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W. H. BROWNE

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2 Sheets-Sheet 1

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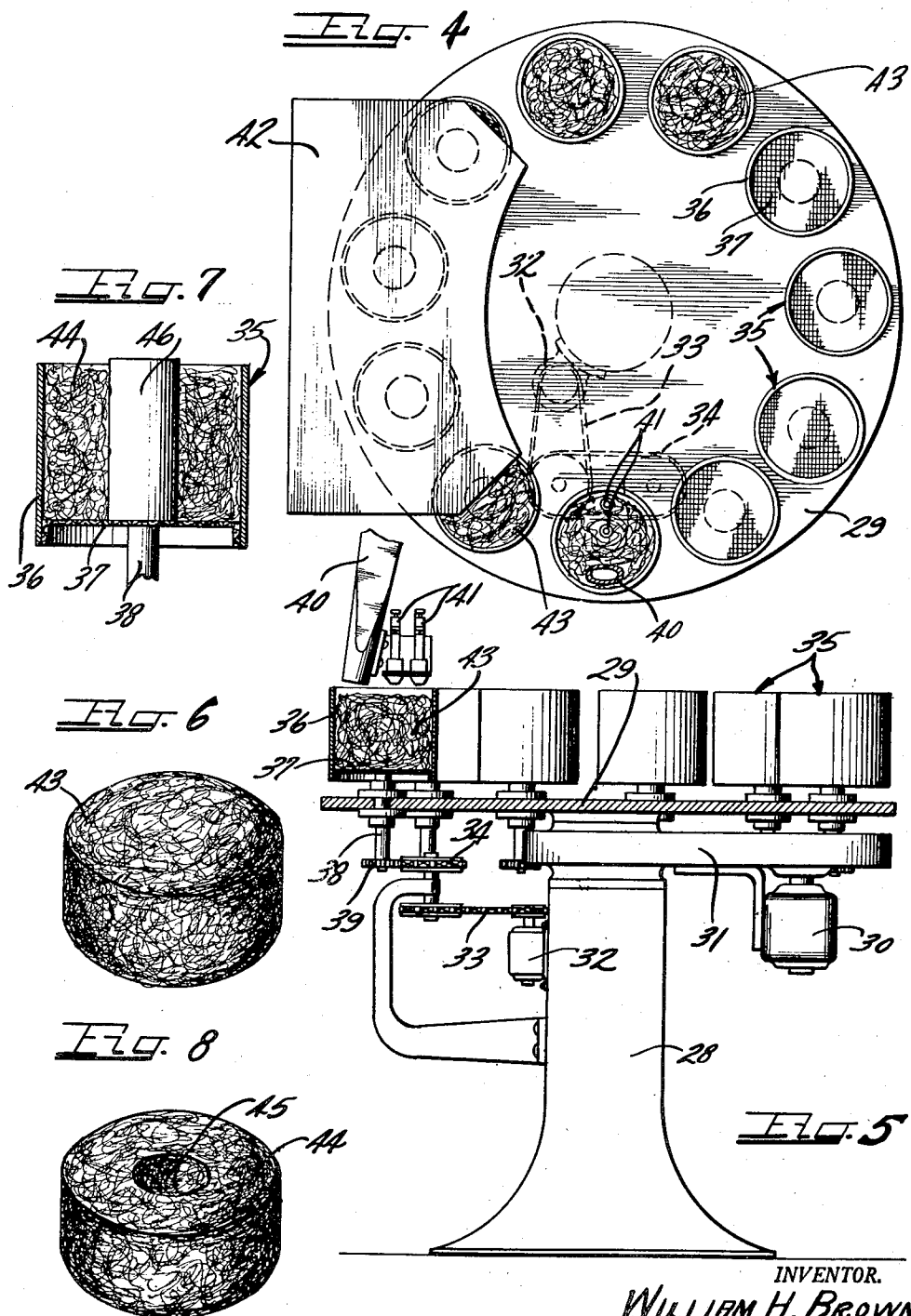
W. H. BROWNE

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2 Sheets-Sheet 2



INVENTOR.

WILLIAM H. BROWNE

BY

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METHOD OF MAKING RESILIENT BATTS

William H. Browne, Columbus, Ohio, assignor, by mesne assignments, to Houdaille-Hershey Corporation, Detroit, Mich., a corporation of Michigan

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4 Claims. (Cl. 154-101)

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This invention relates to improvement in a method of making a resilient batt, such a batt being highly desirable for numerous purposes, including cushioning means, filter units for air cleaners, padding, insulation, and many more uses as will be apparent to one skilled in the art.

In the past, many and various methods have been practiced to acquire a resilient batt. Difficulty has been experienced in producing a resilient batt, especially from stranded material, and having that batt pervious to a fast flowing air stream, and also of substantially uniform density throughout. While batts of stranded materials have been produced rather economically for cushioning means, it is not essential that a cushioning medium have anywhere as near the degree of uniformity of density as is required where the same substance may be used as a filter unit in an air cleaner, or as a filter unit for other purposes. There, if the density is not uniform, there is no high filtering efficiency. Batt with that high degree of uniformity have not heretofore been produced economically; that is, sufficiently economically to warrant their use for many commercial purposes. Further, in batt manufacture as heretofore known, difficulty was experienced in the continuous manufacture of a batt of indefinite length, and there was no economical and accurate means for controlling the density of a batt during manufacture to the desired degree.

With the foregoing in mind, it is an important object of the instant invention to provide a new and novel method of making a resilient batt, which method is very economical and practical.

Another object of the invention is the provision of a method of making a resilient batt of substantially uniform density throughout.

Also a feature of the invention is the provision of a method of making a resilient batt which may be formed in the ultimate desired shape, or formed in an elongated batt of indefinite length from which articles of desired shape may readily be cut.

It is a further object of the invention to provide a method of making a resilient batt of stranded material held together with a bonding agent, and the practice of the method includes the progressive building up of the batt to a desired thickness and the application of the bonding agent in a substantially continuous manner as the batt builds up.

An important object of this invention is the provision of a process for making a resilient batt embodying the steps of controlling the ultimate

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density of the batt by means of compressed air.

In the process of batt making, the instant invention also contemplates the step of delivering fibers to the batt forming location by means of a chute in which the fibers are caused to rebound from the walls of the chute during their passage through it to insure uniform delivery.

Also, in the process of resilient batt making, the instant invention contemplates the novel step of utilizing an air blast for a double purpose, namely for atomizing and spraying a bonding agent upon collected strands of material as the batt is formed, and for the additional purpose of controlling and determining the density of the resultant batt.

Still a further object of this invention is the provision of a new and novel method of making a filter unit.

While some of the more salient features, characteristics and advantages of the instant invention have been above pointed out others will become apparent from the following disclosures, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a diagrammatic illustration of a series of steps that may be performed in the practice of a method embodying principles of the instant invention;

Figure 2 is also a diagrammatic illustration showing certain of the apparatus seen in Figure 1 from a different angle, namely at right angles to the showing in the left hand portion of Figure 1, and diagrammatically showing the method through to completion if filter units are desired ultimately;

Figure 3 is a perspective view of a cut portion of a batt made by practicing the method embodied in this invention, and which might be used as a filter unit or element for air cleaners and similar apparatus;

Figure 4 is a plan view, with parts in section, of apparatus somewhat diagrammatically illustrated and which may be used in the performance of a method embodying principles of the instant invention, and which method employs steps somewhat different than those employed with the diagrammatic arrangement seen in Figures 1 and 2;

Figure 5 is a fragmentary part sectional part elevational view of the structure of Figure 4;

Figure 6 is a perspective view of a batt made with the apparatus of Figures 4 and 5 under the teachings of the instant method;

Figure 7 is a fragmentary vertical sectional view, partly in elevation, of a slightly different

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form of mold for use with the apparatus in Figures 4 and 5; and

Figure 8 is a perspective view of the resultant batt made with the mold of Figure 7.

As shown in the drawings:

In practicing the present method, stranded material is preferably used. This material may be animal hair, vegetable fiber, plastic strands, or even in some instances, metal strands, or any other suitable substance. If a batt is ultimately to be used for fluid filtering purposes, animal hair used in accordance with the instant invention will provide a filter having extremely high efficiency and durability. For some uses animal hair may be a trifle costly, and a highly satisfactory and very economical material for substantially all purposes is vegetable fiber and particularly sisal fiber. When vegetable fiber is used, a hollow fiber, such as sisal, is preferred because if the material is to be flameproofed, the flameproofing medium will penetrate a hollow fiber and will not cake or crystallize on the surface of the fiber and ultimately flake off during use.

For purposes of clarity in description, and not by way of limitation, the instant method will be set forth herein as practiced for the manufacture of a resilient batt that might ultimately be used as a fluid filtering element. The apparatus diagrammatically illustrated in Figures 1 and 2 of the drawings is more fully set forth, described and claimed in my co-pending application entitled Machine for Making Resilient Batts, filed October 24, 1946, Serial #705,277.

Materials such as sisal fiber may economically be obtained in the form of rolls of sliver. This term is used commercially to denote a bunch of strands or fibers of moderate length, and when a supply roll is provided, the ends of one bunch are commingled with the ends of an adjacent bunch so that an elongated cordlike arrangement is obtained, which, while having very little tensile strength, nevertheless may be handled without breaking at an inopportune location. With reference now to Figures 1 and 2, it will be seen that sliver 1 may be supplied from a stock roll 2 carried on a cradle or the like 3. This sliver may first be passed back and forth over suitable rolls 4 or other satisfactory structure positioned in a vat 5 which may contain flameproofing substance. A satisfactory flameproofing substance is ammonium sulfamate in water and the sliver then leaves the vat 5 saturated with the flameproofing medium.

The sliver then passes through a crimping mechanism, illustrated in the form of a pair of rolls 6, which crimp, undulate or curl the sliver. Preferably, these rolls are heated. The action of the rolls will obviously press out some of the moisture in the sliver, and the heat from the rolls will drive out the remainder of the moisture, and at the same time utilize that moisture to steam the crimp in the sliver.

Leaving the rolls 6, the crimped sliver is permitted to form a slack loop 7 from which it enters a pair of feed rolls 8 intermittently operated by a suitable Geneva mechanism or in some equivalent manner. The slack loop compensates for the transfer from the continuously driven crimping rolls 6 to the intermittently driven feed rolls 8.

The feed rolls 8 intermittently advance the crimped sliver through cutting mechanism, diagrammatically shown at 9, which severs the sliver into relatively short lengths. It has been found that linear lengths of one to one and a half inches, not counting the crimps or undulations

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in the strands, are quite satisfactory, although other lengths may be used. These severed bunches of strands 10 are then carried by suitable conveying means 11 into a carding machine 12, which may be a standard Garnett machine. This machine includes a brush 13 which brushes the now separated and crimped strands into a delivery chute generally indicated by numeral 14. This chute which may oscillate back and forth as indicated by dotted lines Figure 1, delivers strands uniformly to the batt forming location. Accordingly, the construction of this chute is somewhat important since it has been found that the configuration of the chute is a strong influence in determining the manner in which the fiber will be distributed. It is desired that the chute distribute fibers uniformly so that the cross section of the resultant batt will be of regular rectangular shape. As more fully pointed out in my aforesaid co-pending application, it has been found that this may be achieved by using a chute having sharply tapered walls in one portion thereof. In the illustrated instance these sharply tapered walls are seen in Figure 2 in the top portion 15 of the chute. Looking at the chute from the adjacent side, or 90 degrees from the showing in Figure 2, the chute may taper uniformly from top to bottom including both the upper portion 15 and the lower portion 16 as seen at 17 in Figure 1. The lower portion 16 need not taper, however, in the other direction but may have parallel walls as seen in Figure 2.

Uniform distribution of the strands results from a chute of this character, by virtue of the fact that the small lengths of separated strands rebound from the sloping walls of the chute rather than bunching up and sliding along the walls. For example, if the chute were straight, that is, with all walls parallel, the fibers would be denser near the center of the chute than along the walls and the resultant batt would be high in the middle. Conversely, if the chute were uniformly tapered throughout the fibers would collect along the walls of the chute, and the strand density in the center of the chute would be less than that along the walls, providing a resultant batt with a drop in the central portion.

The length of the portion 16 of the chute is not critical inasmuch as the main function of this portion of the chute is to extend the chute so as to flatten the arc at the lower end of the chute when it oscillates.

It should also be noted that the sharply tapered portion 15 of the chute may be at the bottom rather than at the top without any change in the uniform distribution of the crimped strands. Likewise, the lower portion of the chute may be uniform throughout its length rather than tapering on two sides as seen in Figure 1.

Preferably carried by the chute is a pair of atomizing spray nozzles 18-19. Air pressure provides the atomizing force, and these nozzles may be also connected with a supply of bonding agent for joining the strands together. Satisfactory bonding agents are plastics commonly known as Vinylite and Geon, although other satisfactory materials may also be used. This plastic bonding agent is in liquid form and is sprayed from the nozzles by virtue of the air pressure.

The chute 14 delivers the strands uniformly on the top of an elongated batt 19 being continuously formed between a pair of endless belts 20 and 21 which are spaced apart on their inner reaches a distance equivalent to the desired thickness of batt. As the strands fall in place, they are sprayed with the plastic bonding agent.

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An important step is practiced at this point in the present method. The air pressure relied upon to atomize and spray the plastic bonding agent upon the delivered strands is also relied upon to control the resultant density of the batt. That is, as the chute oscillates back and forth and delivers strands between the belts 20 and 21, the air pressure in blowing down plastic bonding agent also compacts the strands and the degree of compaction which will determine the ultimate density of the batt may be controlled as desired by varying the amount of air pressure.

The belts 20 and 21 are porous and may be greased with palm oil or the equivalent to prevent sticking by the bonding agent. In the lower portion of these belts the batt being formed is subjected to a heat treatment to set the bonding agent. The heat treating operation is diagrammatically illustrated in Figure 2 in the form of a transversely disposed conduit 22 of substantially the same width as the batt having an open central portion in the region of the batt. At one end of this conduit a blower 23 is provided to draw air through the conduit, while near the other end a suitable electric or other type of heating element 24 may be located in the conduit to provide the necessary heat. The finished batt emanates from the lower end of the belts 20 and 21 in the form of a ribbonlike element which may be of any desired length.

Now, assuming that it is desired to make filter elements from this batt for use in hat type automotive air cleaners, which air cleaners are provided with a center tube outlet, the batt may either be cut into lengths and the lengths passed through a cutting machine, or the batt may be guided through a cutting machine 25, as illustrated, which will sever successive filter elements 26 from the batt. In Figure 3 I have illustrated one of these elements in perspective, and it may readily be cut from the batt by a cutting means in the general shape of the commonly known cookie cutter so as to provide a central aperture 27 through the resultant element.

By virtue of the manufacture of a resilient batt by the instant method, the batt will have a definite springiness when completed and will have power to assume its original shape after pressure has been applied and removed. This resiliency is durable throughout the life of the batt, and by virtue of the bonding agent joining the crimped strands together at different points of contact, no external supporting structure is necessary to maintain the batt in the desired shape.

Obviously, where filter elements are not desired, but a batt may be wanted for a seat cushion, some form of padding, or some other purpose, certain of the operations herein set forth may not be necessary to use. For example, the flameproofing may be omitted and the strands or fibers may be moistened by plain water if it is deemed necessary to steam the crimps or undulations into them. Obviously, the particular cutting operation above described need not be employed when the resultant batt or section of batt is desired in some other shape. The batt may be readily severed at any place and given any desired shape.

In Figures 4 to 8 inclusive I have shown a variation of the method together with the products resulting from the practice of this variation. In this disclosure, the batt is formed in a mold of a predetermined size and shape, each batt being individually and progressively formed before the start of the next batt. Obviously the shape of the batt may be of any desired character, and for

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illustrative purposes I have selected a shape suitable to function as a filter unit for automotive air cleaners and the like. In practicing this variation of the method certain apparatus may be used which is, in some instances, different in character than the apparatus above mentioned.

With reference now more particularly to Figures 4 and 5, I have disclosed a machine embodying a pedestal 28 in which the shaft of a rotary table or turret head 29 is journaled. This table 29 is revolved intermittently by way of a suitable motor 30 and an indexing mechanism of any suitable character contained in a housing 31 which intermittently advances table 29 from station to station.

Supported by the pedestal beneath the table is another motor 32 for continuous operation while the machine is functioning. This motor through a suitable sprocket and chain connection 33 drives an endless chain 34 positioned to be contacted by mechanism carried by the table and thus cause rotation of an individual mold as will more fully later appear.

The table 29 carries a plurality of individual molds generally indicated by numeral 35. As seen more clearly in Figure 7, each mold comprises an individual cylindrical shell 36 with a porous or screenlike bottom 37 therein. Each mold is mounted upon the upper end of a shaft 38 journaled in the table 29 and carrying on its lower end beneath the table a gear 39 which meshes with the aforesaid continuously driven chain 34 when the table is stopped at the filling station. Thus, while the table is at rest at that station, the mold itself is continuously rotated.

Positioned above the table in any suitable manner is a fixed distributing chute 40 which is of the same general character as the chute 14 above described, except for its fixed position and for the fact that the lower end of the chute is preferably round or oval in shape as seen in Figure 4. With that particular shape a better distribution is obtained when the strands are delivered directly into a mold. Associated with the chute 40 is a pair of atomizing spray nozzles 41 disposed side by side but preferably positioned so as to spray the bonding agent on the delivered fibers at the opposite side of the mold from the chute 40. These nozzles function the same as the nozzles 18 above described. Along one side of the table 29 following the filling station a heating oven 42 is provided through which each mold must pass as it is carried through its orbit by the table.

In the practice of the method, the motors 30 and 32 are started, and the table will move to the filling station whereupon the respective gear 39 will contact the endless chain 34 and the particular mold 35 will be continuously rotated. Strands from the chute 40 will be fed into the mold as it rotates and progressively the mold is filled. From the showing of Figure 5, it will be noted that the chute 40 is preferably disposed so that it directs the strands in general towards the bottom corner of the mold. While the mold is being progressively filled with strands, the nozzles 41 spray the plastic bonding agent upon the strands. As in the previous embodiment of the method, the air pressure associated with the spray nozzles is relied upon to determine or control the density of the resultant batt. During the operation, the air escapes directly through the screenlike bottom of the mold, and there is no danger of causing an objectionable disturbance of the strands, or piling them up in one

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location. After the mold has been filled to the desired extent, depending upon the thickness of batt desired, the table is indexed forwardly and as the mold eventually passes through the oven 42, the bonding agent is set. After leaving the oven, the batt 43, of which a perspective showing is found in Figure 6, may be removed from the mold by any suitable instrument.

The finished batt, as seen in Figure 6, is of the general shape of a section of a right cylindrical column, substantially flat both on the top and bottom. This batt may be used as a filter unit for an automotive air cleaner, a cushion, or for various other purposes.

With some installations, as above discussed in connection with Figure 3, it may be desired to provide a batt 44 as illustrated in Figure 8 having a hole 45 through the center thereof. Such a batt may also be readily made as outlined above, by the simple expedient of placing a core 46 in each of the molds 35, as seen clearly in Figure 7.

From the foregoing, it is apparent that I have provided a highly economical and efficient method for producing a resilient batt of substantially uniform density. The resultant batt is long-lived, and will have a very high efficiency if used as a filter.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In a method of making a resilient batt, the steps of rotating an open topped mold, delivering strands of material uniformly in one side of the rotating mold to progressively build up a batt of desired thickness, and applying a bonding agent to the delivered strands at the opposite side of the mold during the building up of the batt.

2. In a method of making a resilient batt, the steps of rotating a mold, delivering strands of material uniformly in one side of the rotating mold to progressively build up a batt of desired thickness, spraying an atomized bonding agent on the delivered strands as the batt is being built up, and utilizing air pressure to both atomize the bonding agent and compact the strands to the desired density.

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3. In a method of making a resilient batt capable of functioning as an air filter, the steps of feeding separated randomly disposed strands of batt forming material to a batt forming location through an oscillating chute of a width substantially equalling the thickness of the resultant batt, carrying the batt under formation gradually away from the point of delivery of said strands, and applying an atomized spray of a bonding agent to the strands as they are delivered, and utilizing the air pressure of said spray to determine the density of the resultant batt.

4. In a method of making a resilient batt capable of functioning as an air filter, the steps of continuously delivering separated and randomly disposed fibers of relatively short length to batt forming location in a manner to steadily add to the entire rear end of the batt undergoing formation transversely thereacross, moving the batt being formed away from the fiber delivery location, and utilizing air pressure to both spray a bonding agent on the fibers as they are delivered and determine the density of the resultant batt.

WILLIAM H. BROWNE.

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