

Nov. 7, 1967

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3,350,859

VACUUM CLEANER FILTER BAG

Filed Oct. 4, 1965

2 Sheets-Sheet 1

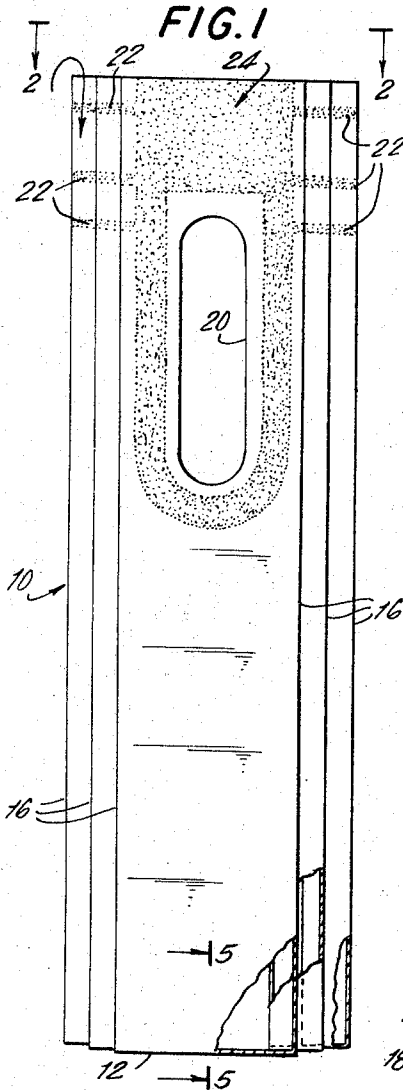
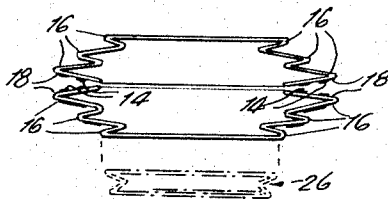


FIG. 2

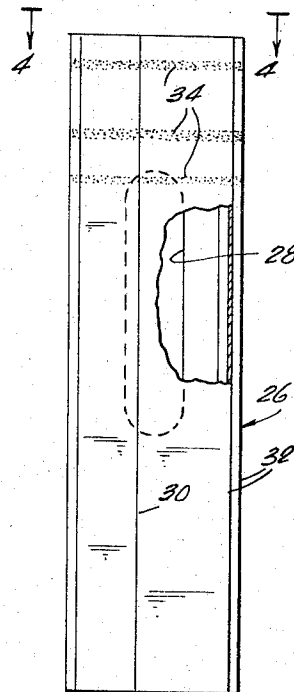


FIG. 3

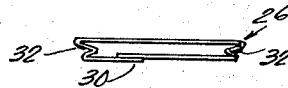


FIG. 4

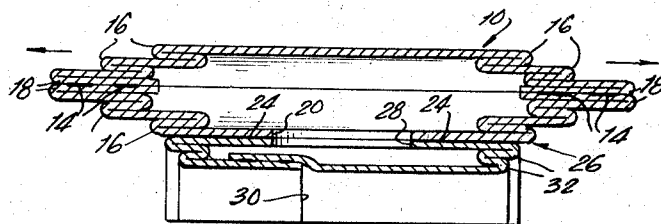


FIG. 5

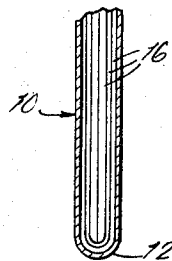


FIG. 6

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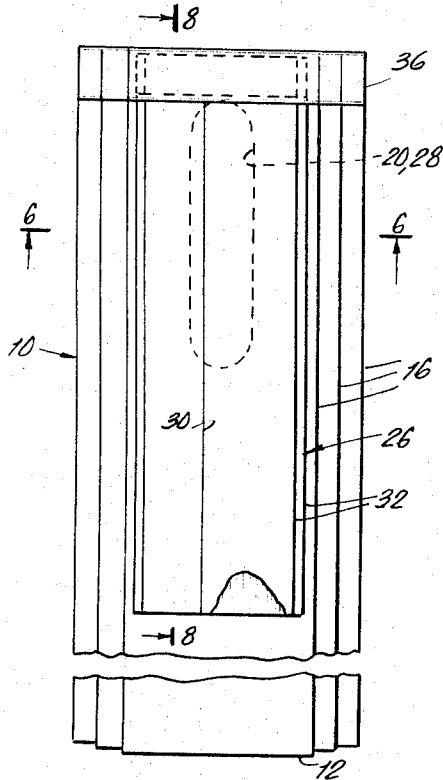


FIG. 7

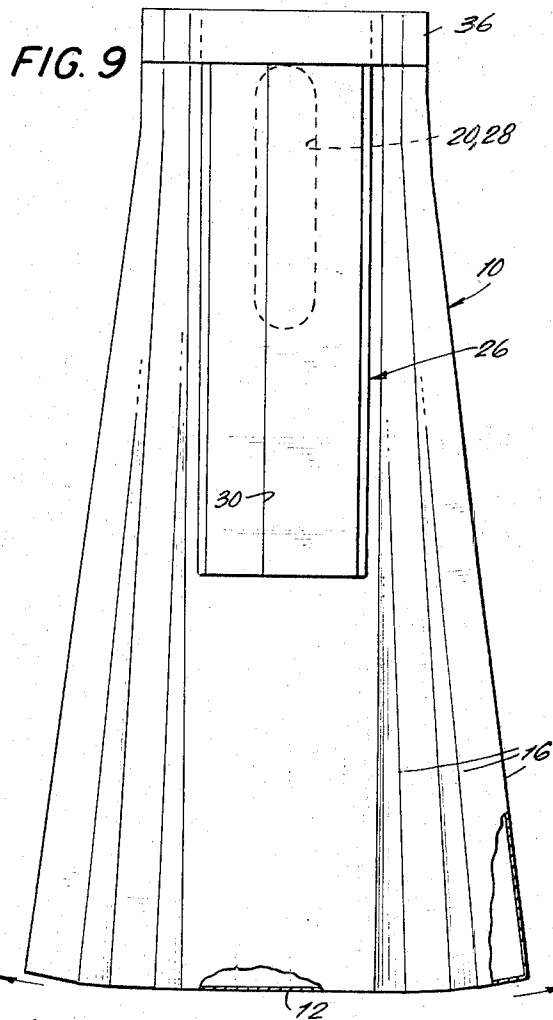


FIG. 9

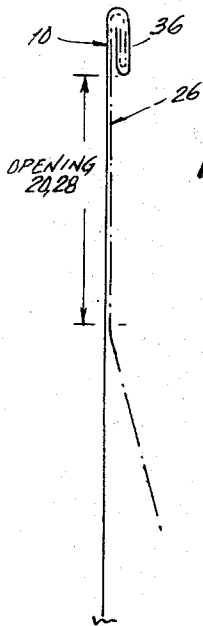


FIG. 8

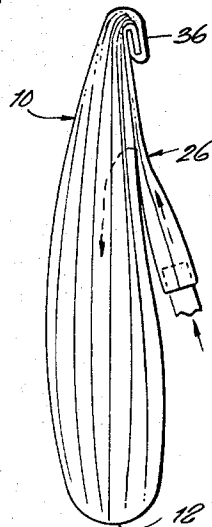


FIG. 10

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3,350,859

VACUUM CLEANER FILTER BAG

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4 Claims. (Cl. 55—380)

ABSTRACT OF THE DISCLOSURE

This disclosure and this invention are directed to a new and improved vacuum cleaner filter bag constructed of an air pervious material and provided with a receptacle portion and a connecting tube joined together by a double fold each provided with a port in registry with the port in the other. The receptacle portion of the vacuum cleaner filter bag is provided with a unique arrangement of pleats wherein at least one knife pleat goes down the face of the receptacle portion and around the bottom and up the opposing face thereby providing a greater capacity receptacle portion.

Background of the invention

In the past, it was common practice, particularly with respect to vacuum cleaners of the upright type, to provide a receiving bag of cloth or the like, into which the dust-laden air drawn up by the blower was introduced. The receiving bag served both as a filter and as a dirt receptacle, in that the dust-laden air was blown into the receiving bag, and the air passed out through the pores thereof, leaving behind the entrained dust and dirt, which were incapable of passing through the pores of the receiving bag. As the receiving bag became filled with dust and dirt, it was necessary periodically to remove the bag from the vacuum cleaner and empty it. This system proved unsatisfactory in a number of respects. For one thing, the chore of emptying loose dirt out of the bag was a messy and unpleasant one, resulting in the probability of redispersing at least a portion of the dirt in the bag into the atmosphere. Also, the receiving bag was required to be structurally strong and resistant to abrasion and snagging such as sometimes occurs in normal use of the machine, and therefore was necessarily made of a fairly tough woven material. The mechanical requirements thus imposed on the receiving bag militated, to some extent, against its efficiency as a filter material, and most commercial embodiments of such bags were not particularly efficient filter media, allowing a substantial proportion of the dust extracted from rugs, upholstery and the like, to pass through the vacuum cleaner and out through the pores of the receiving bag into the atmosphere, whence they were free to settle again on the rugs, furniture, etc.

To overcome these difficulties, it has become customary to use a double-walled construction for the dirt receiver, comprising a permanent outer bag of cloth or the like, which serves to provide an attractive appearance and a mechanical protective shield for the inner bag, and a disposable inner bag of filter paper or similar material, serving the primary purpose of performing the filtering function of separating the air from the dust and dirt entrained therein, and incidentally also protecting the outer bag from becoming blinded and soiled by dust particles trapped in the pores of the outer bag. An additional advantage of the use of the inner filter bag is that it can be made easily closable and removable from the vacuum cleaner, so that it can be used to remove the dirt from the vacuum cleaner and dispose of it without the necessity of handling or pouring masses of loose dust and dirt. Because of these advantages, the use of internal filter bags has become virtually universal.

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In the course of performing the filtering function, such bags eventually tend to become blinded by the entrapment of microscopic dust particles in the pores of the bag. This effect is inherent, and cannot be completely eliminated. It can, however, be alleviated by making the filtering area of the bag as large as practicable. Moreover, it is advantageous to provide as large as possible a filtering area for the following reason: The amount of air passed through the filter must obviously be substantially equal to the amount of air introduced through the intake. The amount of air passed through the filter is directly proportional to the area of the filter, and also to the pressure difference across the wall of the filter. As between two otherwise equivalent filters of unequal area, the filter having the smaller area tends to offer more resistance to the passage of air therethrough. This resistance results in an increase of pressure within the filter bag of smaller area. The pressure increase has two effects; it increases the rate of passage of air per unit area of filter, and it also sets up a back pressure which resists the movement of air by the blower into the filter bag. Because of the latter effect, the blower moves less air per revolution, or per unit of time. Consequently, it follows that the filter bag of smaller area produces a correspondingly smaller blower efficiency, and a correspondingly smaller capacity for the vacuum cleaner.

Numerous types and configurations of vacuum cleaner filter bags have heretofore been proposed. Some of these have been of complicated construction, resulting in numerous cutting, folding and pasting operations for assembly of the bag. Others have been so constructed that the outer surface of the filter bag is substantially co-extensive with the inner surface of the outer cloth bag, rather than providing a filter bag surface exceeding the area of the outer bag.

Still others have been constructed in a form comprising a tube or tunnel having one end adapted to be placed in communication with the discharge end of a blower tube or the like, and another end in communication with a receptacle in the form of a bag or the like. This type of arrangement provides certain advantages, among which may be mentioned the fact that the dust and dirt-laden air is caused to traverse a U-shaped path, which reduces its velocity and tends to prevent the stream of incoming air from disturbing the mass of dust and dirt previously collected. Also, this arrangement prevents the previously-collected dirt from falling back into the blower when the power is turned off. On the other hand, this type of arrangement also suffers from certain disadvantages. Among these may be mentioned the fact that the U-shaped path of the material results in the impingement of a stream of dust and dirt-laden air continuously on a single specific area of the material of the filter bag, which sometimes leads to the wearing of a hole in the bag at this point, particularly when abrasive materials such as sand and the like are being picked up by the blower.

An object of this invention, therefore, is to provide an improved filter bag for vacuum cleaners and the like.

Another object is to provide a filter bag or the like having a maximum effective surface area.

Still another object is to provide a filter bag of simple and inexpensive construction.

A further object is to provide a filter bag adapted to be inserted within an outer containing bag, and having an effective area greater than the area of the containing bag.

Yet another object is to provide a filter bag having a configuration such as to prevent direct impingement of an incoming air stream on a body of previously-collected dust and dirt and to prevent previously-collected dirt from dropping back into the blower, which bag is protected against abrasion of holes in the bag material by impinge-

ment thereon of an air stream laden with abrasive particles.

A feature of this invention is the provision of a bag having a main receiving section made from a fluted blank by folding said blank at right angles to the flutes thereof and adhesively uniting the folded portions.

Another feature is the use of a tunnel member in the form of a sheet of material appropriately folded and glued to form a tube.

Still another feature is the provision of mating elongated apertures in the bag and in the tunnel member.

A further feature is the provision of a reinforced area in the region of the union of said tunnel member with said bag member.

Other objects, features and advantages will become apparent from the following more complete description and claims, and by reference to the accompanying drawings.

In one particularly desirable embodiment, this invention contemplates a vacuum cleaner filter bag comprising in combination a receptacle and a connecting tube, said receptacle being formed of a single sheet of porous paper folded substantially in half along a fold line and adhesively joined along mating edges from said fold line to define a receptacle structure having a top defined by a pair of juxtaposed edges of said sheet opposite said fold line, a pair of faces having sides defined by said joined edges and a seamless bottom defined by said fold line, said receptacle being pleated to provide a plurality of knife pleats of substantial width adjacent each of said sides, each of said knife pleats extending down one face of said receptacle, under said bottom, and up the opposed face of said receptacle, one of said faces being perforated to define an aperture therein; said connecting tube being an elongated paper tube having an open lower end adapted to embrace a vacuum cleaner discharge fitting and an upper end adjacent the top of said receptacle, said connecting tube being perforated to define an aperture registering with said receptacle aperture, said connecting tube being joined to said receptacle by a layer of adhesive interposed between said connecting tube and said receptacle and surrounding said registered aperture, the upper end of said tube and the top of said receptacle being folded together along at least two fold lines generally parallel with the top of said receptacle forming at least a double fold and held in said double-folded configuration.

Referring now to the drawings:

FIGURE 1 is a front view, partly in section, of the receptacle portion of the bag according to this invention, prior to application thereto of the connecting tube.

FIGURE 2 is an end view of the receptacle portion shown in FIGURE 1, taken from a viewpoint as indicated by line 2—2 in FIGURE 1.

FIGURE 3 is a front view, partly in section, of the connecting tube portion of the bag according to the invention, prior to application thereof to the receptacle portion.

FIGURE 4 is an end view of the tube of FIGURE 3, taken from a viewpoint as indicated by line 4—4 of FIGURE 3.

FIGURE 5 is a fragmentary medial cross-section of the receptacle of FIGURE 1, taken along line 5—5 of FIGURE 1.

FIGURE 6 is a cross-sectional view of the assembled bag, comprising the receptacle and connecting tube, in folded condition, taken along line 6—6 of FIGURE 7.

FIGURE 7 is a front view of the assembled bag in folded condition.

FIGURE 8 is a somewhat diagrammatic transverse sectional view taken along line 8—8 of FIGURE 7, showing the manner in which the top of the receptacle and the top of the connecting tube are closed by a common double fold.

FIGURE 9 is a front view similar to FIGURE 7, showing the assembled bag in expanded condition.

FIGURE 10 is a side view of the assembled bag in expanded condition, as it would appear in use inside the outer protective bag.

Referring now more particularly to FIGURES 1, 2 and 5, the receptacle portion 10 of the bag comprises an elongated sheet of porous filter paper which has been folded substantially in half along a fold line 12 which forms the bottom of the receptacle. Adjacent edges of the folded blank extending upwardly from the fold line are united by beads of adhesive 14 to close the sides of the receptacle.

The receptacle is also provided, adjacent each side thereof, with a plurality of knife-pleats 16. Pleats 16 may be formed after the blank is folded along line 12 and cemented along its sides, but ordinarily and preferably are formed in the blank at an earlier stage of operation, so that the blank is already pleated when it is folded over on fold line 12 and face pleats 18 are cemented together. In a preferred method of manufacture, adhesive beads 14 and flutes 16 are formed continuously in the course of passage of a continuous length of porous paper through an automatic bag-making machine, and the continuous length is subsequently cut into lengths corresponding to individual bags. In the same machine or an immediately following machine, the individual lengths may be folded over along fold line 12, and the face pleats 18 cemented together by means of adhesive beads 14, as will also be apparent to those skilled in the art.

Each of the folded blanks has one face which is perforated to provide an aperture 20. The aperture may be cut in the blank after it is cut and folded. In most cases, however, it is preferred to perforate the paper stock at appropriate intervals along its length, before it is pleated, folded and cemented together at the sides. In either case, the aperture should be located as shown, nearer the top than the bottom of the receptacle, and spaced from the top by an amount sufficient to allow for closing of the top of the receptacle by folding, as described below.

At an appropriate point in the manufacturing process, suitably in the same bag-making machinery referred to above, the folded blank is provided with additional adhesive in the form of a plurality of transverse stripes 22 thereof and an overall area 24 surrounding aperture 20 and extending upwardly to the top of the receptacle, as best shown in FIGURE 1.

Connecting tube 26 is suitably made on continuous apparatus operating on a continuous length of paper perforated at intervals to provide apertures 28. The continuous length of paper is folded and cemented along marginal edges, as indicated at 30, to form a tube, and preferably is indented or fluted as indicated at 32, in the same operation, with aperture 28 spaced below the top of each length by a distance substantially equal to the spacing of aperture 20 below the top of receptacle 10. In the same operation, or subsequently, the connecting tube is provided with adhesive in the form of transverse stripes 34.

The bag is assembled by placing the connecting tube over the receptacle in such a way that the tops of the two units coincide and the two apertures 20 and 28 are in registry. When so assembled, they are held together by adhesive 24, as indicated in FIGURE 6.

After the connecting tube is assembled in place and adhesively secured to the receptacle, the tops of both the receptacle and the connecting tube are closed by folding them over together to provide at least a double fold 36. Adhesive stripes 22 on the receptacle and 34 on the connecting tube are thereby brought into contact with the unfolded body portions of the receptacle and the connecting tube, respectively, holding the upper portions of the receptacle and the connecting tube in the doubly-folded configuration.

The double-folded closure as just described serves two important functions. It provides a secure and positive closure of both the upper end of the connecting tube and

the top of the receptacle, so that it is impossible for air and entrained dust and dirt to escape therefrom. Also, it provides a mass of material located substantially at the point where the dust-laden air stream is forced to make a U-turn in proceeding from the connecting tube into the receptacle. The mass of material resulting from the double-folded closure constitutes an effective protective means for absorbing the resulting abrasion, without subjecting the material of the bag to the danger of perforation.

In use, the bag is preferably first distended by manually spreading the lower portion of the receptacle as indicated in FIGURE 9, and then inserting it into the protective outer bag, and then connecting the lower end of the connecting tube to the vacuum cleaner discharge fitting. In accordance with conventional practice, a spring-clamp, elastic ring or the like (not shown) may be used to ensure a close fit of the lower end of connecting tube 26 around the end of the discharge fitting. Alternatively, the step of manually distending the lower end of the receptacle may be omitted, as the internal air pressure provided by the blower will, in most cases, serve to distend the receptacle in much the same manner.

Certain features should be noted with respect to the filter bag as above described under conditions of use. For one thing, as the bag is distended, the pleats open up partially but, in the usual case, are prevented from opening up completely by the restraining influence of the outer bag. Consequently, the ultimate configuration of the filter bag presents a corrugated or fluted shape, having an effective filtering area greater than the surface area of the outer bag. Also, unlike many types of filter bag heretofore proposed, the bag of the present invention provides effective protection against the possibility of perforation by abrasive particles entrained in the air stream, by virtue of the double-folded closure of the top of the receptacle and the upper end of the connecting tube, located substantially at the point where abrasion is most troublesome due to the sudden change of direction of the air stream.

While this invention has been described in terms of certain preferred embodiments and illustrated by way of certain drawings, these are illustrative only, as many alternatives and equivalents will readily occur to those skilled in the art, without departing from the spirit or proper scope of the invention. The invention is therefore not to be construed as limited, except as set forth in the appended claims.

I claim:

1. A vacuum cleaner filter bag comprising in combination a receptacle and a connecting tube, said receptacle being formed of a single sheet of porous paper folded

substantially in half along a fold line and adhesively joined along mating abutting edges in face-to-face relationship extending from said fold line to define a receptacle structure having a top defined by a pair of juxtaposed edges of said sheet opposite said fold line, a pair of face walls having sides said sides being defined by said joined edges and a seamless bottom defined by said fold line, said receptacle comprising a plurality of knife pleats adjacent each of said sides, each of said knife pleats extending down one face wall of said receptacle, under said bottom, and up the opposed face wall of said receptacle, one of said face walls being perforated to define an aperture therein; said connecting tube being an elongated paper tube having an open lower end adapted to embrace a vacuum cleaner discharge fitting and an upper end adjacent the top of said receptacle, said connecting tube being perforated to define an aperture registering with said receptacle aperture, said connecting tube being joined to said receptacle by a layer of adhesive interposed between said connecting tube and said receptacle and surrounding said registered apertures, the upper end of said tube and the top of said receptacle being folded together along at least two fold lines generally parallel with the top of said receptacle forming at least a double fold and held in said double-folded configuration.

2. A vacuum cleaner filter bag according to claim 1, wherein said aperture in said receptacle face and said aperture in said aperture in said connecting tube are in the form of elongated slots.

3. A vacuum cleaner filter bag according to claim 1, wherein said upper end of said connecting tube and said top of said receptacle are maintained in said double-folded configuration by stripes of adhesive extending laterally across said receptacle top and said connecting tube.

4. A vacuum cleaner bag according to claim 1 wherein said knife pleats occupy a substantial portion of the bag width.

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