

Feb. 17, 1970

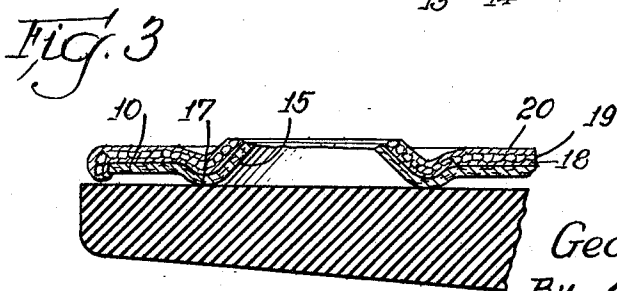
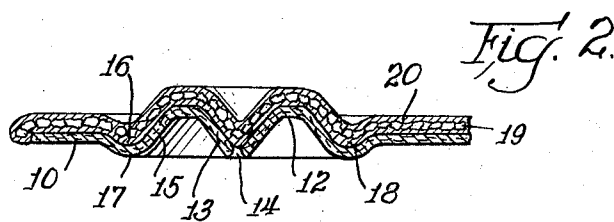
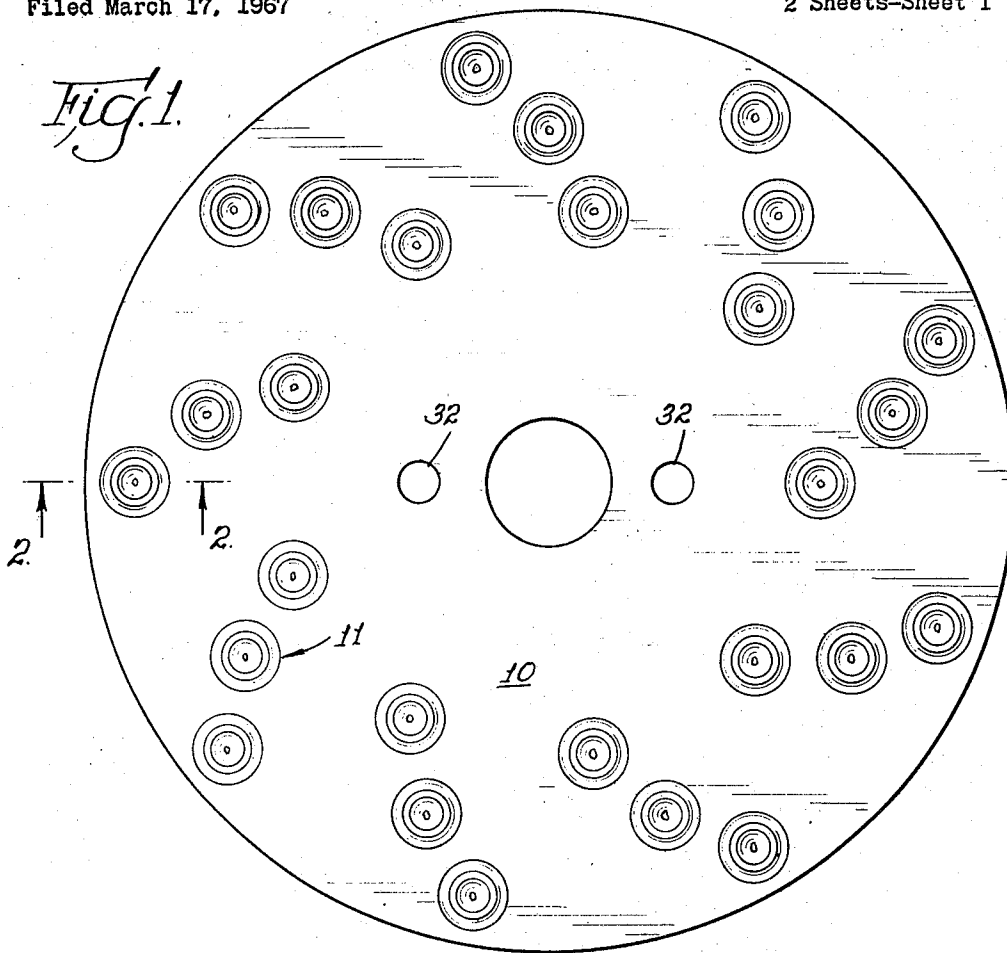
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3,495,362

ABRASIVE DISK

Filed March 17, 1967

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

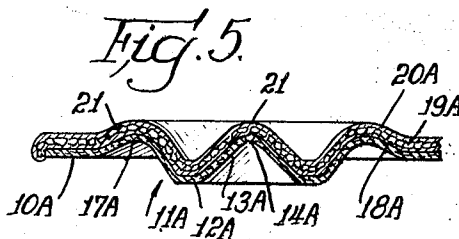
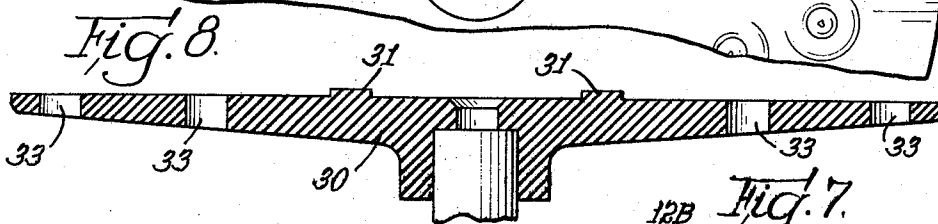
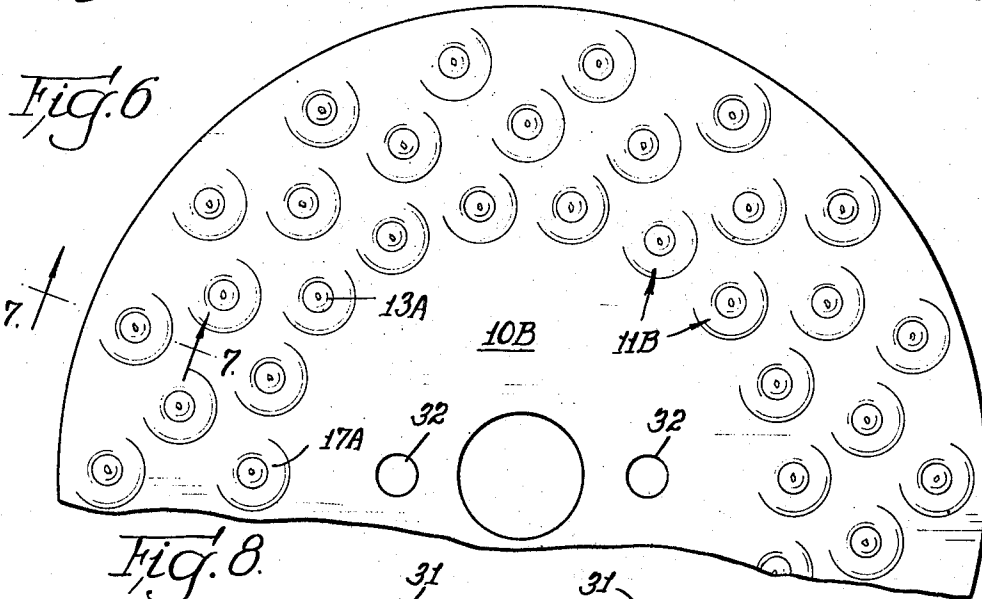
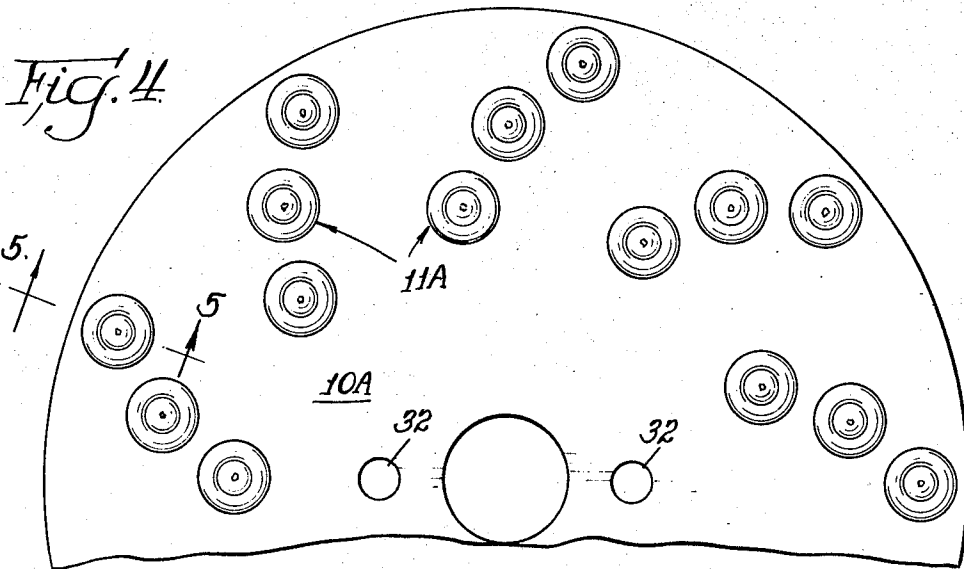


Fig. 7

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3,495,362

ABRASIVE DISK

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Filed Mar. 17, 1967, Ser. No. 623,856

Int. Cl. B24b 11/00

U.S. Cl. 51—395

6 Claims

ABSTRACT OF THE DISCLOSURE

An embossed base member having bosses projecting from each of its faces and coated on one face with a substantially uniform thickness coating of abrasive particles to form an abrasive disk that has separated and distinct abrasive plateaus with the abrasive coating in each plateau reinforced by the embossed backing member.

It is a main object of the invention to provide an abrasive disk base member from both faces of which a plurality of bosses project and terminate in planes which are parallel to the faces of the member.

Another object of the invention is to provide an abrasive disk base member from both faces of which bosses project with the bosses on one face projecting farther from the member than the bosses on the other face.

Another object of the invention is to provide an abrasive disk base member having bosses projecting from one of its faces, these bosses merging into grooves indented into that face which grooves form the interiors of bosses projecting from the other face of the member.

Another object of the invention is to provide an abrasive disk base member composed of a fibrous material and having tapered sidewall bosses projecting from each of the two faces of the member.

Another object of the invention is to provide an abrasive disk base member having bosses projecting from one face thereof, the sidewalls of which bosses terminate at their distal ends in end walls each of which contains a recess indented into it. The base member when coated with a layer of abrasive particles or grit that covers that face of the disk, the sidewalls of the bosses and the end walls and recesses therein, forms an abrasive disk containing a first plateau at the distal ends of the bosses, a second plateau at the sides of the bosses and a final plateau on the face of the member, the abrasive particles in each of said plateaus being reinforced by said base member and the bosses thereon.

Another object of the invention is to provide a multi-plateau abrasive disk in which the first plateau consists of spaced apart areas spaced from the main body of the disk and providing air channels through which air is forced by rotation of the disk to cool the work and disk and to sweep away particles abraded from the work.

Another object of the invention is to provide a multi-plateau abrasive disk in which operation in the first plateau wears away that plateau and opens up holes in the disk which aid in cooling during operation in the other plateaus.

Further objects of the invention not specifically mentioned here will be apparent from the detailed description and claims which follow, reference being had to the accompanying drawings in which a preferred embodiment of the invention is shown by way of example and in which:

FIGURE 1 is a plan view of a base member embodying the teachings of the invention and having a pattern of bosses suitable for use with coarse abrasive particles;

FIGURE 2 is a fragmentary cross sectional view of

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a boss on the base member of FIGURE 1 coated with a coarse grit, in the 16 to 50 mesh range, taken along the line 2—2 of FIGURE 1 and drawn to an enlarged scale;

FIGURE 3 is a view similar to FIGURE 2 and showing the shape of the boss during operation of the disk in an intermediate plateau;

FIGURE 4 is a fragmentary plan view of a base member designed for use with abrasive grits in the range of medium coarseness;

FIGURE 5 is a fragmentary cross sectional view of the base member of FIGURE 4 coated with grit in the 60 to 80 mesh range, taken along the line 5—5 of FIGURE 4 and drawn to an enlarged scale;

FIGURE 6 is a fragmentary plan view of a base member designed for use with abrasive grits of fine mesh;

FIGURE 7 is a fragmentary cross sectional view of the base member of FIGURE 6 coated with 100 to 120 mesh grits, taken along the line 7—7 of FIGURE 6 and drawn to an enlarged scale; and

FIGURE 8 is a cross sectional view of a backing member with which abrasive disks of the present invention may be used advantageously.

Abrasive disks rotated by an electric or pneumatic motor are commonly used in metalworking shops to grind down welds and to smooth and polish metal parts preparatory to finishing the same. Such disks are also commonly used in woodworking shops to smooth glue joints and to prepare other surfaces for finishing.

Prior art disks of this type have frequently consisted of a base member composed of a suitable material such as, for example, a vulcanized fiber if the disk is to be used in a metalworking shop or cloth or paper if the disk is to be used in woodworking. In most of these prior art disks a base member has been planar and the abrasive layer fixed thereon has likewise been planar. As a result of this construction a metal cutting disk has an undesirably short life due to the fact that friction between the abrasive particles and the work heats particles abraded from the work sufficiently to cause them to weld to the abrasive layer with the result that the disk becomes glazed and has metal-to-metal contact which is not conducive to satisfactory cutting by the disk. In the case of woodworking, particles separated from the work frequently become imbedded in the interstices of the abrasive layer and the disk soon becomes glazed to the extent that satisfactory operation thereof is impaired.

In certain prior art disks of which I am aware, after the abrasive coating has been applied to the planar base member, cross hatched lines have been impressed into the abrasive coating dividing that coating into a series of slightly spaced apart abrasive areas. Disks of this type contain grooves through which air is forced by the rotation of the disk thereby to improve the cooling of the disk and work and to sweep away particles abraded from the work. Although the life of disks of this type is somewhat improved the disks have not been altogether satisfactory for the reason that the separated areas of the disk are composed solely of the abrasive particles and the adhesive by which they are affixed to the planar base member. These areas being somewhat fragile soon break up and flake off of the disk with the result that further satisfactory operation is not possible and the disk must be replaced.

The present invention improves upon such prior art abrasive disk by providing a base member which is embossed to have formed in it a plurality of bosses upstanding from each of the two faces of the member. When coated on one of its faces with a layer of abrasive material of substantially uniform thickness the abrasive material on the distal ends of the bosses that project out of the coated face of the base member form a first cutting

plateau. The tapered sidewalls of these bosses to which the abrasive layer is also affixed form an intermediate cutting plateau after the first plateau has completely worn away. As the intermediate plateau wears away the final plateau on the planar surface of the base member is brought into contact with the work. The bosses so coated are spaced apart so that when operating in the first and intermediate plateaus air is drawn between the disk and the work to aid in cooling the disk and work and to sweep away particles abraded from the work. After the first plateau has been worn away the disk becomes perforated and air drawn through these perforations by the rotation of the disk aid in cooling and sweeping away particles abraded from the work during operation in the intermediate and final plateaus. Since the entire abrasive area is reinforced by the base member and bosses thereon, longer useful life of the disk is achieved.

Referring now to the drawings, particularly FIGURES 1 and 2, it will be seen that the base member 10 has upstanding from one of its faces, a plurality of bosses indicated generally at 11. Depending from the other face of the member 10 are bosses 17, which in the example shown, are of lesser height than the bosses 11 and are aligned therewith. If the base member is to be used as a support for metal cutting abrasive it will preferably be composed of vulcanized fiber or plastic of a thickness sufficient to provide the desired rigidity without impairing desired flexibility of the disk. If the base member is to be used in a woodworking disk it will preferably be composed of cloth or paper of suitable thickness. Insofar as the present invention is concerned the base member can be formed of any material capable of being embossed and of retaining the bosses thus formed and having the desired degree of flexibility.

In the base member shown by way of example in FIGURE 1 the upstanding bosses 11 are uniformly spaced apart in concentric rows with the same number of bosses in each row. Each of the upstanding bosses is frusto conical in shape. This particular arrangement of bosses and the shape thereof is shown by way of example only as other shapes and other patterns of bosses may be used within the teachings of the present invention and such use is contemplated.

As will be seen best in FIGURE 2 each upstanding boss 11 terminates at its distal end in an end wall 12 which contains a centrally located indentation or dimple 13 which may be perforated at its apex as shown at 14. The frusto conical sidewalls 15 of the boss merge into a groove 16 indented into the planar portion of the base 10. Each groove 16 forms the inside of a boss 17 that projects from the other side of the base member.

As will be seen in FIGURE 2 the abrasive layer is secured to the base member and bosses by a base coat layer 18 of adhesive material into which material the abrasive particles 19 are partially imbedded and as an aid to securing these particles a thin layer 20 of adhesive material overlays the particles 19 and aids in securing them onto the base 10.

When the disk shown in FIGURES 1 and 2 is attached to the usual somewhat flexible backing member by known means, not shown, as the backing member and disk are rotated by an electric or pneumatic motor, when the disk is first brought into contact with the work only the coating, on the end walls 12 of the bosses, engages the work.

The abrasive coating on the end walls 12 of the bosses forms the first plateau and as the disk is operated in engagement with the work this plateau gradually wears away and eventually thus exposes the end walls 12 of the bosses. While operating in the first plateau a cutting edge is formed at the junction of the end walls 12 and the tapered sidewalls 15 of the bosses. Fast cutting is thus assured. During operation in the first plateau the rotation of the disk draws air through the spaces between adjacent bosses 11 thereby to cool the work and disk and to sweep away particles abraded from the work.

When exposed, the end walls 12 soon abrade away and the central portion thereof is thrown out of the disk to open up perforations therein through which air is drawn to aid in cooling.

After the end walls 12 of the bosses have separated from the disk, further operation occurs in the second plateau and the bosses assume the shape shown in FIGURE 3. The cutting edge is at the distal ends of the bosses during operation in this plateau. The perforations in the bosses are increased in diameter by the wearing away of the sidewalls 15 of the bosses and eventually the abrasive coating adhered to the planar portion of the base 10 is brought into contact with the work. The disk is then operated in the final plateau with the cutting edges formed by the slight indentation adjacent the bases of the bosses 11. Cooling air is forced through the now comparatively large perforations in the disk by the rotation of the disk.

Cooling of the work and disk while the disk is operating in all of the three plateaus minimizes the welding of particles abraded from metal into the abrasive coating on the disk. The action of sweeping these particles away from the disk minimizes the imbedding of such particles in the interstices in the abrasive coating in both metalworking and woodworking applications of the disk. These actions minimize the glazing of the disk and consequently the useful life thereof is increased.

The base member shown in FIGURE 4 has essentially the same pattern of bosses and essentially the same shape of these bosses. As will be seen in FIGURE 5 the higher bosses 11A project from the uncoated side of the disk and the end walls 12A of these bosses engage the backing member with which the disk is to be used. Bosses 17 upstand from the coated side of the base member and the abrasive particles 19A are secured to that side by the base coat of adhesive 18A and the particles are overlaid with a thin coat 20A of adhesive. This type of disk is preferred for use with abrasive particles of grit in the range of 60 to 80 mesh size.

The operation of the disk shown in FIGURES 4 and 5 is much the same as the operation previously described in connection with FIGURES 1 to 3 inclusive. The abrasive coating 21 on the bosses 17A and at the apex of the dimples 13A forms a first plateau and as this plateau wears away the coating on the planar portion of the base 10A is brought into contact with the work prior to the breaking away of the central portion of the boss from the main body of the base member. With the finer grits used with this particular base member less heat is developed than when coarser grits are used and a smaller amount of air forced between the disk and work has proved to be sufficient to give a satisfactory life to the disk.

In FIGURE 6 I have shown a fragmentary plan view of a base member 10B adapted for use with fine grits in the range of 100 to 120 mesh particle size. This base member is of the general type shown in FIGURE 4 in that the main bosses 11B extend out of the uncoated face of the member. It will be noted that there are a larger number of bosses than in the base members shown in FIGURES 1 and 4 and that these bosses are much shallower than the bosses in the other base members shown. In practice bosses 11B and 17B and dimples 13B will project from the plane of base member 10B but a few thousandths of an inch. In FIGURE 7 the heights of these projections have been increased somewhat for the sake of clarity. The layer of fine abrasive particles is secured to one face of the base member as before and when brought into contact with the work only a small portion of the area of the disk is brought into engagement with the work initially. Grits in this range of fineness are used for polishing and the amount of heat generated by engagement of the abrasive coating with the work is much less than with disks having coarser grits.

The particular abrasives used in coating one of the faces of the base member are not of the essence of the present

invention. Corundum and various abrasives available under the trademark "Carborundum" are commonly used in metalworking disks and emery and quartz sand are commonly used in woodworking or sanding disks. These and other suitable abrasive materials may be used on the base member of the present invention. Nor is the adhesive used to adhere the abrasive coating to the base member an essential element of the present invention, rather, such adhesive will be chosen as best suited to the particular type of abrasive particles to be used. So long as the adhesive is capable of fixing the adhesive particles upon the face of the base member in such a manner that the base member reinforces the adhesive layer throughout the operation of the disk, the conditions of the present invention are fulfilled.

The embossed base members of this invention and abrasive disks formed therefrom may be used with the backing members now in common use in production shops. These backing members are composed of a rubber or rubber-like material, having a certain amount of flexibility which is advantageous in use of the disks as will be apparent to those skilled in the art. If desired the base member and abrasive disk formed therewith may advantageously be used on backing members of a different type.

In FIGURE 8 I have shown, by way of example, a cross sectional view of such a backing member preferably composed of a fibrous material such as sisal bound with an elastomeric or plastic binder which imparts to the backing member a desired degree of flexibility. Upstanding from the face of the backing member 30 are lugs 31 dimensioned and positioned to project into perforations 32 in the base members to position the disk in a particular position upon the member 30.

This member also contains a plurality of perforations 33 with which the bosses on the abrasive disks register when the disk is located on the backing member. With this arrangement when the first plateau of the abrasive disk wears away and separates from the disk the work becomes visible through the perforations 33 and the interiors of the bosses 11 due to the stroboscopic effect of the rotating disk. When a coarse grit disk is used with this backing member air drawn through the perforations by the rotation of the member and disk aids in cooling the disk and work during operation on the intermediate and final plateaus.

The backing members shown in FIGURES 1, 4 and 6 are shown to have a circular configuration. Disks of this particular shape are frequently used, however, the embossed base member of the present invention is not to be limited to this particular shape. It is contemplated that in certain instances the base member will be formed with eight or twelve sides or even duodecimal shape rather than circular. These latter shapes are advantageous in that the apexes of the adjacent sidewalls have greater flexibility than as is the case in a circular disk. This is advantageous in that it minimizes the danger of grinding ridges in the work during operation of the coated disk.

From the foregoing it will be apparent that I have designed a new and improved base member for abrasive and sanding disks, which member is embossed and has upstanding bosses over the side and end walls of which an abrasive coating is adhered as well as to the planar portion of the base member and in grooves indented therein. Through this arrangement the base member reinforces the layer of coating throughout operation of the disk. This arrangement permits breaking up the adhesive coating into

a plurality of spaced apart areas in each of which areas the abrasive coating is reinforced by the backing member. This minimizes the tendency of the abrasive coating to slough off of the base member during operation of the disk.

From the foregoing it will be apparent that the embossed base member of my invention possesses many advantages. While I have chosen to show this member as having bosses of a particular shape arranged in a particular pattern, I have done so by way of example only as the use of other patterns of bosses and other shapes of these bosses is contemplated within the teachings of the invention.

Having thus complied with the statutes and shown and described a preferred embodiment of my invention what I consider new and desire to have protected by Letters Patent is pointed out in the appended claims.

What I claim is:

1. A fibrous material embossed base member for abrasive and sanding disks, bound by a binder that permits limited flexibility of the member and comprising:

- (a) a plurality of spaced apart bosses projecting from one face of said base member;
- (b) an end wall on each boss at the distal end thereof lying in a plane that is common to the end walls of the other bosses projecting from that face, which plane is parallel to the face of the planar portion of the member from which the bosses project;
- (c) each end wall containing an indentation that extends into approximate alignment with said planar portion; and
- (d) tapered side walls on each boss extending from the end wall thereon to said planar portion into which the side walls merge.

2. A base member as specified in claim 1 in which a like plurality of bosses project from the other face of said planar portion each terminating in a plane that is parallel to said other face.

3. A base member as specified in claim 2 in which said planes are disposed at different distances from the faces with which they are parallel.

4. A base member as specified in claim 2 in which the bosses projecting from said other face are each aligned with a boss projecting from said first face.

5. A base member as specified in claim 4 in which the sidewalls of the bosses extend into grooves in the planar portion of the member which grooves form the interiors of the bosses projecting from the other face of the member.

6. A base member as specified in claim 4 coated on one face with a substantially uniform thickness coating of abrasive material with the coating on the end walls of the bosses forming a first abrasive plateau that is reinforced by the end walls, the coating on the sidewalls of the bosses forming a second plateau reinforced by the sidewalls and the coating on the planar portions of the member forming a final plateau that is reinforced by that portion.

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OTHELL M. SIMPSON, Primary Examiner