

H. BEHR.

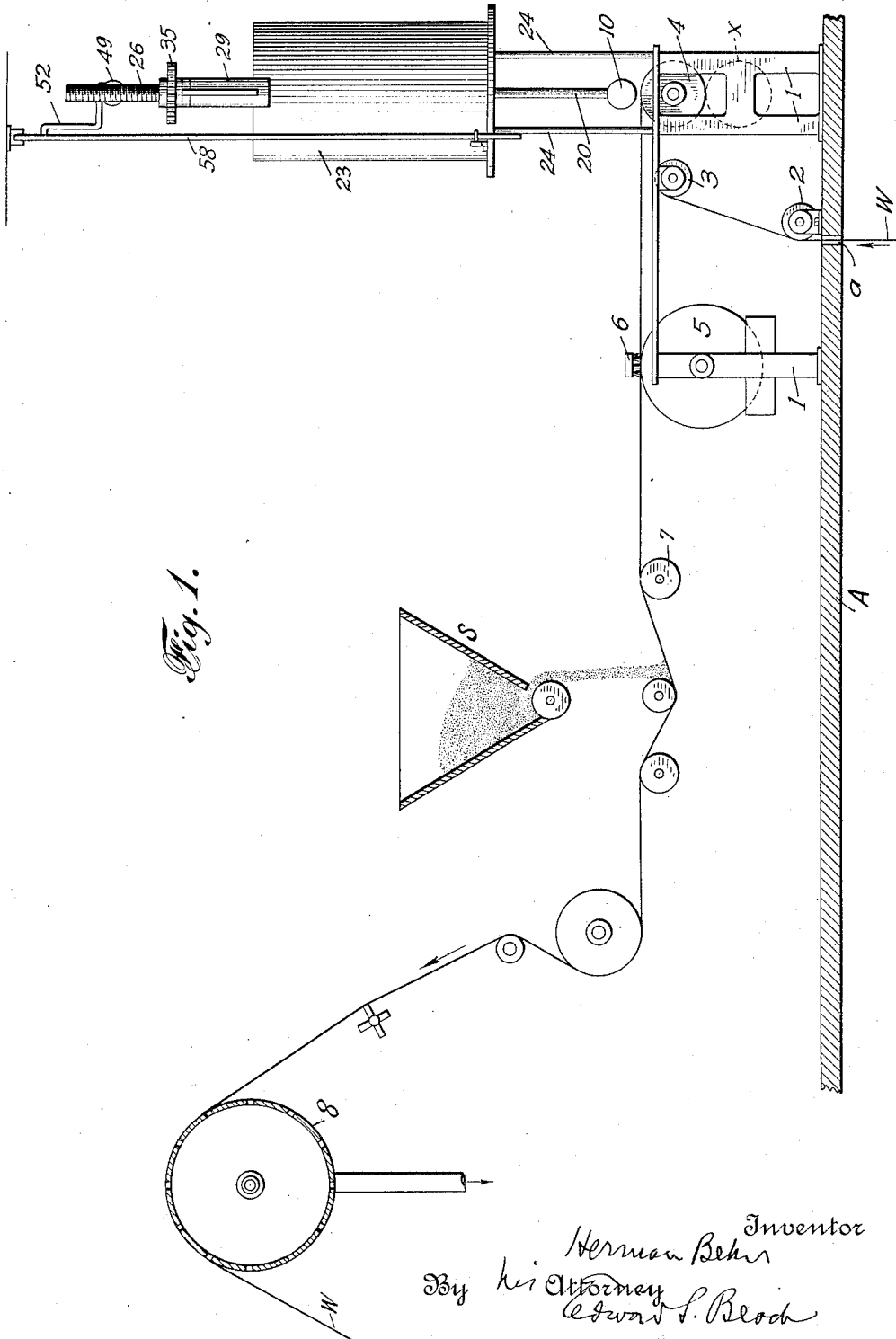
METHOD OF MAKING SANDPAPER AND OTHER ABRASIVE SHEET MATERIAL.

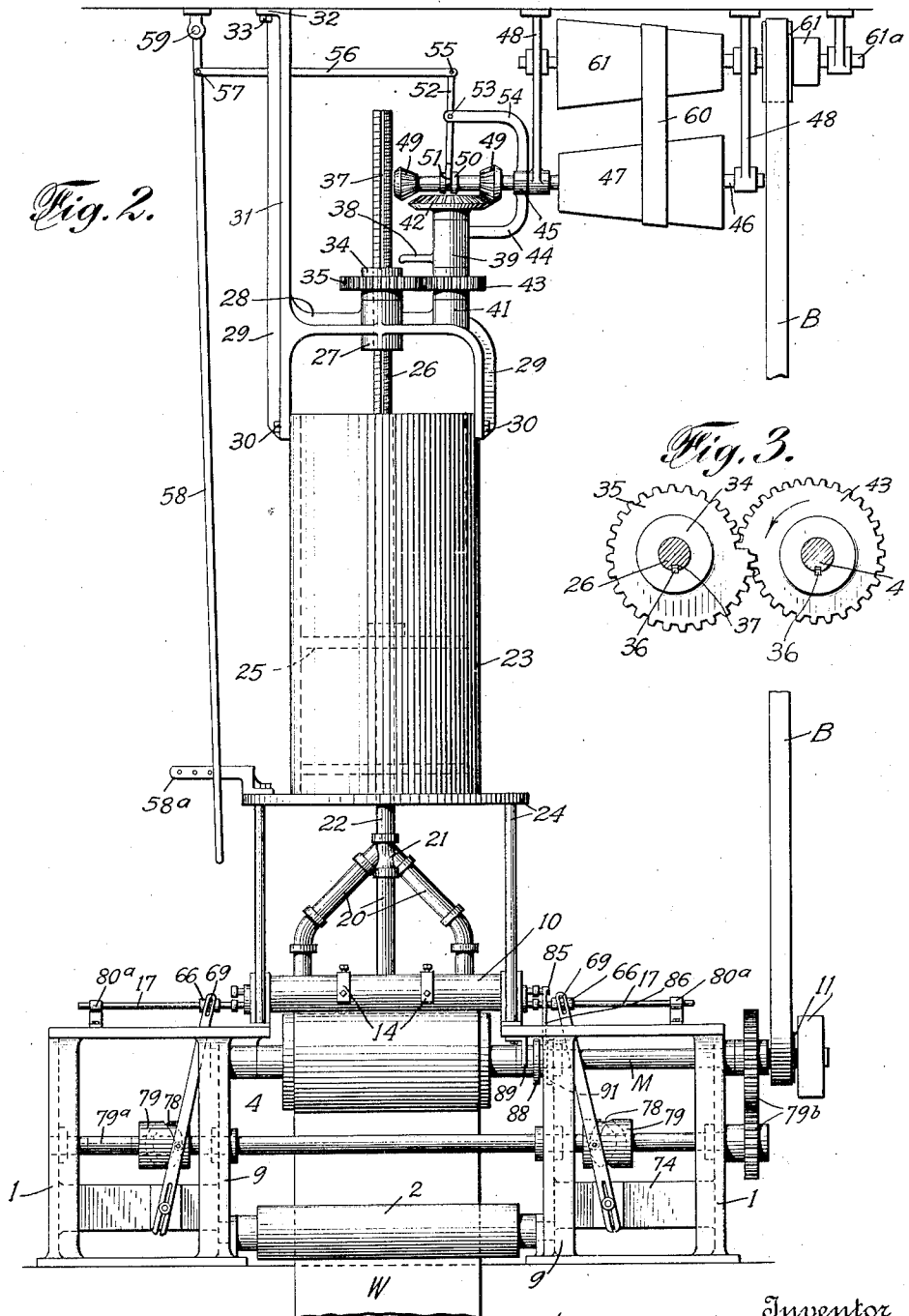
APPLICATION FILED NOV. 29, 1919.

1,357,944.

Patented Nov. 9, 1920.

7 SHEETS—SHEET 1.





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By his Attorney
Edward J. Beach

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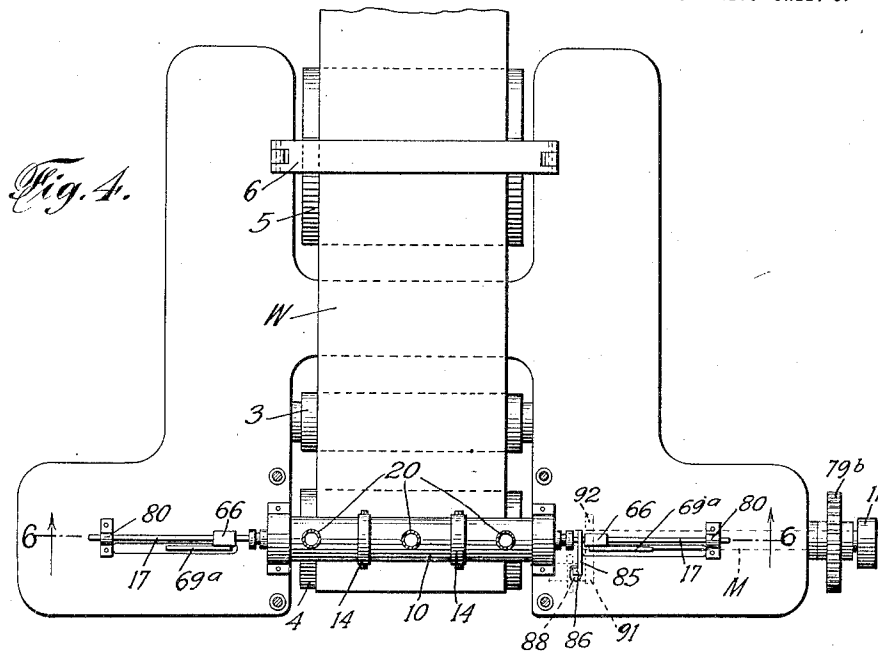
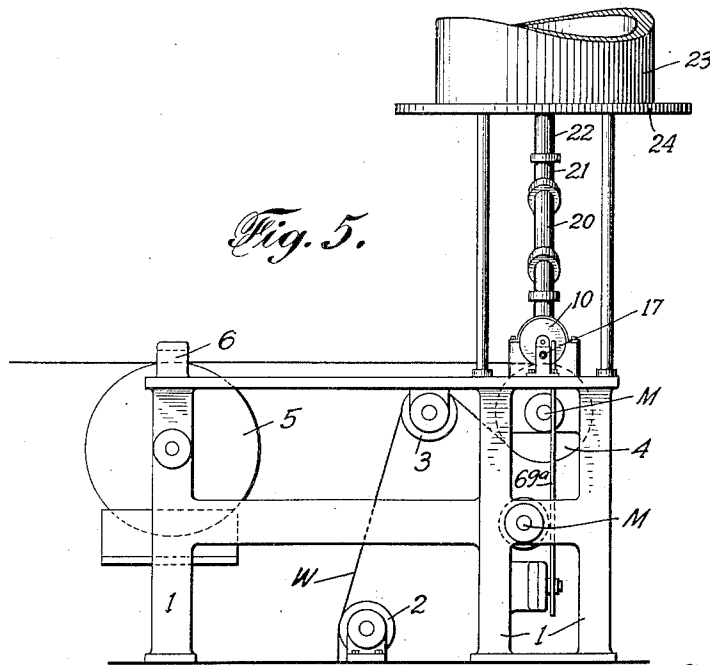
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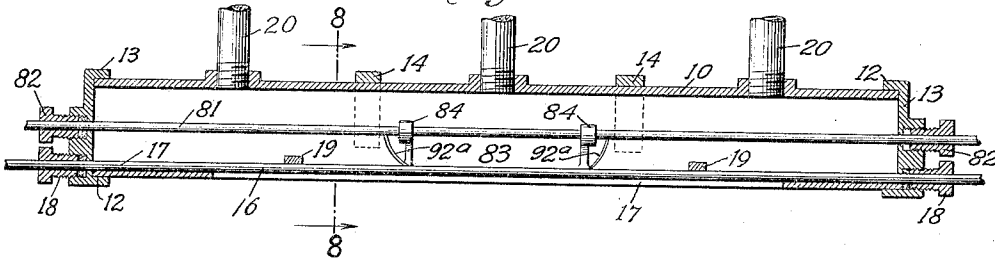
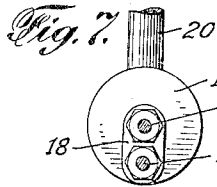
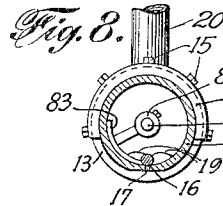
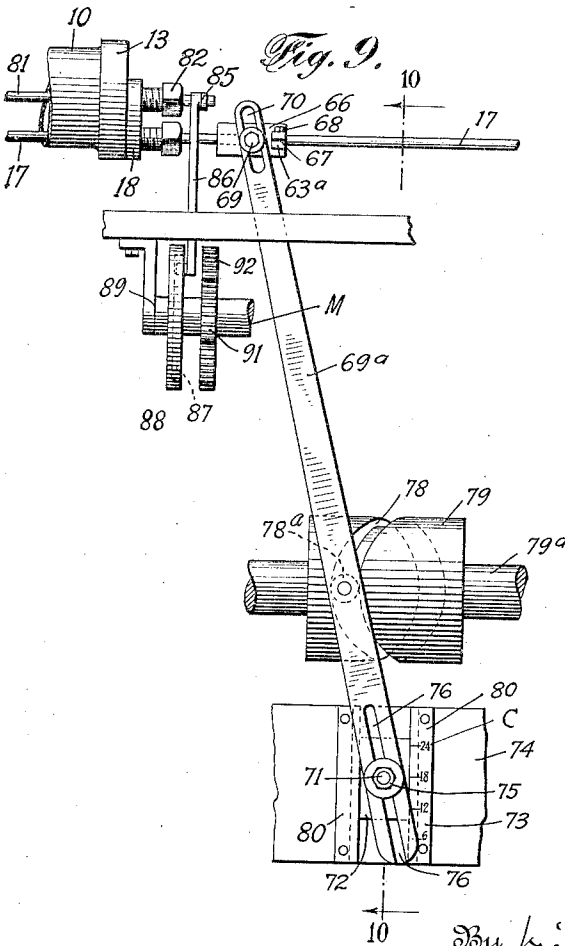
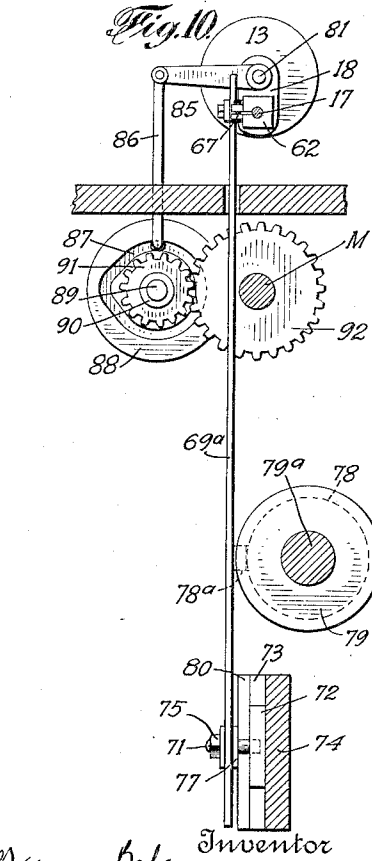
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7 SHEETS—SHEET 4.

Fig. 6.



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Fig. 11.

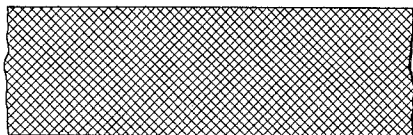


Fig. 13.



Fig. 12.



Fig. 14.



Fig. 15.

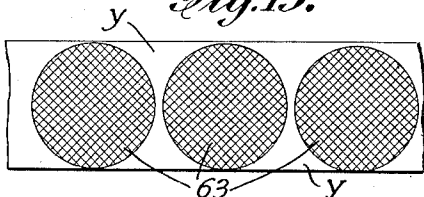


Fig. 17.

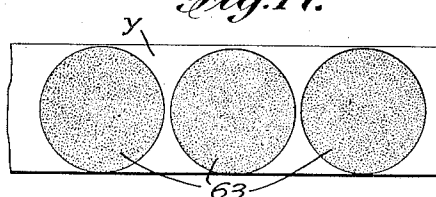


Fig. 16.

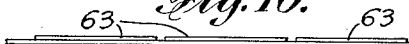


Fig. 18.

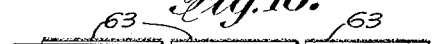


Fig. 19.

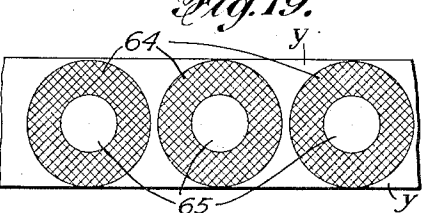


Fig. 21.

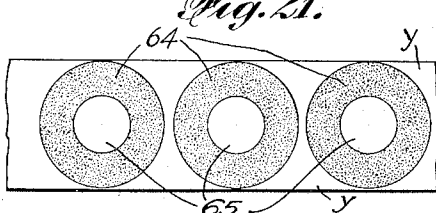


Fig. 20.



Fig. 22.



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Fig. 23.

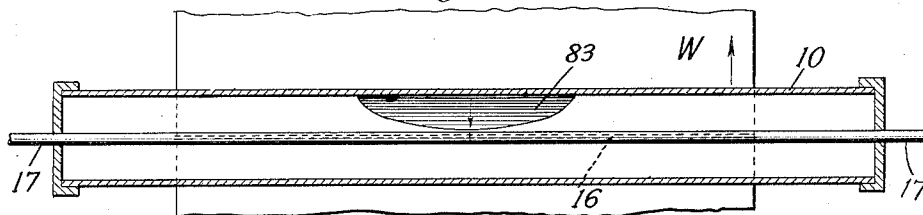


Fig. 24.

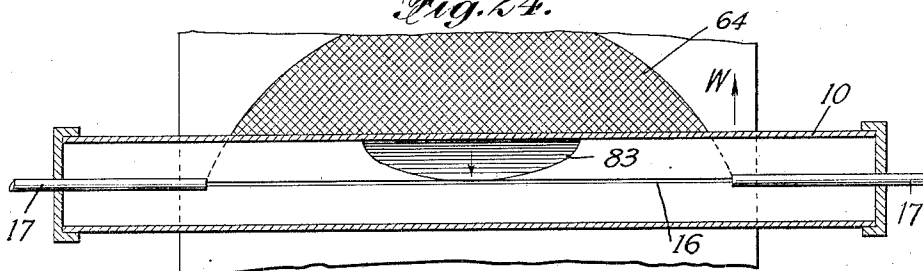


Fig. 25.

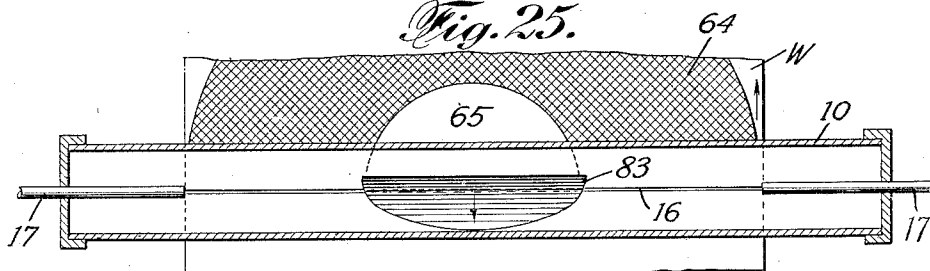
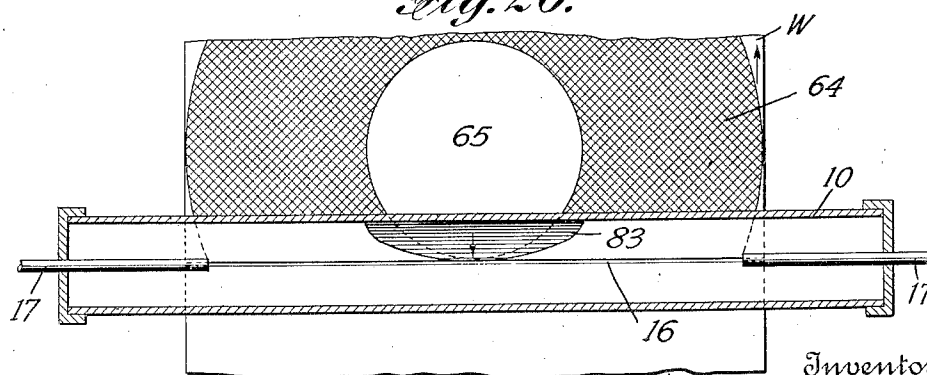


Fig. 26.



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Fig. 27.

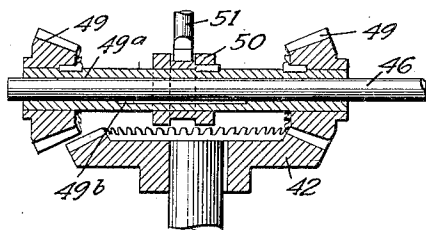


Fig. 28.

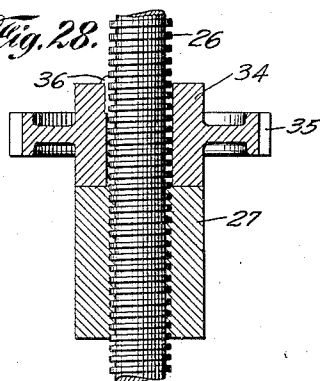


Fig. 29.

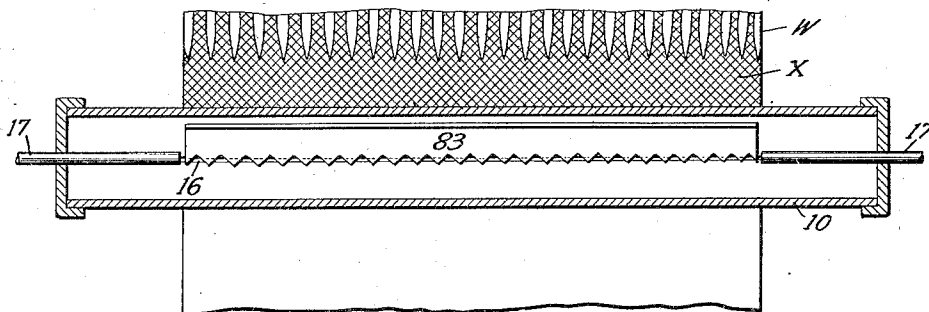


Fig. 30.

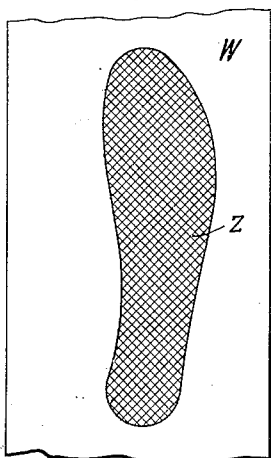


Fig. 31.

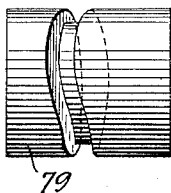
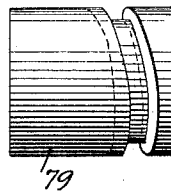


Fig. 32.



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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING SANDPAPER AND OTHER ABRASIVE SHEET MATERIAL.

1,357,944.

Specification of Letters Patent.

Patented Nov. 9, 1920.

Application filed November 29, 1919. Serial No. 341,472.

To all whom it may concern:

Be it known that I, HERMAN BEHR, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Methods of Making Sandpaper and other Abrasive Sheet Material, of which the following is a specification.

The objects of this invention are set forth in connection with a description and mode of operation of machines forming the subject-matter of my companion application Serial No. 341,470, filed November 29, 1919, and Serial No. 341,471, filed November 29, 1919. My new method may be practised by use of various other mechanisms, or by hand operations if it were so desired. For the reason that I desire to show some form of apparatus or machine by which the method can be practised more efficiently and rapidly than by hand operation, I prefer to show the machine set forth in said application Serial No. 341,470 wherein the production of three different abrasive products are mentioned, to wit: a backing provided with adhesive and superimposed abrasive across its full width; a backing provided with adhesive and superimposed abrasive in the form of separated disks; and a backing provided with adhesive and superimposed abrasive in the form of annuli or in other words in the form of disks with integral arbor-hole sections that are to be cut from the untreated portions of the web or backing when the latter is separated by a subsequent operation from the perimeter of the annuli. In the case of the disks, the untreated portions of the web or backing are also separated from the perimeters of the disks by a subsequent operation.

This invention relates to a method for use in the manufacture principally of abrasive sheet material having flexible paper or textile fabric backing, either in long strips having abrasive material from edge to edge on one surface; or, in long strips having a series of abrasive disks spaced apart one from another; or, in long strips having a series of abrasive rings spaced apart one from another on one surface, as the case may be; such strips being adapted to be subsequently cut up into either sheets or disks or rings.

By abrasive is meant any abrasive or cutting material applied in fragmentary form; by glue or matrix is meant any suitable kind

of adhesive; and by backing is meant any desired material on which the adhesive and thereon-deposited abrasive are superposed. All kinds of the abrasive material may be considered as included in the term sandpaper.

The machine now shown may be used in any one of three different ways at the will of the operator. First, the machine may be used for depositing adhesive either wholly or partially across the width of the backing preparatory to applying abrasive on such adhesive. Second, the machine may be used for applying the adhesive to the backing in disk form or in a series of successive disks, preparatory to applying abrasive to the adhesive disks. Thirdly, the machine may be used to deposit an annulus of adhesive or a series of such annuli on the backing, the disk-forming means in such case operating in conjunction with an arbor-hole stopper valve for preventing deposit of adhesive at the central sections of the disks so that at its such central sections the backing is left free of both adhesive and abrasive, and such sections may be cut to form arbor-receiving holes in the abrasive disks, the perimeters of which are also to be cut from the untreated backing.

In the accompanying drawings forming part hereof and illustrating the principle of my invention in the best form now known to me of applying that principle in a form of machine useful in working the present method,

Figure 1 is a side elevational, diagrammatic view, in part, of so much of a known sandpaper manufacturing apparatus as is necessary to be shown in connection with the present invention; and in part, of such apparatus when it indicates features of this invention. The view shows in end elevation, looking from a side of the machine, my new gluing apparatus with a web of backing running through it and past means for application of abrasive on the previously deposited layer of adhesive on the upper surface of the web; the usual pneumatic web-feeding drum being also shown. In this diagrammatic view, the glue-depositing cross-head is shown above its normal working position which is illustrated in other figures following.

Fig. 2 is a front elevation of my new gluing apparatus, an end view of which is partially indicated in Fig. 1.

Fig. 3 is a plan view of a pair of intermeshed scroll gears shown in Fig. 2, and forming part of mechanism for forcing the adhesive under pressure, on the backing.

Figs. 4 and 5 are, respectively, a partial top plan and a partial side elevation of the machine shown in Fig. 2.

Fig. 6 is a lengthwise sectional elevation at line 6-6 of Fig. 4 of the transverse, lengthwise-chambered glue-depositing crosshead which forms a part of the gluing apparatus; this view showing the lengthwise-extending glue-escape slit of the glue-depositing crosshead closed by endwise-slidable rod-valves; and also showing in side elevation, the arbor-hole stopper-valve herein-after mentioned.

Figs. 7 and 8 are, respectively, an end and a vertical sectional view of the glue-depositing crosshead, Fig. 8 being in section at line 8-8 of Fig. 6 and showing one of a pair of the rod-valves and an end elevation of the arbor-hole stopper-valve.

Fig. 9 is a front elevation of one of two identical cam-controls for one of the two identical reciprocable rod-valves contained in the glue-depositing crosshead.

Fig. 10 is an elevational view, partly in vertical section at line 10-10 of Fig. 9, and further illustrates one of said controls, and also the mechanism for operating the arbor-hole stopper-valve.

Figs. 11 and 12 are respectively a plan view and an edge view of a portion of a web of backing having a deposit of adhesive from edge to edge of one surface; and

Figs. 13 and 14 are views corresponding to Figs. 11 and 12 but showing the abrasive in place on the adhesive.

Figs. 15 and 16 show in plan and edge view a series of disks of adhesive spaced apart on the backing; and

Figs. 17 and 18 are corresponding views showing abrasive in place on the adhesive disks shown in Figs. 15 and 16; the disks of adhesive and abrasive to be cut from the backing for completion of the product.

Figs. 19 and 20 show in plan and edge view, rings of adhesive spaced apart on the backing; and

Figs. 21 and 22 are corresponding views showing abrasive on the adhesive rings shown in Fig. 19 and 20; the central sections of the backing inclosed by the adhesive and abrasive to be cut out to form holes for reception of tool arbors or shafts; and the perimeters of the rings to be cut free of the backing for completion of the product.

Figs. 23 to 26 inclusive are a series of diagrammatic views illustrating different successive stages of the relative positions of the rod-valves and arbor-hole stopper-valve for formation of a ring of adhesive on the backing.

Fig. 23 indicates the opposed ends of the

rod-valves in contact and closing the exit slit of the glue-depositing crosshead; by an arrow indicates that the web is traveling rearwardly; and by another arrow indicates that the arbor-hole stopper-valve is traveling downward and forward. The rod-valves are about to be separated for beginning the rear edge deposit of adhesive from the crosshead.

In Fig. 24 the web has traveled rearward; a portion of a disk of adhesive has been deposited on the web in consequence of the increasing separation of the free ends of the rod-valves; and the forward rear edge of the arbor-hole stopper-valve has moved downwardly and forwardly until its crown is alined with the exposed adhesive-exit slit of the crosshead where the rear bend of the arbor-hole section of the backing is to begin, at a point removed rearwardly from the center of the disk of adhesive under formation.

In Fig. 25 the web has traveled farther to the rear; the opposed ends of the outwardly-moving rod-valves are shown separated at the transverse diameter of the partially formed ring and concentric arbor-hole section, the outward movement of the disk-forming rod-valves having been arrested; a rearward portion of the arbor-hole section is shown free of adhesive; and the arbor-hole stopper-valve is shown farther forward.

In Fig. 26 the web of backing has traveled still farther rearward; a greater portion of the disk of adhesive has been formed by approachment of the opposed ends of the rod-valves, subsequent to their position at the diametric position shown in Fig. 25; and the free front edge of the arbor-hole stopper-valve has moved upwardly and backwardly as indicated by the arrow thereon in Fig. 26.

Fig. 27 is a vertical central sectional detail of the construction of the reversing gear mechanism shown in Fig. 2 with the threaded piston rod rising from the piston in the container for the adhesive, the reversing gears being shiftable into inoperative positions relative to a beveled gear shown on the threaded piston rod.

Fig. 23 is a vertical sectional detail showing said threaded piston rod threaded through a stationary nut which is a portion of a bracket shown in Fig. 2, and of the inoperative connection of one of the scroll gears shown in Fig. 3 with the threaded piston rod for turning it in its said nut.

Fig. 29 shows an elongated stopper valve or shield provided with a serrated front edge and a deposit of irregular form different from the forms of deposit shown in Figs. 15 to 22 inclusive.

Fig. 30 shows a still different form of deposit in the shape of a shoe sole; and

Figs. 31 and 32 show a pair of pattern cams having grooves dimensioned to move the rod valves for effecting the shape of deposit shown in Fig. 30.

5 Referring to that form of said machine shown in the drawings, 1 indicates upstanding side frames of the gluing machine; 2 a transverse roll past which the web W of flexible backing runs upwardly through a
10 transverse slot *a* through the floor A on which the machine is located; 3 indicates a transverse upper roll for the web which is led over it and forwardly and downwardly under and thence upwardly and rearwardly
15 over a transverse, front web-supporting roll 4 which is the preferable form of work-support, or support for the material to be treated. From roll 4 the web is shown extending rearward over a transverse drum 5
20 with the upper surface of the web in contact with a transverse wiper 6, the web with its upper surface faced with adhesive running over a transverse supporting roll 7, and thence under means for depositing ab-
25 rasive on the adhesive on the backing and shown as the usual sander S, and thence over a pneumatic-suction web-feed drum 8 by which the web is continuously pulled from the web-supporting roll rearwardly under
30 the sander, and thence to the festooning mechanism referred to but not shown. In Fig. 1, I show in dotted lines *x*, the old gluing roll that ran in a glue trough and deposited the glue or matrix on the web as
35 it turned upward over the front web-supporting roll 4. Said glue-roll *x* and its trough are now dispensed with and the upper surface of the web W at the upper peripheral crown of the roller 4 has the ad-
40 hesive deposited on it by a lengthwise-chambered glue-depositing crosshead, parallel to and extending lengthwise of the upper peripheral crown of roll 4.

The gluing machine is shown provided
45 with inward upstanding posts 9 each of which is transversely alined with an outward upstanding side frame 1. The usual revoluble shaft M of the web-supporting roll 4 constitutes the main-shaft of the gluing machine, but in the present case is pro-
50 longed at one end of roll 4, the prolongation having a bearing in each frame member 1 and 9 (Fig. 2). Said glue-depositing crosshead is indicated by 10. The shaft
55 M is equipped with a belt pulley 11 for application of power. The glue-depositing crosshead is formed of a lengthwise-split tube the ends of which are exteriorly screw-
60 threaded at 12, each end of the split tube being provided with a screw cap 13 on its threaded end; and the members of the split tube are otherwise held in tubular assem-
65 blage by arcuate clamps 14 and screws 15 through the arcuate clamps, the free ends of each clamp embracing the upper split

tube member and extending downwardly into engagement with upper opposed portions of the under split tube member which is formed at its bottom crown portion with a lengthwise-extending glue-exit preferably in the form of a continuous slit 16 from which the adhesive is pressed out evenly and under regulable pressure upon the upper surface of the web while it is in continuous rearward travel from the
75 front web-supporting roll 4 and has its upper surface coated with glue from edge to edge or between its edges, according to the adjustment of the lengthwise-alined, end-wise-movable, rod-valves 17 each of which
80 projects into the chamber of the glue-distributing crosshead through a stuffing box 18 with which each cap 13 is provided in its lower portion, the inward end portion of each rod-valve passing between interior side
85 guides 19 between which the rod-valves work. The guides 19 are fixed to the interior bottom wall of the under split member of the glue-distributing crosshead, and are located adjacent and some at one side and
90 others at the other side of the exit slot 16. The under surface of each rod-valve works in close contact with the inner wall surfaces adjacent the slot 16.

The rod valves may be pushed in wholly
95 or partially to close the slot 16; and may be pulled out by hand when desired to open up the exit slot 16 to any desired length, according to the width of the web to be
faced with the adhesive or to the width of
100 the adhesive to be deposited on the web.

For obtainment of a determinable thickness of adhesive on the web surface to be treated, and in order to secure uniformity of thickness of the deposited adhesive, the
105 glue-depositing crosshead is, preferably and by one feature of this invention, supplied with adhesive which is under a forced and constant pressure feed that is regulable by means of variable-speed and piston me-
110 chanisms whereby, for a given quantity of adhesive at a given temperature, with the web traveling at a predetermined speed, and with the controllable forced feed adjusted to a known operating condition, it is prac-
115 tical not only to deposit the adhesive uniformly on either all or selected parts of a length of web in its travel; but also, for subsequent repeat orders, similarly to de-
120 posit the adhesive on other webs, corresponding in thickness of deposit to the condition of earlier-treated webs. To this end, the distributing crosshead 10 is connected at its upper side with preferably branched
125 conduit members 20 connected at their tops with a union 21, which, at its top, is connected with a conduit 22 dependent from the bottom of a main and cylindrical up-
standing container 23 for the adhesive or
130 glue, this container being supported on the

top of an upstanding frame member 24 above and over the distributing crosshead, the container 23 holding the supply of adhesive for the distributing crosshead. The 5 branched conduit members 20 as shown are three in number, the outermost members severally connecting with the distributing crosshead near an end thereof and the intermediate branch member connecting with 10 the distributing crosshead midway between its ends. In this way close uniformity of supply of adhesive to the chamber of the transverse distributing crosshead is obtainable. The upstanding main cylinder container 23 is open at its top and provided 15 with a piston 25 descent of which forces adhesive into the distributing crosshead through said conduits. The piston is provided with an upstanding threaded piston-rod 26, the lower end of which is fixed to the piston which, by the present construction, is given a rotary movement whenever it is moved downwardly or upwardly in the container 23. The threaded piston rod 25 extends upwardly through a nut portion 27 of a top bracket 28 having depending arms 29 which oppositely embrace the upper end of the container 23, the latter being detachably secured to the bracket arms 30 by set-screws 30. This bracket 28 has an upwardly-extending arm 31 provided with a horizontal lug 32 through which bolts 33 pass into the ceiling of the room of installation; but the bracket may be, if desired, 35 otherwise rigidly installed. Above the bracket 28, the threaded piston rod 26 extends upwardly through the hub 34 of a scroll gear 35, the hub bore being provided with an interiorly projecting feather 36 40 which is entrant in a groove 37 formed lengthwise of the piston rod 26. Rotation of the scroll gear 35 in one direction compels rotational descent and in the other direction compels rotational ascent of the piston in the cylindrical container 23. The upper 45 end of the scroll gear hub 34 bears on the upper end of the nut 27 of bracket 28 and the gear 35 is kept from rising by a lug 38 that projects from a bracket sleeve 39 in which a vertical shaft 40 has a bearing, 50 the foot of this shaft running in an upstanding bearing 41 integral with the bracket 28. The free end of lug 38 is adjacent the top of the scroll gear hub 34. The upper end of shaft 40 carries a horizontal bevel gear 42 and has fixed to it, 55 between the bearing 41 and the bracket sleeve 39, a scroll gear 43 which is in constant mesh with the scroll gear 35. Rotation of bevel gear 42 in either direction will thus impart movement to the scroll gears 43 and 35 and through the latter to the piston rod 26. The bracket sleeve or bearing 39 is shown with an upstanding U-shaped 65 bracket extension 44 the recess of which

is opposed to the upper part of the piston rod 26 which is made of sufficient length to permit the piston to be moved closely to the bottom of container 23 with the piston rod at all times in connection with the 70 scroll gear 35.

The vertical portion of the U-shaped bracket extension 44, between its ends, is formed with a horizontal bearing at 45 for the horizontal shaft 46 of an under cone 75 pulley 47 supported in the lower ends of a pair of hangers 48 shown fixed to the ceiling in a usual way. The cone pulley shaft 46 projects over the bevel gear 42 and is provided with a pair of bevel, reversing 80 gears 49 spaced apart on the shaft and which are to be brought one at a time into mesh with the bevel gear 42 to rotate the latter in the desired one of its two rotational directions. Between these reversing 85 gears 49, the shaft 46 is provided with a peripherally grooved collar 50, the arms 51 of a forked shifting lever 52 working in the groove of the collar, and the lever being pivoted at 53 on the upper arm 54 of 90 the upstanding bracket 44. The upper end of the shifting lever is pivotally connected at 55 to an end of a connecting rod 56, above the machine, the other end of the connecting rod being pivoted at 57 to a dependent 95 hand lever 58 the upper end of which is pivoted at 59 to a ceiling fixture. By manipulating the hand lever 58, either of the two reversing gears 49 is brought into and the other carried out of mesh with the bevel 100 gear 42 for changing the direction of rotation and consequently the vertical movement of the piston rod 26, without changing the direction of rotation of the cone shaft 46, the cone 47 on which is driven 105 by a belt 60 from an upper power drive cone 61, the pair of cones and belt being a well-known form of change-speed mechanism. The shaft of cone 61 is provided with a pulley 62 from which a belt B goes to the 110 pulley 11 of main shaft M.

The mechanism above described is, all things considered, the best form of embodying my invention now known to me, for application of an adhesive to the traveling web 115 from edge to edge or between the edges of the latter, preparatory to application of the cutting or abrasive material and the subsequent operations of sizing and drying by carriage in the usual festooning apparatus 120 to the delivery drum.

It is equally important, in the manufacture of abrasive disks or rings, to apply the adhesive under regulable control for obtaining of uniformity of adhesive in successive 125 runs of web; and my present invention broadly considered is applicable to the manufacture of either abrasive disks or rings in the production of which a wholly new and economically important method of 130

manufacture is involved. The machine which I have above described constitutes an invention which in one sense is wholly distinct from other features of my invention now to be described, and which are herein described because the machine shown is a machine which may be used at will for either gluing the web wholly or part way across its width as required in the manufacture of abrasive sheets as distinguished from disks; or for depositing the adhesive in the form of either disks or rings for subsequent reception of abrasive or cutting material.

The prior common practice in the manufacture of abrasive disks is to apply the adhesive to the backing, then to apply the abrasive and size and dry; and afterward to punch the center arbor-holes, cutting the completed rectangular sheets into disks and cutting the arbor holes in the disks and through the abrasive glued thereon. In usual large-scale operations, great quantities of adhesive and of abrasive are wasted by such procedure. As is well known, abrasive disks vary in diameter from sizes suitable for dental work in the human mouth, to say 36 inches, more or less, when such disks are wanted for metal and wood working. By the construction and mode of operation about to be described, I may apply the adhesive to the traveling web either in successive independent disks 63, or in rings 64 (Figs. 15 to 21).

If the application of adhesive and superposed abrasive is made in the form of a disk, then usually a center arbor-hole 65 will have to be punched through such disk, and yet abrasive disks as distinguished from abrasive rings may be useful. However, what I herein call abrasive rings are commercially designated as abrasive disks; and it is therefore preferred to deposit the adhesive and abrasive in the form of rings 64, the peripheries of which are coincident with the edges of the web, and subsequently to punch the arbor holes through the untreated backing, and cut the abrasive rings from the web.

Brief consideration will make it clear that if the contacting opposed ends of the rod valves 17 are gradually separated during a rearward travel at proper speed of the web, the outflowing adhesive, through the exit 16 of the distributing crosshead, will take the shape of a semi-disk, the crown edge of which will be rearward; and that by following up such gradual separating movement, after the transverse diameter of the disk has been reached, with a gradual approaching movement of the opposed ends of the rod valves, the remainder of a disk will be formed.

It is not essential that the perimeter of the disks be mathematically exact or be pre-

cisely coincident with the edges of the web; the perimeter may be more or less jagged, but such disks of deposited adhesive should have diameters slightly in excess of the diameter of the tubular punches subsequently used to separate the completed, abrasive disks from the intervening portions of the web. The appropriate movements of the rod-valves 17 are very simply obtainable as follows. Each rod valve 17, outwardly of the distributing crosshead 10 is provided with a collar 66 which is preferably lengthwise-adjustable on the rod-valve. For this purpose the collar has a split end, formed by an end slot as at 67, and opposed laterally projecting ears 63^a the opposed walls of which are spaced apart by the slot. A screw 68 threaded through holes in the ears suffices to pinch the collar in an adjusted position on the rod valve.

Each collar is provided with a projecting pin 69 working in the elongated lengthwise-extending slot 70 in the upper end of a vertically-disposed cam-controlled lever 69^a the foot of which near the base of the machine is pivoted by a pin 71 on an adjustable slide block 72 mounted in vertical ways 73 on a frame member 74. The bottom pivot pin 71 is fixed in the slide block, its outer end being threaded for reception of a clamp nut 75. The lower end of the lever 69^a is lengthwise slotted at 76 and forks over the pin 71, bearing on a shoulder 77 on which the slotted end of the lever is clamped by the clamp nut 75. By adjusting the position of the slide block, the throw of both levers 69^a may be varied, and as the vibrations of each are controlled by the pitch of an endless cam groove 78 in a rotary cam 79 mounted on a countershaft 79^a rotated by the intermeshed spur gears 79^b, one on main shaft M and the other on the countershaft 79^a (Fig. 2), it follows that the alined rod-valves 17 may be reciprocated to cause their opposed ends to separate and to approach, as may be desired; the adhesive being forced out of the exit 16 according to the varying lengths of such exit occasioned by the separating and approaching movements of the alined rod-valves.

Each lever 69^a is provided with a cam roll 78^a working in the cam groove 78. Thus disks of adhesive of any desired diameter may be deposited on the traveling web, the opposed ends of the rod-valves being brought temporarily into contact to close the exit 16 temporarily while the web travels a slight distance to form the space γ between the disks. Each lever 69^a cooperates with a cam 79, the contour of the groove 78 in each of which determines the throw of the lever and consequently the diameter of the disk of adhesive to be deposited, but one of the pair of marginal guide-plates 80 for each slide block 72 is shown

calibrated, in Fig. 9, at C to indicate different diameters of the disks of adhesive for production of which the levers 69^a may be differently adjusted without changing the cams 79 from one size to another.

It is here noted that when the machine is to be used for gluing the web continuously from edge to edge or part way from edge to edge, as first above described, the levers 69^a are disconnected from the rod-valves 17, so that the latter may be separated by hand and remain separated until it is desired to close the exit 16 of the distributing container. Such disconnection may be effected by removing the pins 69 or better by removing the levers 69^a from the machine, for it is only when disks or rings are to be formed that the levers 69^a are used. The outer end of each rod-valve is supported in an upstanding side bearing 80^a.

For the reason that there is economy in depositing the adhesive in ring form rather than in disk form, especially in the larger sizes of abrasive disks, the machine is provided with an automatically controlled valve for stopping the exit 16, midway between its ends, in order to form the unglued arbor-hole portions 65 of the successive disks formed in series on the web, as described, and while the disks proper are being successively formed.

For this purpose, the glue-distributing crosshead 10 is provided (Fig. 6) with a lengthwise-extending rocker-shaft 81 journaled in stuffing boxes 82 on the screw caps 13. The mid-section of this rocker shaft is provided with an arcuate stopper-valve 83 by means of rocker arms 84. The stopper valve as shown is a portion of a metal disk having concavo-convex surfaces and is detachably connected to the rocker shaft. The stopper valve may be of any desired dimension, to suit the diameter of the arbor-hole space 65 which it is desired to produce in the formation of a disk by controlled separation and approach of the opposed ends of the rod-valves.

One end of the rocker-shaft 81 projects beyond an end of the glue-depositing crosshead and is provided (Figs. 9 and 10) with a rocker arm 85 from the free end of which a thereto pivoted link 86 depends, its lower end having a cam roll working in an endless cam groove 87 in the face of a cam 88 fixed on a shaft 89 which is journaled (Fig. 2) in front of the main shaft M, in frame members 1 and 9. The hub 90 of the cam 88 is formed (Fig. 10) with a pinion 91 which is in mesh with a spur gear 92 on the main shaft M from which the cam 88 and its shaft 89 are rotated. The contour of the cam groove 87 determines the time during which the stopper valve 83 will be closed between the opposed ends of the rod-valves 17, and returned into inoperative position with its

inner and forward free edge rearward of the exit 16. The convex wall of the stopper valve 83 is in sliding contact with the inner wall of the under tube member of the glue-distributing crosshead 10 and in its movements, imparted by the cam groove 87, at times works between the opposed ends of the rod-valves 17 to cover or uncover to a constantly varying length, the glue exit 16, between the rod-valve ends.

The operation is:

As the web travels rearwardly, the stopper-valve 83, which is a form of slide valve, is initially in its lifted and inoperative position with its free forward edge back of and above the exit 16; the contacting ends of the rod-valves are separated for starting the formation on the web of a disk of adhesive, the formation of such disk being commenced at its rearward edge or bend. The rod-valve separating movement continues until the transverse diameter of the disk of adhesive under formation is reached by the rearward travel of the web, but when the rear edge of the arbor-hole space is reached by the rearward travel of the web, a portion of the disk of adhesive having been meanwhile formed rearward of the arbor-hole space, the stopper-valve moves downwardly and forward and begins to cover the exit 16 continuing the covering movement while the rod-valves are continuing in their separating movement up to the time when the transverse diametric line of the disk of adhesive and of its central arbor-hole space are being formed; and then, the web still continuing its rearward movement, the opposed ends of the rod-valves gradually approach and the stopper-valve gradually recedes so that the forward half of the disk and of the arbor-hole space are continuously formed, the final rearward movement for carrying the stopper valve out of covering relation to the exit 16 occurring when the front point or bend of the arbor-hole space is completed. The approaching movement of the opposed ends of the rod-valves continues until the forward edge or point of the disk of adhesive is completed. This is readily accomplished by a proper mechanical layout of the cam grooves 78 and 87. The edges 92^a of the stopper-valve 83, shown in Fig. 6, are struck on a circle corresponding to the diameter of the required arbor-hole dimension. The edges 92^a indicated in Fig. 6 are a part of the intermediate forward free-edge arc of the stopper-valve.

The cams 79 and 88 have their respective cam grooves 78 and 87 so formed as to produce a dwell of the rod-valves 17 with their edges in contact for closing the exit 16 during the time required for spacing the disks apart as at γ .

For the reason that when the meeting

ends of the rod valve 17 are moved apart, the adhesive if under pressure may jet out through the then more or less open exit slit 16 to the detriment of the desired character of deposit of the adhesive on the web, the beveled shifting-gears 49, and the shifting apparatus connected therewith are so constructed that said gears may be given an inoperative or neutral position out of contact with the beveled gear 42. To this end, as shown in Fig. 27, the beveled gears 49 are each fixed on a sleeve 49^a carrying the grooved shifting collar 50 and spaced apart on the sleeve by a distance in excess of the diameter of the beveled gear 42, the sleeve 49^a being splined by a lengthwise-extending feather 49^b to the shaft 46 so that the gear-carrying sleeve is coupled to rotate with the shaft 46 but may be moved lengthwise thereon by manipulation of the hand lever 58 for bringing the beveled gears 49 into neutral position relatively to the gear 42, or to bring either of the two gears, one at a time, into coöperating mesh with the beveled gear 42.

The shaft 61^a on which the cone pulley 61 is fixed may be a member, and desirably is a member, of the driven line shafting, and is so shown; and as it is preferred to drive the main shaft M directly from the line shafting instead of indirectly from the cone pulley shaft 46 as obviously might be done, the pulleys 62 and 11 are each shown as step pulleys whereby the belt B may be shifted and the rotational speed of the main shaft varied at will to suit working conditions.

The contour of the endless cam grooves in the revoluble cams 78 which are pattern cams in effect, may be widely varied for the purpose of widely varying the timing of the reciprocation of the rod valves 17 either or both, for deposit of adhesive on the web in various forms other than across the width of the web. The pattern cams 78 may be removed and replaced by other cams having a different pattern style of cam or cam grooves; and I do not intend to limit all the appended claims either to abrasive products or to adhesive products of the pattern style set forth. And in connection with the described rockable stopper valve 83 it is noted that its edge contour may be widely varied; that its dimension may be increased or diminished relatively to the length of the exit slot 16, and that its movements may be variously timed according to the contour of the cam 87 from which as a pattern cam the rockable stopper valve 83 is actuated. Instead of adhesive, my new machine may be used for the deposit on a web of paint or color or other matter, in a considerable variety of forms and shapes of deposit. It will be observed that the valve rods 17 are positively actuated. When disks or annuli are to be made, the transverse wiper 6 which

is used when adhesive is deposited across the width of the web, is to be removed to prevent spreading of the adhesive disk or annular deposits of adhesive.

One of the important features of said machine consists in depositing on the web adhesive through an adhesive-exit, with the adhesive supply under pressure, because there is thereby obtained on the web a deposit of adhesive of more body than is ordinarily obtainable from a transfer roll such as heretofore used; and this body of deposit is in respect to thickness readily controlled by the operator of the machine, who, while the web or backing is in its continuous feed movement rearwardly, may by manipulation of the accessible hand lever 58 arrest the pressure on the adhesive in container 23 and thereby prevent the liquid contents of the container from spurting or jetting out when the exit 16 is initially opened, or at any other time; and may also vary the pressure at will to suit different working conditions dependent on temperature, hygrometric and other conditions of the container contents and of the backing. A catch bracket 58^a is provided for the lever 58 so that it may be held at will in an adjusted position relatively to either of the two working, or the non-working neutral position of the reversing gears 49 to the gear 42. Either member 10 or 13 is a liquid-holder, and together they form a distributor.

In Fig. 29 the rod valves 17 are shown separated to uncover the exit 16 for the full width of the web or backing W; the stopper valve or reciprocating shield 83 being elongated and provided with a serrated front edge 83^a whereby the adhesive or other fluid in the container will be deposited as shown by pattern *x* on the web. This merely illustrates one of many contours or shapes which may be given to the member 86 with variant effects on the shape of the deposit.

Another example of a change of form is shown in Fig. 30 where the web W appears with a deposit *z* of the shape of a shoe sole. By making the contours of the cam grooves of the form shown in the pattern cams shown in Figs. 31 and 32, the rod valves 17 may be moved to form such a shaped deposit as is shown in Fig. 30.

Figs. 29 to 32, inclusive, are intended to illustrate the nature and character of changes that may be made in the form of machine shown if different-shaped deposits are wanted.

The cams for operating the rod valves and the cam for operating the stopper valve constitute mechanical pattern-control valves.

It will be understood of course that as the lengthwise-grooved piston rod 26 is

threaded through the nut 27, and the gear 35 is interiorly threaded to mesh with threads on the piston rod and is connected by the feather 36 slidably mounted in the lengthwise-extending groove 37 of the piston rod, rotation of the gear 35 on the piston rod carries the feather 36 against one or the other side of the groove 37, compelling the piston rod to turn either up or down in its stationary nut 27, according to the direction of rotation of the gear 35.

Many changes may be made in embodiments of this invention without departure from the invention.

15 I have said above that my new method may be practised by hand if so desired, and such is the case; for example, one person might pull the web over a support and another might with a brush paint adhesive or other liquid fully across the width of the traveling sheet, exerting a pressure on the brush charged with adhesive. And in the case of forming either a disk or annulus of adhesive, the painter might hold a brush 25 in each hand and during the travel of the web paint either a disk or an annulus of adhesive on the web under brush pressure; and obviously as a mechanical proposition a considerable variety of machines might 30 be devised of a very different construction and mode of operation than those of the machine shown, for performing the steps which are performed by the machine shown and for accomplishing the indicated results.

35 What I claim is:

1. In the manufacture of abrasive sheet-material which is to be cut up into abrasive sheets having openings within their perimeters, a method consisting in continuously 40 feeding a web of back-forming sheet-material; in progressively making a series of separate adhesive deposits on the traveling web; during such travel of the web and during the formation of each adhesive deposit, 45 in progressively arresting, within the perimeter of the adhesive deposit, the deposit of adhesive, thereby leaving within such perimeter an adhesiveless portion of the backing; during the continuous feed movement of the 50 backing, in depositing adhesive on the successive, separate, adhesive deposits; and in subsequently separating from the non-abrasive portions of the web the superimposed adhesive and abrasive deposits and backing 55 thereunder.

2. The method of manufacturing abrasive

6 sheets having arbor holes, consisting in progressively forming on a web of back-forming sheet-material, an adhesive deposit having an approximately circular perimeter and during the formation of such deposit in progressively arresting, at the central portion of such perimeter, the deposit of adhesive, thereby leaving at such central portion an adhesiveless portion of the back-forming material; in depositing abrasive on the adhesive deposit; and in subsequently separating from the back-forming material, the superimposed adhesive and abrasive deposits with their underlying section of the 7 backing.

3. In the manufacture of abrasive disks, the method of converting a continuously traveling web of back-forming sheet-material into separate abrasive disks, such 71 method consisting in continuously feeding a web of back-forming sheet-material; in progressively forming thereon a series of disk-forming lines of adhesive material of different lengths, each successive line contacting with a preceding line for forming 81 the disk of adhesive material, during the continuous feed movement of the backing; in depositing abrasive on the successive separate adhesive disklike deposits; and in subsequently separating the superimposed adhesive and abrasive deposits and backing sections thereunder, from the untreated portions of the web.

4. The method of applying glue to a traveling web in variable form, which consists in forcing glue through a longitudinal slot over the web, and in variably closing the ends of said slot so as to narrow the deposit of the glue, and in variably opening the 95 ends of said slot to widen the amount of glue deposited upon the web and thus deposit the desired form of glue area.

5. The method of applying glue to a traveling web in irregular form which consists 10 in forcing glue through a longitudinal slot placed over the web, and in closing the ends of said slot so as to narrow the deposit of glue upon the web, and in opening the ends of said slot for widening the amount of glue 101 deposited; and in variably closing and opening said slot at its center in order to leave certain central portions of the web uncoated.

In testimony whereof I have hereunto set my hand this 28 day of November, 1919.

HERMAN BEHR.