extending from a point which at least lies inwardly of the outer edge of the fabric reinforcement to a point adjacent the periphery of the disc.

2. A pad for use on a rotary surfacing machine and adapted to operatively support a sheet of surfacing material, the pad being in the form of a disc of substantial thickness, the disc being composed of a tough flexible elastomer and having embedded therein a plurality of reinforcing means lying substantially in spaced parallel planes which lie substantially parallel to and between the faces of the disc, at least one of said reinforcing means being in the form of strong and flexible cords disposed in a plurality of loops substantially parallel to the periphery of the disc, the cord in each of said loops being located at substantially equal distances from that in each adjacent loop, said cord reinforcing means extending at least from a point adjacent the periphery of the disc to a point a substantial distance inwardly of the periphery.

3. A pad for use on a rotary surfacing machine and adapted to operatively support a sheet of surfacing material, the pad being in the form of a circular disc of substantial thickness and having a central hole, the disc being composed of a tough flexible elastomer and having embedded therein reinforcing means lying substantially in a plane substantially parallel to and between the faces of the disc, said reinforcing means being in the form of strong and flexible cords disposed in a plurality of loops substantially parallel to the periphery of the disc, the cord in each of said loops being located at substantially equal distances from that in each adjacent loop, said reinforcing means extending at least from a point adjacent the periphery of the disc to a point a substantial distance inwardly of the periphery.

4. A pad for use on a rotary surfacing machine and adapted to operatively support a sheet of surfacing material, the pad being in the form of a circular disc of substantial thickness, the disc being composed of a tough flexible elastomer and having reinforcing means embedded therein, said reinforcing means being in the form of strong and flexible cords disposed in a plurality of loops substantially parallel to the periphery of the disc, the cord in each of said loops being located at substantially equal distances from that in each adjacent loop, said reinforcing means extending at least from a point adjacent the periphery of the disc to a point a substantial distance inwardly of the periphery.

5. A pad for use on a rotary surfacing machine and adapted to operatively support a sheet of surfacing material, the pad being in the form of a circular disc of substantial thickness, the disc being composed of a tough flexible elastomer and having reinforcing means consisting of a strong flexible cord lying in a spiral having a plurality of loops whose adjacent loops are spaced at least roughly at equal distances from each other, said cord lying at least generally in a plane roughly parallel with the faces of the disc, said cord extending throughout at least a substantial portion of the distance from a point adjacent the center of the disc to a point adjacent the periphery of the disc.

6. A pad for use on a rotary surfacing machine and adapted to operatively support a sheet of surfacing material, the pad being in the form of a circular disc of substantial thickness, the disc being composed of a tough flexible elastomer and having reinforcing means embedded therein, said reinforcing means consisting of strong flexible cords lying substantially in circles generally parallel with the faces of the disc, such circles being of progressively increasing diameter, said reinforcing means extending throughout at least a substantial portion of the distance from a point adjacent the center of the disc to a point adjacent the periphery of the disc.

7. A rotary surfacing device comprising in combination a supporting hub having means by which it may be supported and rotated, said hub having a pad supporting surface of substantial extent at right angles to its axis and an upstanding generally cylindrical coaxial portion, said upstanding portion having an annular recess therein, and a flexible pad mounted on the hub with the upstanding coaxial portion of the hub extending through a hole in its center, there being a projection on the wall of the central hole in the pad interlocking with the annular recess on the upstanding portion of the hub, said flexible pad being composed of a tough flexible elastomer having a reinforcement embedded therein, said reinforcement being in the form of a strong flexible cord disposed generally in successive loops of different diameters substantially parallel to the periphery of the disc.

8. A pad for use on a rotary surfacing machine and adapted to operatively support a sheet of surfacing material, the pad being in the form of a disc of substantial thickness, the disc being composed essentially of a tough flexible elastomer and having embedded therein a plurality of reinforcing means lying substantially in spaced parallel planes which lie substantially parallel to and between the faces of the disc, at least one of said reinforcing means being fabric and being located at the central portion of the disc to render such portion difficultly flexible, and at least one other of the reinforcing means being in the form of strong flexible cords disposed in a plurality of loops substantially parallel to the periphery of the disc, the cord in each of said loops being located at substantially equal distances from each adjacent loop, said cord reinforcing means extending from at least the outer edge of the fabric reinforcing layer to a point adjacent the periphery of the disc, whereby the peripheral portion of the pad may flex readily but is reinforced in a radial direction.

LEON A. PATT.