Oct. 31, 1950 C. G. BERGQUIST 2,528,332

SELF-ACTING CLOSURE

Filed July 3, 1947

Fig. 1

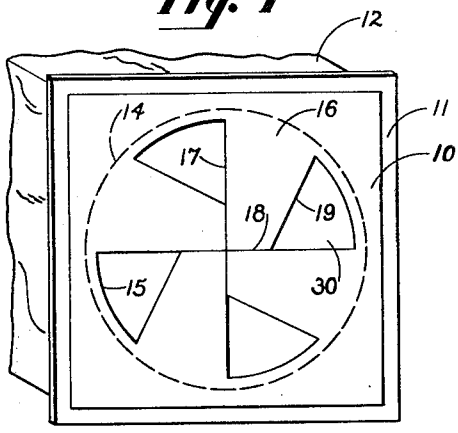


Fig. 4

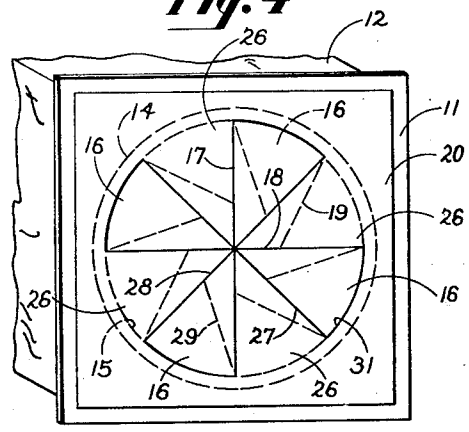


Fig. 2

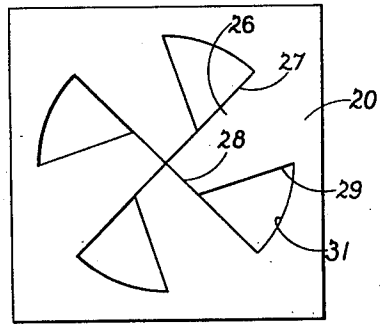


Fig. 5

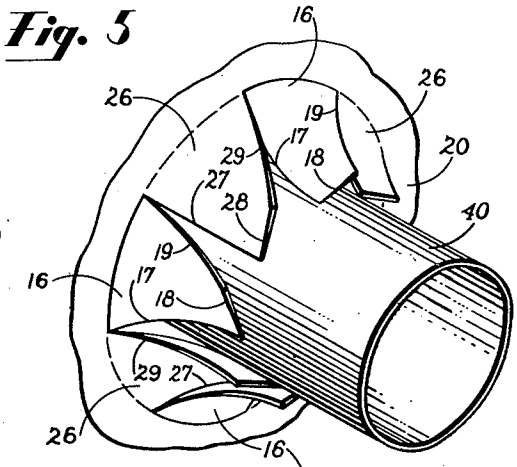


Fig. 3

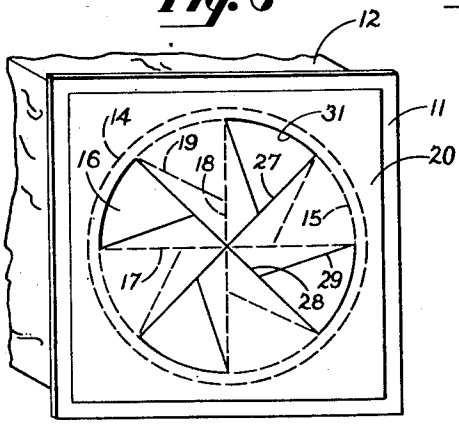
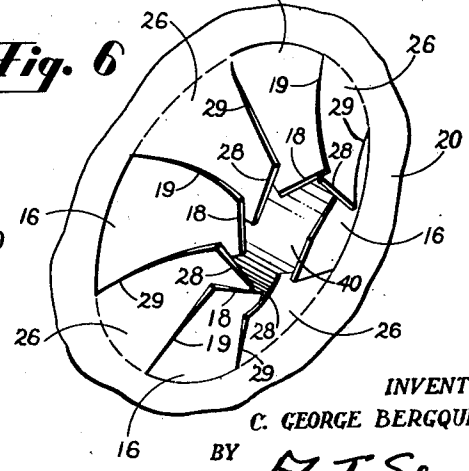


Fig. 6



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SELF-ACTING CLOSURE

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4 Claims. (Cl. 229—43)

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This invention relates to receptacle closures and is particularly concerned with self-acting closures which automatically return to an aperture closing position after opening movement thereof.

While the basic inventive concept is broadly applicable to a wide variety of receptacles including rigid metallic and wooden boxes and glass or like containers it may well find its greater application in the field of bags and boxes formed of inexpensive material, such as cloth or paper. In particular, the invention is adapted for use as a closure for porous dust receptacles of suction cleaners and is specifically designed for use as a self-closing mouth for a disposable porous paper dust separating receptacle for tank type suction cleaners.

It is among the prime objects of the present invention to provide a novel, simple and improved receptacle closure which is automatically self-closing.

Another prime object is to provide a closure of the type referred to which is adapted for manufacture from inexpensive and readily available materials and which may be efficiently assembled by automatic equipment with a minimum of fabricating expense.

A similar object is to provide a closure which will automatically and effectively close a receptacle aperture after the opening thereof and which while inexpensive as to materials and manufacturing cost will have a long efficient and effective life.

Another object is to provide a closure member in which a plurality of partially independent flexible fingers cooperate in automatically flexing into a common plane proximate to the plane of a receptacle aperture to closing such aperture.

Similarly an object is to provide a closure in which interlacing closure elements cooperate to provide an effective but yieldable seal for the aperture of a receptacle.

A further object is to provide a closure which is adapted to receive therethrough a tube or the like and which by operation of such device is caused to provide for an interlacing of parts whereby the closure will automatically seal a receptacle aperture as an incident to the withdrawal of the tube.

Numerous other objects and features of the present invention will be apparent from the following specification when taken into conjunction with the accompanying drawing, in which:

Fig. 1 is a top plan view of a first element of the closure;

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Fig. 2 is a similar view of a second element of the closure;

Fig. 3 is a top plan view showing the elements of Figs. 1 and 2 in superposed position before insertion of the filling tube;

Fig. 4 is a similar view of the closure of Fig. 3 after removal of a filling tube;

Fig. 5 is a perspective view showing the closure with the filling tube inserted therethrough, and

Fig. 6 is a similar view showing the filling tube being withdrawn from the closure.

The structure of the present invention includes a pair of cooperating elements each of which comprise an encircling body having inwardly extending fingers. Such elements are arranged together with a related orientation such that the fingers of one member overlie the proximate edges of the fingers of the other member. An important feature of the invention is that the fingers are formed to include edges, the radial extent of which are less than the radial extent of the next adjoining edge of the next adjoining fingers of the companion element. This arrangement is such that in response to flexing pressure upon the fingers, as by the insertion of a filling tube or the like, the fingers are sprung inwardly to lie in a position angularly oriented with relation to the base of the fingers and with the shorter edges overlying the longer ones. Thus, when pressure is relieved, as when the tube is withdrawn, the longer side edges of the fingers will start to move in the direction of resumption of the normal plane of the elements before the shorter edges and thus such longer edges will pass beneath the shorter ones of the next adjacent finger so that the fingers will become interlaced to sealingly close the aperture.

A feature of the invention is that interlacing of the fingers may be either an overlapping or an underlapping i. e. the non-radial finger corners, that is the corners formed between the radial ends 18 or 28 and the chordal short sides 19 or 29 may either overlap the adjacent long sides 17 or 27 as in Fig. 4 or they may be oppositely moved to underlap. Thus, the device is self-actuating, in response to the projection therethrough of a tube or the like, from either side thereof.

Referring now more particularly to the drawing, the element of Fig. 1, which may be termed the first element, is preferably formed of a substantially rectangular sheet 10 of material, preferably paper or foil, having a natural flexibility so that its normal position is with all parts thereof in a single plane. While paper or foil is here

suggested, as usually adequate and both available and inexpensive, thin flexible metal or treated and synthetic sheets may, of course, be used. The important characteristics of the material are, in addition to strength, lightness and durability, an ability to flex back into a single plane after movement therefrom, it being desirable that such flexibility be such that the return will take place even after a sustained deflection.

The sheet 10 is here shown as secured to a more rigid apertured end member 11 to which a receptacle body 12 may be secured in any desired manner. For use as a suction cleaner dust separating and retaining receptacles the body 12 will be formed of porous material preferably of paper or similar inexpensive and readily disposable material. The invention is, of course, not limited to a construction including the flexible body glued or otherwise conveniently secured to a rigid apertured end member of a structure in which the end member has applied over the aperture thereof the separately formed elements one and two of the closure itself. Obviously, the elements one and two may be formed integrally by a single sheet folded back upon itself to superimpose the cooperating sections thereof and if desired such elements may themselves constitute the entire end structure to which the bag body is attached. Likewise the end and body may be formed integrally. Thus, it will be seen that the structural embodiment described and depicted is not intended to limit the extent or scope of the inventive concept.

The more rigid end member 11 has a central circular aperture 14 over which the first member 10 is positioned. The spaces between the bases of the fingers of the member 10 constitute a central aperture 15 which is adapted for registration with the aperture 14 of the end member 11. Inwardly from the aperture 15 member 10 is provided with a plurality of uniformly spaced fingers 16, here shown as four in number. Each finger is provided with a long radial side 17 extending from the edge of the aperture 15 to the center thereof. Each finger is also provided with a radially disposed end 18 which extends from the center of the aperture radially at an angle of 90° to the long side 17 for a short distance and terminates in its juncture with a short chordal side 19 of the finger which is disposed at an angle to the long radial side 17 and to radial end 18 and lies on a chord of the aperture and thus will constitute the short side of the finger.

With respect to Fig. 2, it will be seen that the second element 20 is formed with a duplicate number of similarly formed fingers 26 having the long radial sides 27, radial ends 28 and chordal short sides 29 corresponding to the long sides 17, ends 18 and short sides 19 of the fingers of the first element. The fingers 26 of the second element 20, however, are oriented at 45 degrees with respect to the finger 16 so that the bases of the fingers 26 will upon superimposition of the elements lie directly over the apertures 30 between the fingers 16, while the bases of the fingers 16 will lie directly under the apertures 31 formed between the fingers 26 of the second element 20. The second element 20 is positioned in oriented relation over the first element 10 and secured therewith to the base 11 as by gluing. The parts thus assembled will be as shown in Fig. 3, with the fingers of the first and second elements lying in their own plane without interlacing therebetween. After manipulation of the fingers as will be hereinafter explained, the short side and

the radial end of each finger will be moved to the opposite side of the next adjacent finger to overlie or underlie the long radial side of such next adjacent finger, thus interlacing the fingers to automatically form an interlocking sealing closure as depicted in Fig. 4.

While the interlacing of the fingers of the elements may be preformed by manual manipulation or otherwise prior to the filling of a container to which the invention is applied, Figs. 5 and 6 illustrate the automatic interlacing of such fingers upon insertion of a filling tube. Fig. 5 illustrates the internal face of the closure with a filling tube 40 inserted therethrough.

Upon insertion of the tube its side walls engage the long radial sides 17 and 27 of the fingers 16 and 26, respectively, deforming them inwardly out of the plane of the closure and in so doing, the fingers are twisted so that the short chordal sides 19 and 29 extend outwardly from the axis of the tube beyond the position of the edges 17 and 27, thus giving each finger an axial or longitudinal twist. Fig. 6 shows the tube 40 withdrawn to a point beyond the terminal ends of the radial ends of the fingers and in such withdrawal the twisted relation of the relation of the fingers will cause the corners formed by the radial ends and the chordal sides to underlie the next adjacent finger so that upon full withdrawal of the tube, the aperture of the receptacle will be fully closed by the interlaced fingers as shown in Fig. 4. Thus, a container provided with the present closure may be delivered empty with the closure fingers of each element lying in their own planes as in Fig. 3, but upon insertion of a filling tube and the withdrawal thereof the fingers will assume the strong interlaced and sealing relation shown in Fig. 4.

As before pointed out, the interlacing may be by overlying or underlying of the non-radial corners. Thus, if the tube were inserted oppositely from the side indicated in Fig. 5 subsequent withdrawal thereof would cause an opposite interrelation from that shown in Fig. 4 or if the tube were such that upon withdrawal they would be drawn outwardly with the tube, upon full disengagement of the tube, the fingers would drop into oppositely interrelated position.

While the fingers may interleave in either the overlapping or underlapping relation, it has been found that once interleaved the closure partakes of a check valve characteristic in that while reopening may readily take place by thrust from the non-overlapping side, that is the side shown in Fig. 4 an opening thrust from the opposite side, here shown as the inside of the bag is strongly resisted. In response to such a reverse thrust, the overlapping portions must be forced past the radial sides and hence offer resistance to such movement. Thus, when used as a receptacle closure as here shown the device is not only a self-closing structure, but is also a check valve closure.

From the foregoing, it will be seen that the present invention provides a novel, simple and improved self-actuating closure fully fulfilling the objects of the invention hereinbefore set forth. It will be understood, of course, that numerous changes, modifications and the full use of equivalents may be resorted to in the practice of the invention without departing from the spirit or scope of the appended claims.

What I claim is:

1. A receptacle mouth structure comprising a pair of normally flat cooperating sheet members,

each comprising a perimeter structure defining a circular aperture with a plurality of inwardly directed resiliently deformable spaced fingers normally lying in the plane of their perimeter structure, the number of fingers on each member being identical, the fingers of one member being oriented with respect to those of the other so that they overlie the spaces between the fingers of the other and overlap a portion of such fingers.

2. A self-closing receptacle closure comprising a plurality of normally flat sheet members secured together one over the other, said sheet members including sets of resiliently deformable closure fingers arranged with each set in closely parallel planes with a portion of the fingers of one set overlapping a portion of the fingers of an adjacent set, the number of fingers on each member being identical, the fingers of one set being movable between the fingers of the adjacent set and past the edges of the overlapped portions thereof whereby the fingers of the adjacent sets are interleaved.

3. In a structure for closing an aperture, a pair of normally flat sheet members secured together one over the other, each member including a perimeter portion defining a circular aperture and a plurality of spaced fingers extending inwardly across said aperture from said perimeter portion, the number of fingers on each member being identical, each of said fingers including a radial side edge extending to the center of the circular aperture, said radial side edges facing in the same circumferential direction, an opposite non-radial side edge angularly disposed with respect to the radial edge and an inner radial end edge on each finger, the inner radial edge of each finger coinciding with a portion of the radial side edge of the adjacent finger of the same member, said members being oriented with respect to each other so that said circular apertures are in alignment and the fingers of each member overlap the spaces between the fingers of the other member and overlap portions of the fingers of the other member.

4. In a structure for closing an aperture, a pair of normally flat sheet members secured together one over the other, each member including a perimeter portion defining a circular aperture and a plurality of spaced fingers extending inwardly across said aperture from said perimeter portion, the number of fingers on each member being identical, each of said fingers including a radial side edge extending to the center of the circular aperture, said radial side edges facing in the same circumferential direction, an opposite non-radial side edge angularly disposed with respect to the radial edge and an inner radial end edge on each finger, the inner radial edge of each finger coinciding with a portion of the radial side edge of the adjacent finger of the same member, said members being oriented with respect to each other so that said circular apertures are in alignment and the fingers of said members are interleaved so that the fingers of each member overlap the spaces between the fingers of the other member and overlap portions of the fingers of the other members.

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