Aug. 16, 1932. H. CAVE 1,871,775

BRUSH ELEMENT AND PROCESS

Filed Dec. 14, 1925 3 Sheets-Sheet 1

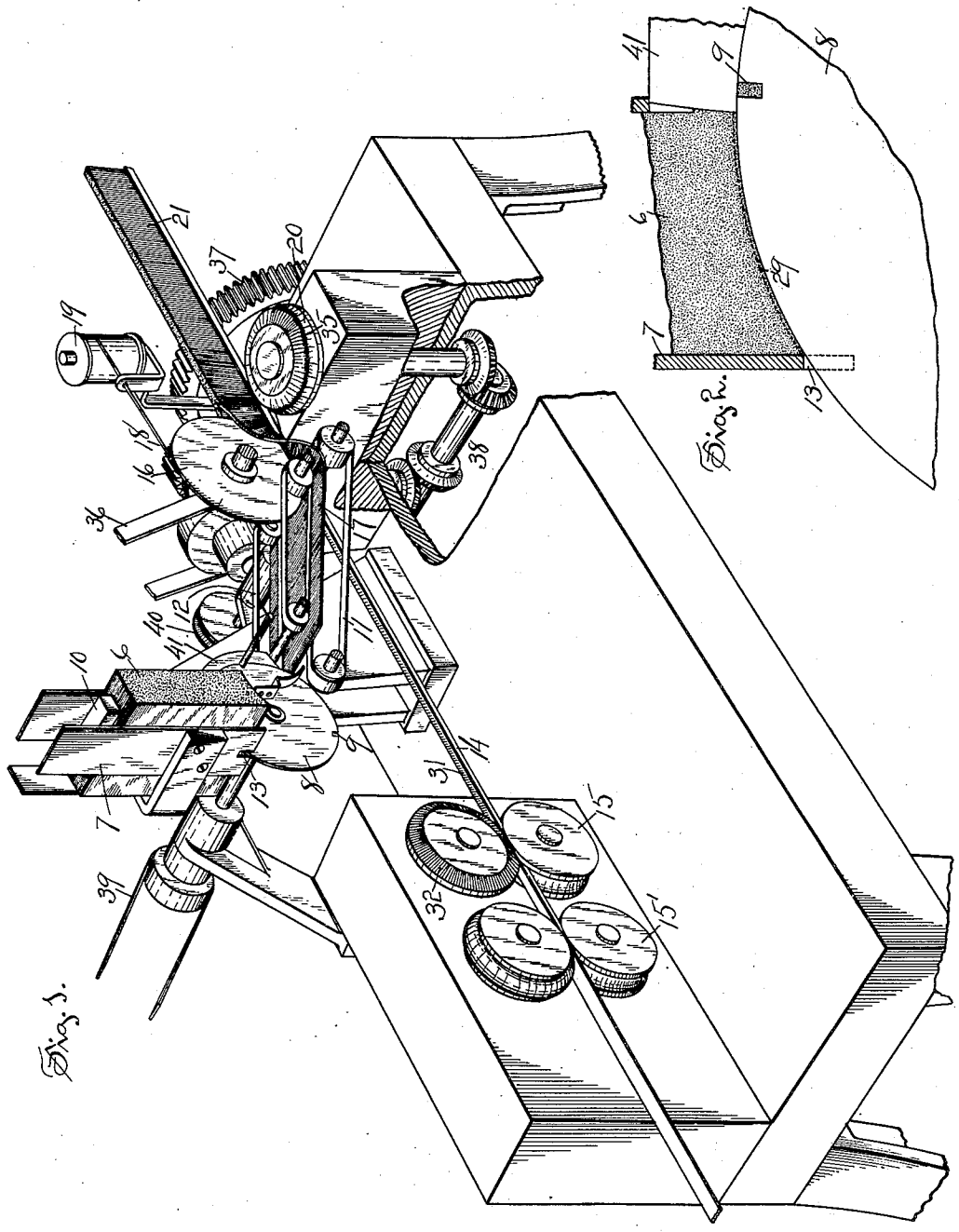


Fig. 2.

Fig. 1.

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Fig. 11.

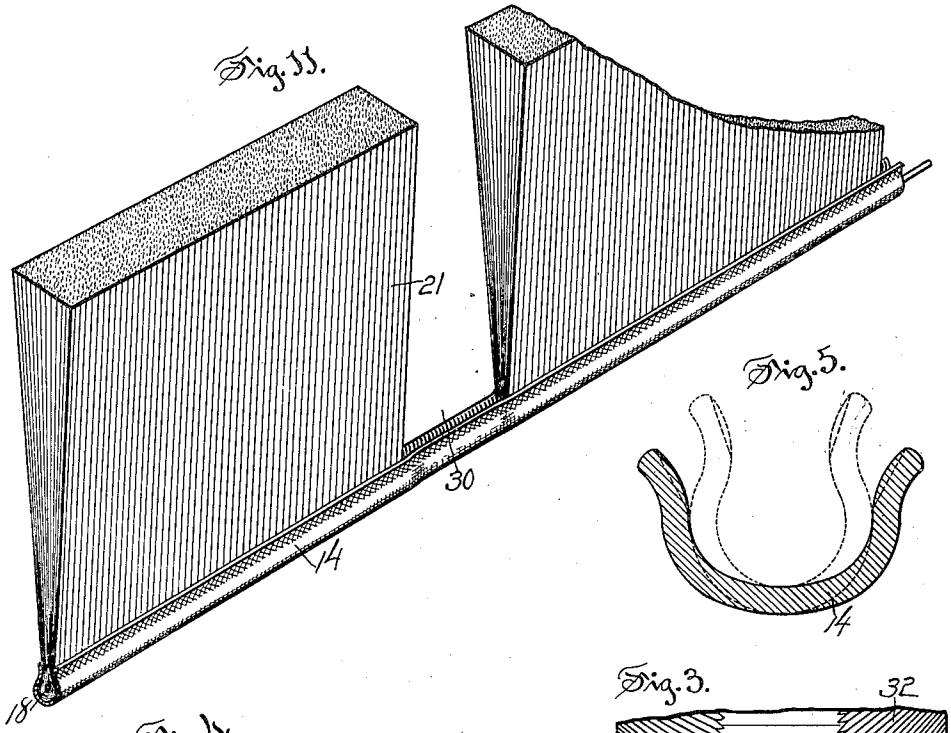


Fig. 5.

Fig. 4.

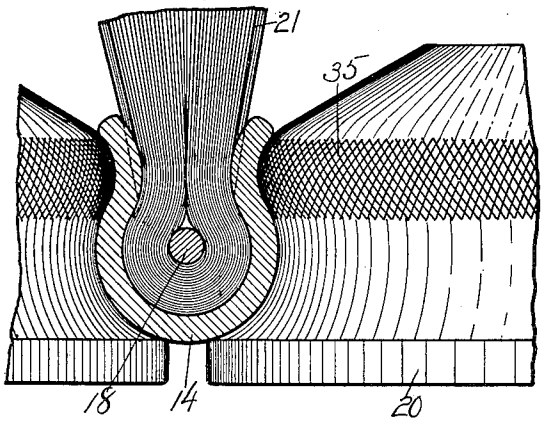
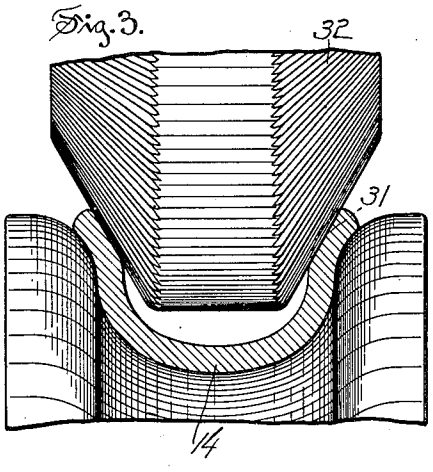


Fig. 3.



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BRUSH ELEMENT AND PROCESS

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Fig. 6.

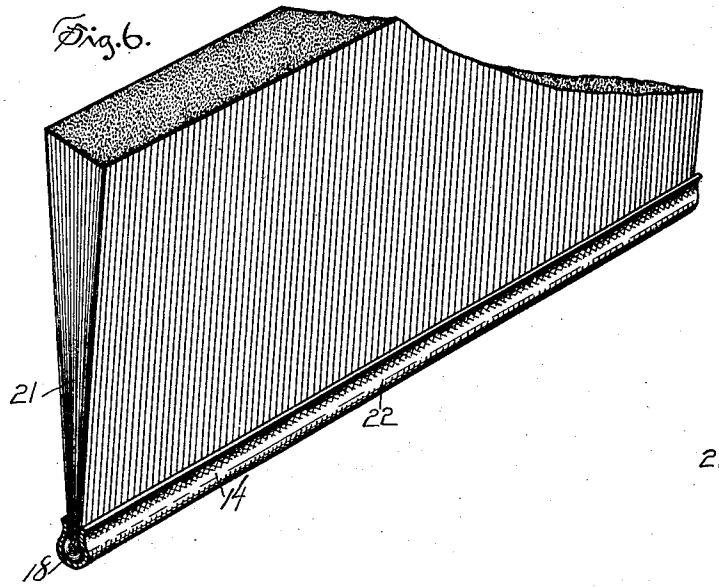


Fig. 7.

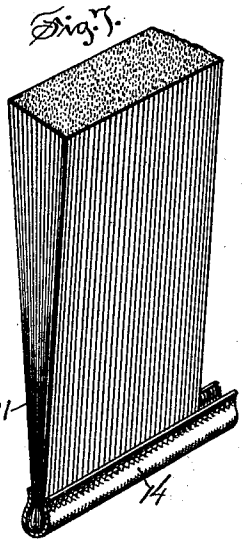


Fig. 8.

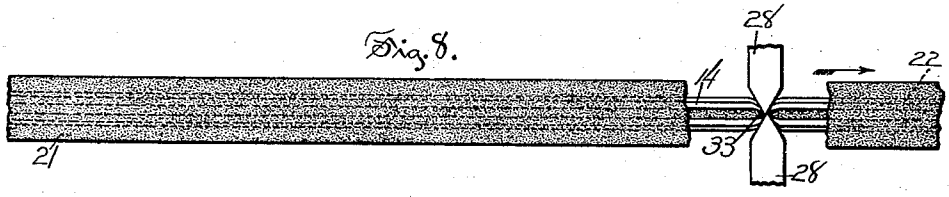


Fig. 9.

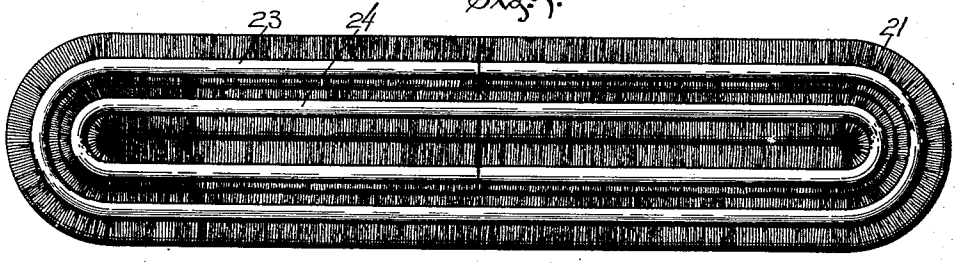
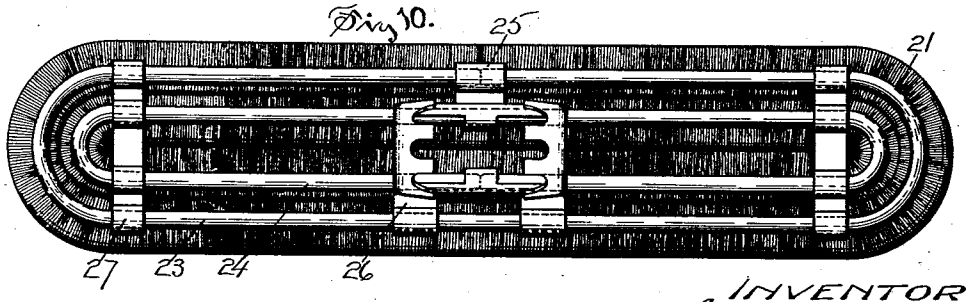


Fig. 10.



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UNITED STATES PATENT OFFICE

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BRUSH ELEMENT AND PROCESS

Application filed December 14, 1925. Serial No. 75,219.

This invention relates to the brush making art. It involves an improved brush structure, and the method of making brushes. The various features of the invention will be understood from the following illustrative description and annexed claims.

In the drawings, accompanying the description:

Figure 1 is an isometric view with a part of the frame broken away to indicate the machine elements arranged to operate according to my invention.

Figure 2 is a detail view of the bristle feed mechanism.

Figure 3 is a detail view of metal forming rolls used in the machine for preparing the channel strip to close on the bristles.

Figure 4 is a detail view of metal pressure rolls used in the machine for progressively closing the channel strip on the bristles.

Figure 5 is a detail view showing in full lines the sheet metal channel section in position to receive bristles and in dotted lines the channel section in position to bind the bristles in the strip by mechanical pressure.

Figure 6 is an isometric view of a portion of the brush structure constituting the product of my invention in one form.

Figure 7 is a view like Figure 6 of a slightly modified form of brush structure.

Figure 8 is a view illustrating the step of cutting the brush structure into desired lengths for use in final brush assembly.

Figures 9 and 10 are views showing two stages of brush making to illustrate how the brush structures of Figures 6 and 7 may be manipulated into one of many desired brush formations, the one shown indicating a floor brush.

Figure 11 (Sheet II) is a view like Figure 6 of another modified form of brush structure.

A brush structure is indicated in Figure 7 to show a simple form of the invention. The sheet metal channel strip 14 is substantially filled with bristles 21 between its sides and along its length to any desired extent. With the bristles located all along between the sides, the channel section is so formed as to present a constricted pressure neck located just above the bottom of the channel and the bristles are gripped for effective holding purposes in the constricted portion of the channel with all the parts braced to hold the grip. This portion of the channel presents two parallel pressure tracks with suitable surfaces to compress the bristles. The bristles in mass formation and under sufficient pressure to hold them are resilient to a substantial degree and this is particularly true of the slippery or stiffer types of bristles. I have discovered by experiment and actual demonstration that a simple sheet metal strip can be made to serve as the sole binding means for practically all types of bristles.

In the structure shown in Figure 7, the resiliency of the bristles exerts its force outwardly against the parallel tracks of the side portions. But the particular location of these tracks just above the bottom portion of the channel strip insures the desired bracing effect because of the extremely small leverage offered for any bending action. The channel strip is permanently set against the bristles with a section peculiarly adapted to hold them and is sufficiently stiff for this purpose. The section of the channel is provided with a constricted neck portion so that the greatest pressure will be in the preferred form, applied far enough below the edges of the channel to cause the bristles to begin to flare outwardly from the constricted neck portion and not be bent sharply where they are under the greatest compression and therefore weakest against bending strains. This pressure neck arrangement for the channel avoids pinching the bristles along a line and provides a gradual release of the holding pressure to permit an easier bending action on the bristles.

It will now be apparent that I have provided a brush structure, of any desired length, of bristles effectively bound along one edge portion by a sheet metal channel strip which can be made narrow enough and thin enough if formed properly to add very little to the bulk of the structure at the edge. The sides of the channel strip overlap the bristles only a short distance so the bristles are left free

to be used in their bending functions for practically their whole length. All these effects are attained in my improved structure by remarkably simple means while heretofore more elaborate or bulky means have been considered necessary in binding bristles in the brush making art.

The brush structure shown in Figure 6 differs from that in Figure 7, already described, in having its bristles folded around a small core or cord 18, shown in this instance as round. This core is of such small volume that it may lie in the channel section without materially increasing the bulk of the parts. Preferably, the core 18 is small enough to just about fill out the space left below the neck portion of the channel section within the fold of the doubled bristles, although it may be larger if it does not substantially increase the bulk to defeat my purpose. There is no objection to pressure between the metal strip and the doubled bristles below the constricted neck portion of the channel and some such pressure may be desirable to act with the wire in retarding any creeping of the bristles along the channel. However, I wish to emphasize the fact that the bristles are gripped for holding purposes along the constricted pressure neck of the sheet metal channel where the sides may grip the bristles with great force and yet where the parts will yield enough to prevent crushing. If the bristles are crushed or broken below the constricted part of the channel no particular harm is done because they are still held in the constricted portion. If for any reason the channel section is injured or distorted so as to release its grip locally, the core retards the creeping of the bristles along the channel for successive release at such local point. In addition, the core is of great assistance in economically making the brush structure as will be hereinafter pointed out.

As indicated in Figures 3, 4, 5, 7, and 11 the upper side portions of the channel strip may be slightly corrugated. It should be particularly noted, however, that these corrugations are shallow and they should extend in parallel relation to the individual bristle length. This feature is desirable to prevent any bending of the bristles from their upright path toward the direction of the channel length until they are quite free of the gripping pressure imposed by the channel sides. With the wire and the corrugations used the bristles can not creep sidewise along the channel to release the pressure between the sides and this construction is put in by way of precaution. The corrugations also assist as the core does primarily in making the brush, as will be pointed out.

As indicated in Figure 11 the brush structure may be made with a part 30 of the channel left free of bristles. In this case the sides of the channel may be pressed directly together with only the core in place or a suitable filler of short material may be used instead of bristles at the bare section of the strip to fill the space between the sides. Such bare sections are frequently desirable where bends are to be made in some types of brushes and bristles are not desired at the bends.

In Figures 9 and 10 I have indicated the way my brush structure may be assembled to form a floor brush or clothes brush. Two suitable lengths of the brush structure, shown in Figure 6 for example, may be bent into the oblong shaped loops 23 and 24 one within the other. In this bending operation it is important to support the metal strip on both sides as the bend is made and to cause both the side portions of the channel to flare out slightly to a wider curve than the bottom portion. This will prevent the side portions opening up to release the bristles from their grip and will also cause the bristles to flare outwardly at the bends which is desirable. Such bends may be conveniently made around a cone shaped surface by forcing the channel strip against the desired portion of the surface with a suitable pressure roll. It should be noted that in making such bends the small bulk of the sheet metal binding element is of great assistance. The brush arrangement of Figures 9 and 10 has the bottom of the channel strips in the same plane and clamps 25, 26 and 27 may be applied to hold them in place for any desired handle portion, not shown.

I will now describe my improved method of making brushes. The method is peculiarly well adapted to make the brush product already described but I desire to emphasize the fact that there are many desirable features in the method steps capable of general application in brush making independently of the product as claimed.

To carry out my method in one simple form I assemble bristles to fill the channel as desired between the sides of a metal strip and continuously close the sides of the strip against the bristles as fast as they are assembled. I am aware of the prior art in which bristles are fed between the sides of metal channels by reciprocating motions as a plunger action and by closing the sides together when the plunger is removed and of various adaptations of such principles. But the steps of my method in one of its important features, involve the possibility of an assembly of the bristles and strip and a continuous closing of the channel sides to complete the assembly so that there is no necessary pause or interruption in my method as there is in prior art methods. To emphasize this distinction, I may assemble a continuous stream of bristles with a continuous strip of sheet metal or similar binder without a single

moment's interruption and just as long as the material can be supplied for my operations whether it is for ten seconds or ten hours or longer. The object of the method is, of course, economy in manufacture, but in addition there are definite advantages from the method which are built into the product as are herein pointed out. My method also enables me to make brush structures of any desired lengths with great ease of operation.

I will refer to Figure 1 for a better understanding of a preferred way of carrying out my method which may be done by hand tools instead of a machine although the latter is desired for obvious reasons. A pair of pressure rolls 20 (see Figure 4) are applied to opposite sides of the channel strip 14 to close such sides against bristles 21. As the rolls 20 are turned the assembled brush structure is delivered on one side while the temporarily assembled structure is drawn into the bight of the rolls from the other side for final pressure action. The temporary assembly is made by the rolls drawing the channel shaped strip 14 under the middle portion of a continuously fed stream of bristles, arranged transversely of the channel and below a grooved depositing wheel 16 which presses the bristles and a core 18 riding in the groove into the bottom of said channel. These bristles 6 may be fed by any convenient means as from a hopper 7, measuring wheel 8 and conveyor belts, all of which will be hereinafter described, or even by hand. The core 18 is drawn from spool 19. It will be seen that if the bristles are continuously fed, which may be done by hand, and the wheel 16 is pressed to the bottom of the groove, which may be done by hand, the pressure rolls 20 will, when rotated by hand or otherwise, cause the wheel 16 to rotate and fold the bristles into the channel, the core 18 under a proper degree of tension will hold the bristles in upright position between the roll 16 and the bight of rolls 20 and the latter will deliver pressure to close the sides of the channel strip and complete the brush structure in one form. Instead of using the core 18 which enters into the product, I may hold the bristles in upright position by any suitable holding operation between the time they are placed in the channel by wheel 16 and are grasped in the operation of the pressure rolls. For example, if wheel 16 is made thin and so as to approach as near as possible to the bight of rolls 20 and corrugations 31 indicated in Figure 3 are provided on the sides of the strip, as by means of corrugated surfaces 32 on the rolls, the core 18 may be dispensed with and other suitable tools may be employed for the same purpose, but I prefer to use the core entering continuously into the product as a convenient means to aid my method steps, and as a help to the product.

Figure 8 indicates the step of cutting the continuous length of brush product into desired lengths. The bristles are shown broken away to disclose the cutting action. The cutting elements 28—28 preferably give a shearing cut by pressure from opposite sides of the strip. Such pressure acting on the channel section bends the end portions inwardly at each edge of the cut, which narrows the channel section. In this manner the bristles at the cut ends are compressed and held effectively because of the narrowed throat portion 33 at such ends. Of course, the sheet metal strip is stiff enough to substantially hold the narrowed condition left by the cutting elements 28 shown. The latter preferably have their ends of a double wedge form so as to leave each cut end substantially in the same condition. This feature is an advantage in my product as well as in my method. But at this point I wish to emphasize the fact that the brush structure continuously delivered by the operation of rolling the channel sides against the bristles may be cut into desired lengths by the shears which can operate while the strip is moving and give an end holding form to the channel at all cut edges. The shears may, of course, be operated by hand and moved with the channel strip until the latter is cut as and when desired.

I will now describe a machine for carrying out my improved method and for making the desired brush product. This machine is shown in skeleton form with sufficient specific showing to enable one skilled in the art to construct it in all its essential features. I intend to confine the description to one machine organization of tools which will carry out my method substantially as described and for economical factory operations. In the production of brushes by my machine (see Figure 1), I first arrange a mass of bristles or other suitable brush material in a pile 6, as in a hopper 7, and I remove a succession of layers of substantially uniform thickness from side to side from the bottom of said pile. In removing these layers it has been found that in order to obtain satisfactory results the fibers must be removed uniformly from side to side from the bottom of the hopper, as otherwise extremely unsatisfactory results will be obtained, as an uneven feed of the fibers, or a tangling thereof, or other objectionable feature.

I have described and claimed the bristle feeding mechanism with some detail in another copending application as it is capable of general use as a feeding mechanism. It is here referred to briefly as a preferred feed for cooperating with the desirable elements of the machine herein claimed.

In effecting my bristle feeding purpose I mount a rotatable disk 8 in such position that the fibers in the hopper will rest upon its

periphery and I provide notches 9 (see Figure 2), shown as of rectangular shape in such periphery, so that as the disk is rotated the fibers will be gradually received in said notches as they move across the bottom of the pile. These notches are made of a depth and width such as will require a movement of each notch substantially across the bottom of the pile to cause it to be filled, and on the contrary, that will not result in the filling of a notch before such movement substantially across the pile has taken place. This will permit the fibers to settle evenly throughout the width of the hopper and will, therefore, tend to prevent such compression, compacting or wadding of the fibers as to cause a more rapid delivery to the disk at one point in the hopper than at another therein. This action is indicated in Figure 2 wherein the layer removed at each passage of a notch 9 is indicated by line 29. The stripper 41 is here indicated as resting on the periphery of the disk 8 with a heel to stop the feed at the right point. This stripper is important and should be fitted to the disk with such accuracy as to shear a bristle which might be half in the hopper and half in the notch as the notch is brought entirely under the stripper. The main function at this point is to strip the bristles in the notch from those in the hopper and not permit any bristles to follow the passage of the notch beyond the stripper. Different kinds of bristles may require different feeding arrangement, and the details of other arrangements are set forth in copending applications involving the bristle feeding mechanism. A weight 10, or other device, may be employed if desired to rest upon the top of the pile of bristles and press them downwardly in the hopper. The notches 9 are preferably placed in the disk a considerable distance apart so that the fibers in one notch which might adhere at their ends with the fibers in the hopper, although separated elsewhere, can be separated completely before the succeeding notch starts its feeding function.

From the disk 8 the fibers are deposited upon a carrier in a layer or mass of such character as may be desired. In the apparatus shown herein this carrier comprises two sets 11 and 12 of belts arranged to hold a continuous feed or stream of the bristles between them and cause such bristles to be carried along with the belts in their movement. The periphery of the disk 8 is preferably passed through notches 13 in the lower edges of the sides of the hopper 7, the periphery of the disk also projecting into the space between the belts of each set 11—12.

The bristle feed described or some other suitable form may operate to deliver a continuous stream of bristles above a channeled or holding strip 14 of any suitable material as soft steel. This strip 14 is formed from a simple flat strip, so as to have channel section, by the operation of one or more pairs of rolls 15 and 15', being fed in an indefinite length to the depositing wheel 16 and underneath the lower side of the stream 17 of bristles or fibers between the feed belts 11 and 12 and to pressure rolls 20 which are the driving rolls for the feed. As shown in Figure 1 the wheel 16 is mounted on the upper side of the bristles where the bristle stream meets the strip 14.

The core 18 is fed under tension from any suitable source of supply, as a reel or spool 19, to the groove in the wheel 16 and thus to a point overlying the stream 17 of bristles and the holding strip 14, that is presented with its open channel upward and preferably with a channel section about as shown in full lines in Figure 5. The bristles are at this point located between the channel strip and the core guided on the periphery of wheel 16. This depositing wheel 16 operates to lay or deposit the core, together with the bristles into the open channel between the sides of the strip and with sufficient pressure to hold them in place. This depositing action operates to double the bristles, projecting their outer ends upwardly, and in this condition the holding strip, core and bristles pass to the action of pressure rolls 20 oppositely arranged as shown best in Figure 4 to receive the assembled brush strip between them and to force the sides or legs of the holding strip together with an intense pressure to tightly and firmly secure said fibers or other brush material to said holding strip, as previously described. I have by these means bound the bristles so tightly to the channel strip that in pulling bristles one by one I have found that they will actually break rather than slip. Furthermore, they generally break at the pressure neck. I have thus demonstrated that the bristles are bound to the strip by pressure alone and under proper conditions for bending in use.

It will be seen from Figure 1 that the parts are arranged to assemble the bristles transversely of the holding strip so that they are delivered in a continuous stream to the moving channel strip at a point close to the pressure rolls 20. At this point the depositing wheel 16 lays the core 18 and folds the bristles in position for the pressure rolls to act. I prefer to have the bristles folded and applied to the holding strip close to the pressure rolls for there is then less chance for the bristles to be displaced before being finally gripped between the legs of the metal strip.

I preferably use special means to safeguard the position of the bristles after they have been deposited upright in the channel strip by wheel 16 and until they are locked by pressure between the sides of the channel ap-

plied by the pressure rolls. These means are the slightly corrugated sides at the top sides of the channel strip and above the core 18. The corrugations are imposed on the metal strip as it passes between the pair of metal working rolls 15 and by the upper roll as clearly shown in Figure 3. These corrugations are parallel with the individual bristle lengths with which they contact and act to substantially prevent any tipping of the bristles forwardly or backwardly after they are inserted with the core 18. The core 18 is drawn from spool 19 under sufficient tension to keep it tight. When it is deposited in the bottom of the channel it is held against the bend of the bristles by the wheel 16 pressing downwardly and is drawn along in this position with the product and under the driving action of the pressure rolls 20. In this manner the proper transition of the bristles carried in the channel section 14 shaped as in Figure 5 from the depositing station at wheel 16, is safe guarded up to and through the pressure rolls 20 by the core and the corrugations arranged for this purpose.

The pairs of rolls 15—15′ and 20 are, of course, properly mounted for pressure as compression rolls for metal bending and folding operations usually are. In the machine shown, the driving means for the channel strip are the pressure rolls 20 and these are knurled as at 35 in Figure 4 to get a sufficient grip for driving purposes against the sides of the channel strip where the greatest pressure is applied. The rolls 20 draw the strip 14 through rolls 15 and 15′ which form the section shown in Figure 3. After the bristles and core are inserted the temporary assembly of parts is maintained in position for final assembly, as shown in Figure 4. It is important to provide a proper drive between the pressure rolls because if there is slip at this point the bristles will be fed out of proportion to the desired amount per unit length of strip. These rolls 20 are driven from a belt 36 to a spur gear meshing with gear 37 and from the shaft of the latter through bevel gear arrangement 38 connecting both rolls for positive action. The latter are adjusted in the usual way not shown for getting the desired pressure from the rolls upon any material passing between them. The details of mounting such metal working rolls are so well known that they are omitted from the drawings for the sake of clearness. It will be understood, of course, that the peripheral speed of rolls 20 and belts 11 and 12, may be substantially the same. The speed of disc 8, however, may differ according to the desired feed of bristles from hopper 7 in relation to the number per unit length of the brush strip wanted in the product delivered from rolls 20. A separate drive 39 is, therefore, indicated for disc 8 since it may be desired to change the speed of the bristle feed from hopper 7 without changing the speed of the other parts of the machine. It may be desired to feed a certain length of bristles from hopper 7 and then stop while the metal strip 14 and bead wire 18 continue to pass through pressure rolls 20 after which the bristle feed again starts. That is to say, the bristle feed may be intermittent while the metal feed is continuous. The pressure rolls 20 will then act to press the folded sides of strip 14 directly together where there are no bristles and operate as before where there are bristles. The bare portions of the strip may be desirable for handle forming or other purposes in the building of the brush strip to a desired form. I have indicated in Figure 11 what the brush strip will look like when the bristle feed is intermittent although the transition from a bare section to a bristle section may be more gradual than that shown but when trimmed will be about what is illustrated. By varying the bristle feed in other ways, more bristles may be fed at one part of the strip than at another which may be desirable, for example, at portions of the brush strip which is to be bent around the end of the finished brush, as indicated in Figures 9 and 10. Swinging bearings for supporting the near ends of some of the rolls for the belts 11 and 12 are purposely omitted to center the attention on the operative parts. The means for driving the belts is merely indicated as the pulley 40 which may be understood as suitably connected for driving the shafts holding belts 11 and 12.

The formed brush structure may be disposed of in any suitable manner for subsequent cutting into lengths for the formation of brushes or the cutting mechanism may be incorporated in the machine to act beyond the delivery side of the pressure rolls. These cut-up lengths may be treated in many different ways to comprise brush structures, one manner of disposing of them being shown in the drawings herein and already referred to in connection with Figures 9 and 10.

From the foregoing description, it is clear that my invention involves an improved brush structure, and a novel and useful method of making brush structures. The product may be made by other methods and by other machines than the preferred ones disclosed in this specification. It is true also that the method can be used to produce brush structure not within the product of this invention. For example, the substitution of a different character of material for the sheet metal or different forms for the channel section and by applying the pressure on the sides differently than above described, a great variety of brush structure might be made by my improved method. But in spite of these facts the very close relation which exists between the product and method in connection

with the useful improvements in brush making, makes it desirable to disclose them both in one specification.

I desire to claim my invention in all its various aspects broadly and specifically.

I claim:—

1. The method of making brush structure which consists in forming a narrow strip of stiff metal into channel form, forming surface indentations in the inner faces of the sides of said channel, inserting a series of bristles, or like brush material, between the sides of the strip with the bristles extending lengthwise of the indentations and with a part of the bristles lying in the same so that the entire series will be held against creeping and falling lengthwise of the channel, and pressing the sides of the channel against the bristles with sufficient force to compress the bristles and hold them against removal from the channel.

2. The method of making brush structure which consists in forming a narrow strip of stiff metal into channel form, holding a series of bristles, or like brush material, between the sides of the channel and while so held tightly pressing the channel sides against the bristles with the degree of pressure applied to the sides varying transversely thereof to form a constricted pressure neck close to the bottom of the channel and also to form a flared opening at the mouth of the channel.

3. The method of making brush structure which consists in continuously advancing a single length of flat strip of metal, shaping said strip into channel form with the edge portions of the sides of the channel flared outwardly and without interrupting the travel of the strip, forming elongated indentations in the inner faces of the sides of said channel, inserting a series of bristles, or like brush material, between the sides of the strip with the bristles extending lengthwise of the indentations and with a part of the bristles lying in the same so that the entire series will be held against creeping and falling lengthwise of the channel during the advancing of the strip, and pressing the sides of the channel against the bristles with sufficient force to compress the bristles and hold them against removal from the channel.

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