June 5, 1934. F. RICKS ET AL 1,961,596

MOLDING APPARATUS

Original Filed April 17, 1926

Fig. 1.

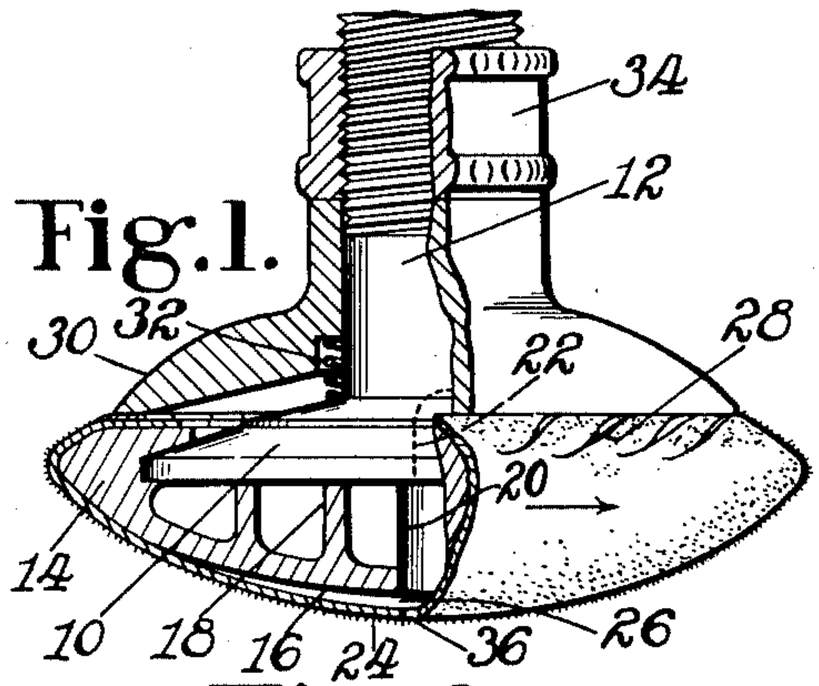


Fig. 2.

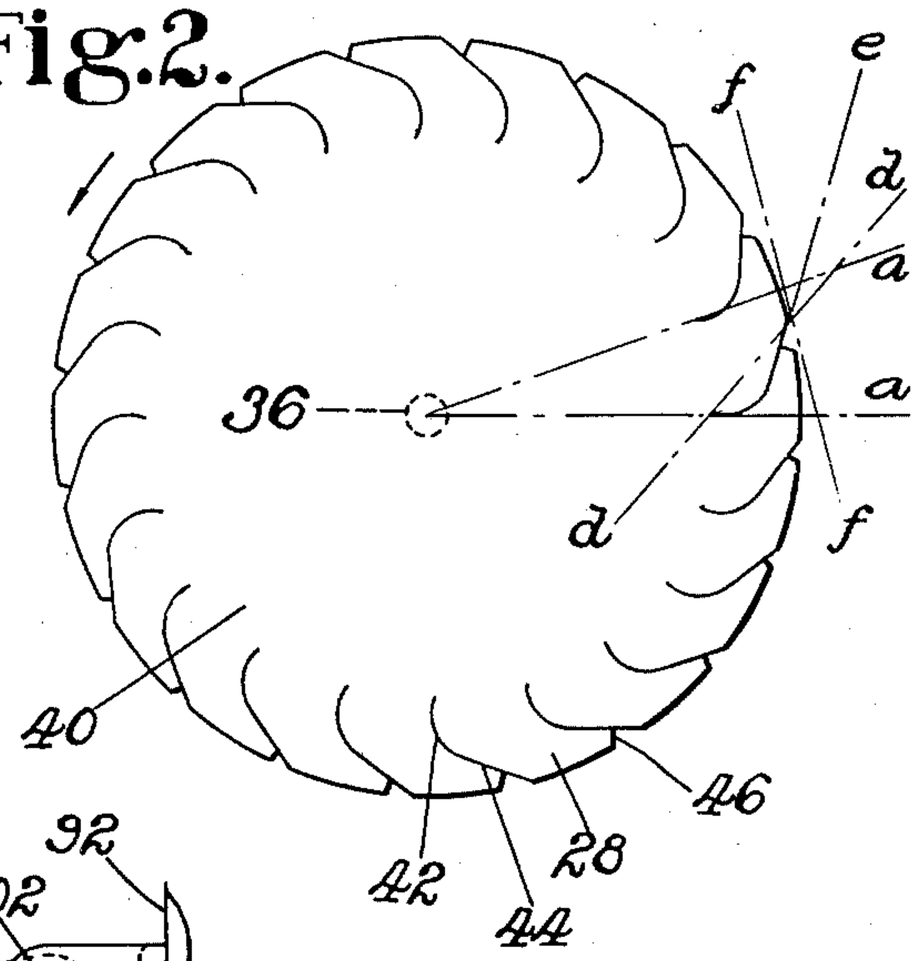


Fig. 3.

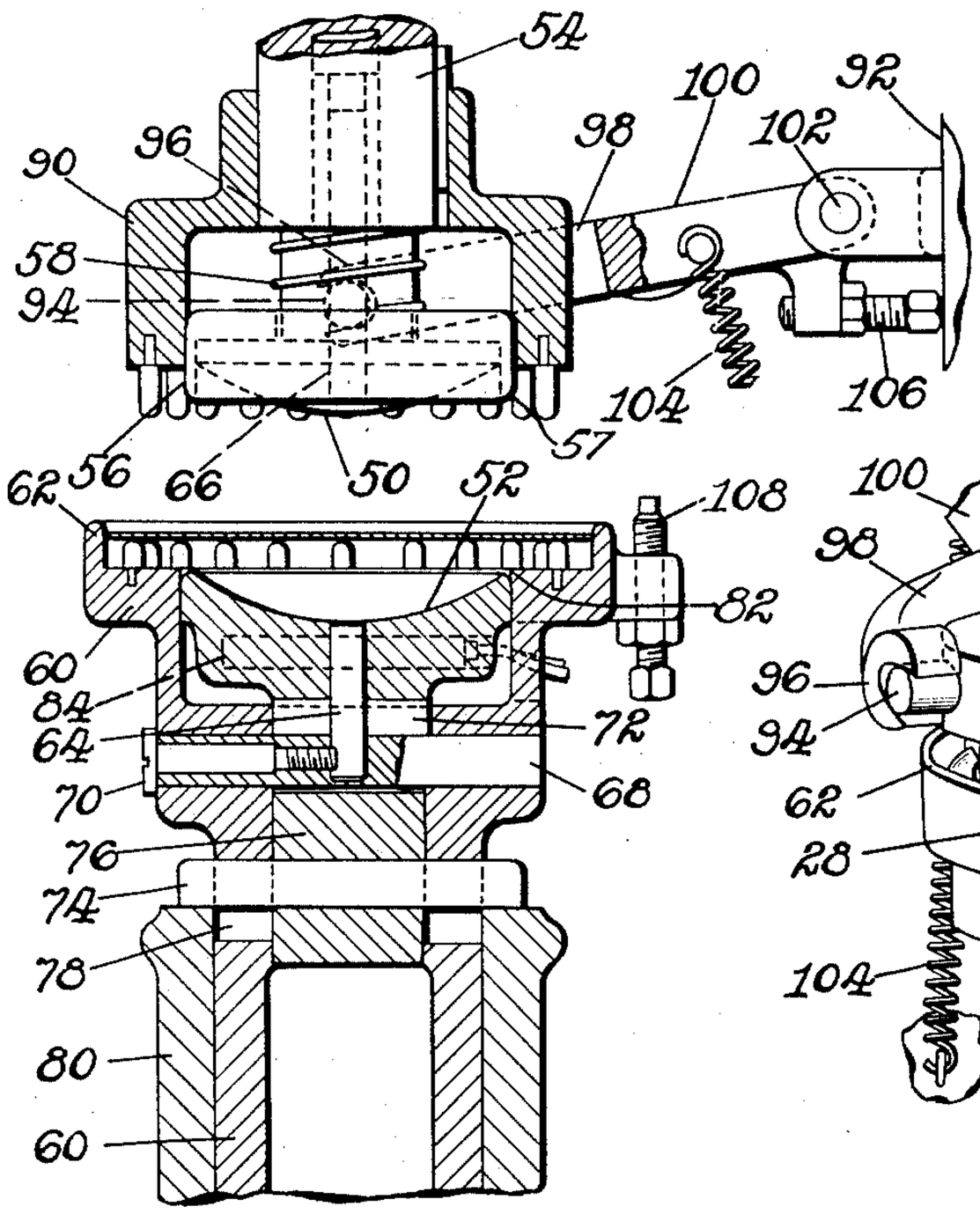


Fig. 4.

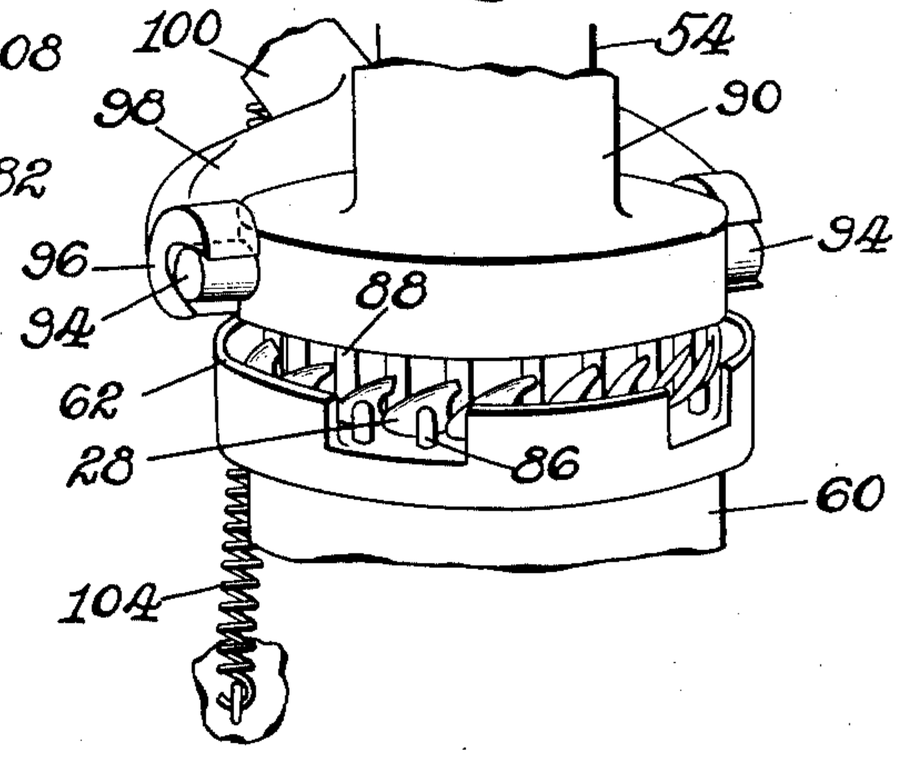
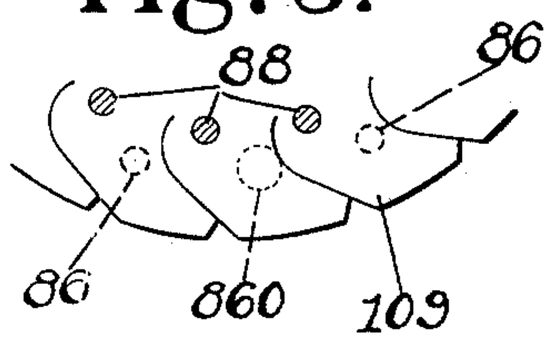


Fig. 5.



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1,961,596

MOLDING APPARATUS

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Original application April 17, 1926, Serial No. 102,688. Divided and this application February 11, 1932, Serial No. 592,351. In Great Britain April 25, 1925

5 Claims. (Cl. 113—49)

This invention relates to molding apparatus and is herein illustrated as embodied in apparatus suitable for molding abrasive covers of the type illustrated in United States Letters Patent No. 1,944,302, granted January 23, 1934, upon our application, Serial No. 102,688, of which this application is a division.

The abrasive cover disclosed in the above-mentioned patent is therein disclosed with special reference to its adaptability to Naumkeag buffing tools of the type disclosed in United States Letters Patent No. 1,227,622, granted May 29, 1917, upon the application of Ernest Hope. Such an abrasive cover together with a Naumkeag tool to which it may be applied is also disclosed in United States Letters Patent No. 1,917,329, granted July 11, 1933, upon our application Serial No. 499,528, which also was a division of our above-mentioned application Serial No. 102,688.

A buffing tool of the type referred to comprises a rigid supporting member covered with a resilient non-inflated pad of cellular construction. For a purpose later to be explained, both the abrasive cover and the resilient pad may be provided with a central perforation. An abrasive cover of the type above mentioned consists of a disk of abrasive sheet material molded to give its active central surface a radius of curvature shorter than that of the corresponding surface of the resilient pad with the result that one side of the pad applied to the tool is spaced a substantial distance from the pad even though its margins are drawn up tightly to the tool thereby producing a smooth action. The marginal portion of the cover is slitted to form tabs which are molded in upstanding relation to the central portion of the cover to facilitate clamping them to the upper face of the tool.

An object of the present invention is to provide an apparatus adapted for molding covers of the type under consideration. In accordance with the present invention, the illustrated molding apparatus comprises complementary molding members which, as in the illustrated apparatus, may be, respectively, convex and concave, gripping devices arranged to engage the marginal portion of an uniformed abrasive cover, and means for operating the molding members and the gripping devices, the operating means being constructed and arranged first to cause the gripping devices to grip the abrasive cover and to stretch the abrasive cover against the convex molding member, and then to cause relative approach between the molding members to press the central portion of the abrasive cover between the molding members. In operating upon articles such as abrasive covers, which are usually composed of cloth or paper, the preliminary stretching of the article about the convex molding member is important to avoid wrinkling and creasing of the material. In cases where it is desirable to form a central perforation in the abrasive cover, a punch may be provided for this purpose, the convex molding member being recessed to accommodate the punch and the punch being operated after the cover has been stretched by the gripping devices against the convex molding member. The perforation facilitates the application of the cover to a pad by the use of a tool of the type disclosed in the above-mentioned Letters Patent No. 1,917,329, which applying tool is provided with a pin adapted to extend through the perforation of the cover for centering the cover and for spacing the central portion of the cover from the pad. In the illustrated apparatus one of the gripping devices is provided with a beveled edge which cooperates with the other gripping device to turn up the peripheral portion (usually formed in tabs) of the abrasive cover.

While the Naumkeag tool disclosed herein and in our above-mentioned co-pending applications is of the non-inflated type and while the radius of curvature of its working surface differs from that of the working surface of the abrasive cover, it is to be understood that in various aspects the present invention is not limited in applicability to molding covers for non-inflated tools as distinguished from covers for inflated tools or to molding covers which have different radii of curvature from the tools to which they are to be applied.

These and other features of the invention are described in the following specification and illustrated in the accompanying drawing, in which

Fig. 1 is a side elevation, partly in section, of an abrading tool with a molded abrasive cover in position thereupon;

Fig. 2 is a plan view of a disk of abrasive material prior to being molded;

Fig. 3 is a vertical, sectional view of the novel molding apparatus which constitutes the subject-matter of the present application;

Fig. 4 is a perspective view of the apparatus shown in Fig. 3; and

Fig. 5 is a diagram illustrating the position of certain parts of the molding apparatus with respect to the marginal tabs of the cover.

The tool illustrated in Fig. 1 is a Naumkeag pad of the non-inflated type shown in United States Letters Patent No. 1,227,622, above men-

tioned. In this tool a rigid, circular, disk-shaped head or support 10 is secured to or formed upon the lower end of a threaded stem 12 by means of which the tool may be rotatably mounted in a machine. Upon this head 10 is mounted a circular pad 14 of rubber or the like provided with a convex working face 16. This face is supported by means of a plurality of intersecting ribs 18 formed upon the inner surface of the pad to provide a series of polygonal pockets or cells completed by the end surface of the disk 10 as the upper edges of the ribs 18 bear against said disk. A hole 20 is provided at the center of the pad for a purpose to be later explained and registering with this hole is a concentrically disposed recess 22 formed in the head 10 and of smaller diameter than the hole 20. It will be observed that an abrasive cover 24 has been applied to said pad engaging it tightly around the periphery but spaced therefrom, as at 26, a substantial amount.

The marginal portion of the cover is folded over the upper surface of the pad with the tabs 28 of said cover in overlapping relation and gripped against the upper surface of the pad by means of a clamping cover plate 30. A spring 32 is interposed between the disk 10 and the cover plate 30 for a purpose which will later appear, and a clamping nut 34 is provided upon the stem 12 by means of which the cover plate may be clamped firmly against the marginal tabs of the cover to grip them upon the pad 14. The abrasive cover is provided with a central opening 36 which registers with the hole 20. The tool is intended to rotate in a counter-clockwise direction when viewed from above or clockwise when viewed from below as indicated by the arrows in Figs. 1 and 2 respectively, and it will be seen that the pad cover, when applied to the tool, has minimum of such local protuberances of folded or bent up material at the end of the slits as would promote undue wear of the cover. Furthermore the overlapping relation of tabs 28 of the cover at or immediately adjacent to the edge of the tool is in such relation to the rotation of the tool that any contact of a piece of work with the tool at this portion tends to lay the tabs down on each other rather than to tear them apart.

To promote this result the cover is preferably formed from a disk 40 of abrasive material shaped as in Fig. 2. Such disks 40 are preferably first cut from sheets of abrasive material such as emery cloth by properly shaped knife edged dies in a press in the usual manner, the dies employed having portions projecting inwardly at intervals to cut slits in the margin of the disk which form the tabs to be folded over the pad. The slits in the disks to be used with the tool above described are preferably cut as shown in Fig. 2 in the form of more or less curved slits 42 which start from their inner ends substantially along radii *a* of the disk and curve round into lines *e* forming straight cuts 44 disposed at an angle of some 30° with tangents *f* to the disks at the points where the slits emerge from the edge of the disk. A line *d* joining the beginning and end of the slit makes an angle of some 45°–60° with such a tangent. The angle between adjacent radii, *a*, *a* is preferably 18°, giving twenty tabs. The pointed tabs produced by slitting in the above manner would have sharp tips produced by the junction of the slits with the circular cut defining the periphery of the disk. Since such tips have no value and may in practice be apt to bind in the knife, they may be cut off at 46, the outline of the knife employed being circular with a series of small indentations therein as indicated by the outline of the disk shown in Fig. 2. The central perforation to be later produced is indicated at 36.

After such disk-shaped pieces have been cut out, they are molded so that the central active portions or operative face of the cover has a curvature the radius of which is less than the radius of the corresponding face 16 of the pad and the marginal tabs of the disk are turned in upright position in proper overlapping relation ready for the application of the cover to the pad

To this end, there is provided a molding apparatus shown in Figs. 3 and 4 comprising an upper, fixed, convex die 50 and a lower concave die 52. It will be noted that the convexity of the upper die 50 is continuous over the entire work-engaging surface of the die. The upper die is carried at the lower end of a fixed vertical shaft 54 and is provided with a ring 56 having a beveled edge 57 adapted to engage the disk 40 of abrasive material to be molded at a distance within its outer edge represented approximately by the radial measurement of the tabs. The ring is pressed downwardly by a spring 58 and retires as the dies approach, as will be described.

The lower die 52 is carried within a plunger 60 adapted to be raised, by power applied through a strong spring (not shown), towards the upper die 50. The plunger 60 is provided with an upstanding rim 62 forming within it a circular recess by which the unmolded disk 40 may be accurately centred. Fixed to the plunger 60 and projecting through the centre of the die 52 is a pin 64 adapted to enter a central hole 66 in the upper die. This pin 64, which operates as a punch to form the central opening 36 of the abrasive cover, is supported in a cross piece 68 and held in position by a screw 70. The die 52 is slotted at 72 to receive the cross piece 68 and has a cross pin 74 fast in a stem 76 on the die with its ends traversing a slot 78 in the plunger of greater vertical dimension than the pin 74. As shown in Fig. 3 the ends of the pin 74 rest, when the dies are separated, upon the upper end of a standard 80 in which the plunger 60 reciprocates. When the plunger first rises the die remains stationary until picked up as the pin 74 contacts with the bottom of the slot 78 and then the die 52 and plunger 60 move upwardly together. Assuming that a disk of abrasive cloth or the like has been placed inside the rim 62, it will be gripped primarily as the dies approach one another between the lower bevelled edge of the ring 56 and the inner edge 82 of the plunger, this grip acting both to prevent any lateral displacement of the disk and partially to turn up the tabbed margin of the disk. As the plunger 60 rises further the spring 58 yields until the abrasive disk, gripped between the plunger 60 and the ring 56, is tightly stretched against all portions of the convex surface of the die 50. Continued upward movement of the plunger 60 raises the die 52 until the disk is pressed and molded between the two dies. The central perforation in the cover will have meantime been punched in the gripped disk by the pin 64. The lower die 52 may conveniently be heated by any usual means such as an electric heating cartridge 84.

Within the rim 62 is a series of vertically upstanding pins 86 of less height than the rim and arranged in a circle of diameter roughly half way between that of the central uncut portion of the cover and that of the cover disk in its

flat condition, as indicated in Fig. 5, one pin being provided for each tab which is to be folded up.

A complemental set of pins 88 projecting vertically downwards is mounted upon a sleeve 90 surrounding the top die 50. These pins 88 are disposed on a circle slightly smaller than the circle of the pins 86 and are arranged to contact with the tabbed portions of the cover disk at points approximately midway between the points engaged by the first pins, as indicated in Fig. 5. The sleeve 90 carrying the second set of pins 88 is slidably mounted on the upper die-carrying stem 54 which projects downwardly from the upper and overhanging end (not shown) of a column 92 of the apparatus and is connected to the column by diametrically disposed trunnion pins, of which one is shown at 94 on said sleeve 90 in position to engage the slotted ends 96 of arms 98 (embracing the sleeve 90) of a lever 100 pivoted at 102 to the column 92. A spring 104 is provided to hold the lever 100 normally down in a position in which the pins 88 on the sleeve 90 project well below the bottom edge of the spring pressed ring 56 on the upper die 50. An adjustable stop screw 106 mounted on the lever contacts with the column 92 in this position. During the latter stage of the cover molding operation the lever 100 and sleeve 90 are lifted, as will be described, by contact of the lever with a second stop screw 108 mounted on the rim 62 between the lower die 52 and the column 92.

In operation a flat cover disk 40 placed within the rim 62 will in fact at first be supported by the lower ring of pins 86. The position of the disk may be fixed, as regards rotation inside the rim, so that its tabs occupy the desired relation to the pins, by turning down one tab 109 (see Fig. 5) by hand and positioning its edge against one pin 860 (see Fig. 5) of the lower pins 86 which may be made of larger diameter than the others to act as a locator. In this desired relation the lower pins 86 touch the faces of the tabs near their concavely curved edges while the upper pins 88 will each be vertically over a portion of each tab near its convexly curved edge as shown in Fig. 5. When the apparatus is set in operation the rising of the plunger 60 causes the disk to be engaged first by the two sets of pins 86 and 88 with the result that the tabs 28 are twisted, their points being bent upwardly and inwardly as shown in Fig. 4, thus ensuring that the tabs are bent in a manner that brings the point of each well inside the next tab before the margin of the disk is sharply bent up by the ring 56 and brought into vertical position during the final gripping of the central portion of the cover between the convex and concave dies 50 and 52. Since, as stated, the cover margin is to be turned up into a vertical position (the convex die 50 entering within the part of the plunger 60 surrounding the concave die 52 during the latter portion of the latter's travel for this purpose) it is necessary that the pins 88 be removed from within the space encircled by the turned up tabs. Such removal is obtained at the proper time by the contact of the screw 108 with the lever 100 above referred to, the sleeve 90 carrying the upper ring of pins 88 being moved upwardly at a greater rate than that at which the lower die rises by reason of the fact that the screw 108 is between the axis of the die centres and the pivot 102 of the lever 100 and lifts said lever at about its mid point. The sleeve 90, being actuated by the free end of the lever, therefore moves upwardly at about twice the rate at which the lower die moves after the screw 108 contacts with the lever and thus lifts the upper set of pins 88 entirely clear of the molding members and of the upturned margin of the cover.

As previously stated, the abrasive disk is gripped between the plunger 60 and the ring 56. As the plunger 60 continues its upward movement, the ring 56 will yield upwardly, and the abrasive disk, being gripped adjacent to its marginal portion, will be stretched about the convex die member 50. Such stretching prepares the disk for the molding operation by maintaining the disk in tension and thus preventing the formation of wrinkles which might otherwise develop in the attempt to mold a material such as cloth or paper from a flat form to the curvature of the die members. Further upward movement of the plunger 60 causes the die member 52 to press the disk against the die member 50, thereby molding the disk to the desired shape.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. An apparatus for molding the central area of an abrasive cover, comprising a molding member having a continuously convex face, a molding member having a concave face opposed to and substantially complemental to the convex face of the first-mentioned molding member, means for gripping the marginal portion of an unformed abrasive cover, and operating means constructed and arranged first to cause the gripping means to stretch the central portion of the abrasive cover tightly against all portions of the convex face of the first-mentioned molding member and then to cause relative approach of the two molding members to press the central portion of the abrasive cover between the convex and concave faces.

2. An apparatus for molding to convex form the central area of an abrasive cover, comprising a substantially circular molding member having a continuously convex face, a substantially circular molding member having a concave face opposed to and substantially complemental to the convex face of the first-mentioned molding member, a ring surrounding the first-mentioned molding member, a support for said ring constructed and arranged to enable said ring to yield relatively to the first-mentioned molding member, a ring surrounding the second-mentioned molding member and relatively movable with respect thereto, and operating means for causing the second-mentioned ring to advance and to grip the marginal portion of an unformed abrasive cover against the first-mentioned ring and by continued advancing movement, as the first-mentioned ring yields, to stretch the central portion of the abrasive cover tightly against the convex face of the first-mentioned molding member, said operating means having a lost-motion connection to the second-mentioned molding member for causing the second-mentioned molding member to press the stretched central portion of the abrasive cover against the convex face of the first-mentioned molding member.

3. An apparatus for forming abrasive covers, comprising a forming member having a continuously convex face with a central recess therein, means for gripping the marginal portion of an unformed abrasive cover, a punch constructed and arranged to be received within the recess in said forming member, and operating means con-

structed and arranged to cause said gripping means to grip the abrasive cover and to stretch the central portion of the abrasive cover tightly against all portions of the convex face of said forming member, and to cause said punch to enter said recess and thereby to effect a central perforation in the stretched abrasive cover.

4. An apparatus for forming abrasive covers, comprising a pair of substantially complemental molding members, a pair of members constructed and arranged to grip between them the marginal portion of an abrasive cover, a punch positively connected to one of said gripping members and centrally disposed with respect to said molding members and said gripping members, one of said molding members being recessed to receive said punch, and operating means constructed and arranged to cause said gripping members to grip between them the marginal portion of the abrasive cover and to stretch the abrasive cover against said recessed molding member, then to cause said punch to perforate the central portion of the abrasive cover, and to cause relative movement of approach between said molding members to cause the central portion of the abrasive cover to be pressed between said molding members.

5. An apparatus for molding to convex form the central area of an abrasive cover for a Naumkeag pad comprising opposed complementary molding members which are respectively convex and concave, said members being adapted to engage the opposite faces of the cover, and a pair of gripping devices arranged to engage the marginal portion of the cover a substantial distance within the periphery of the cover prior to the engagement of the molding members with the cover to position the cover during the molding action, one of said gripping devices having a beveled edge which cooperates with the other gripping device to turn up the portion of the cover adjacent to the periphery of the cover in the general direction of the curvature of said molding members.

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