

Sept. 20, 1960

M. L. ABEL
WASHING MACHINE

2,953,009

Filed Oct. 25, 1957

2 Sheets-Sheet 1

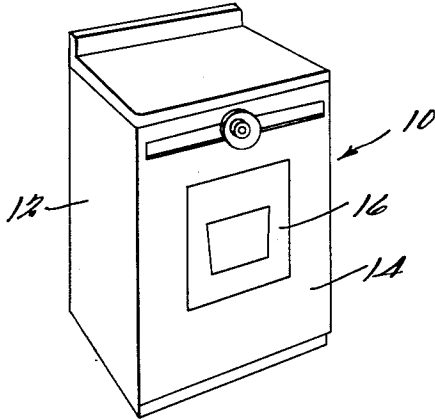


Fig. 1

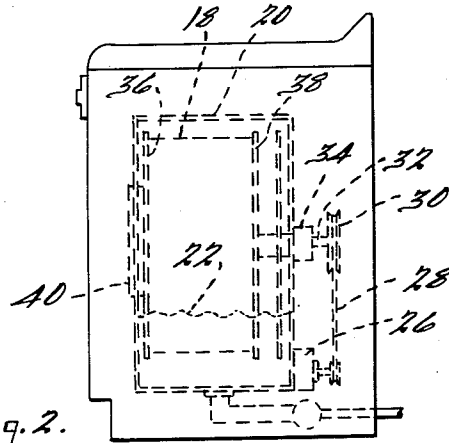


Fig. 2.

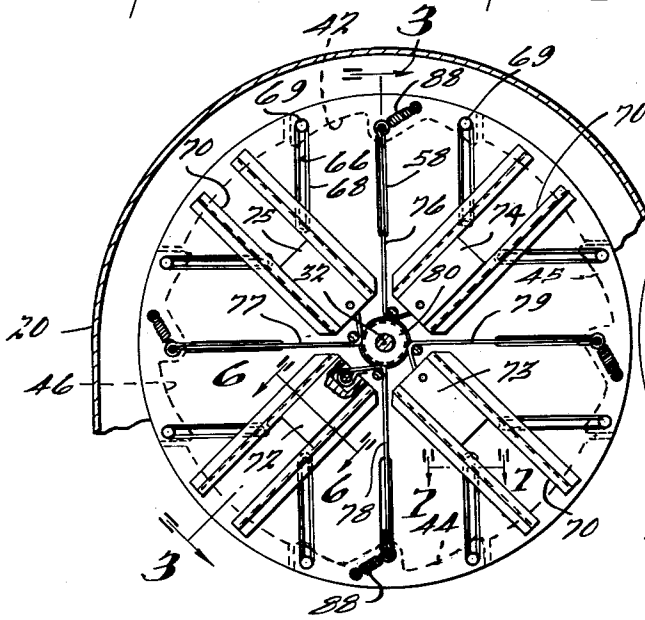


Fig. 4.

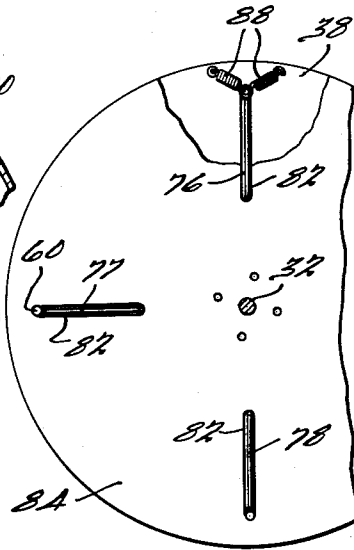


Fig. 5.

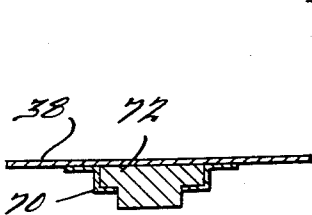


Fig. 6.

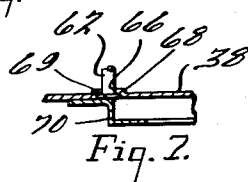


Fig. 7.

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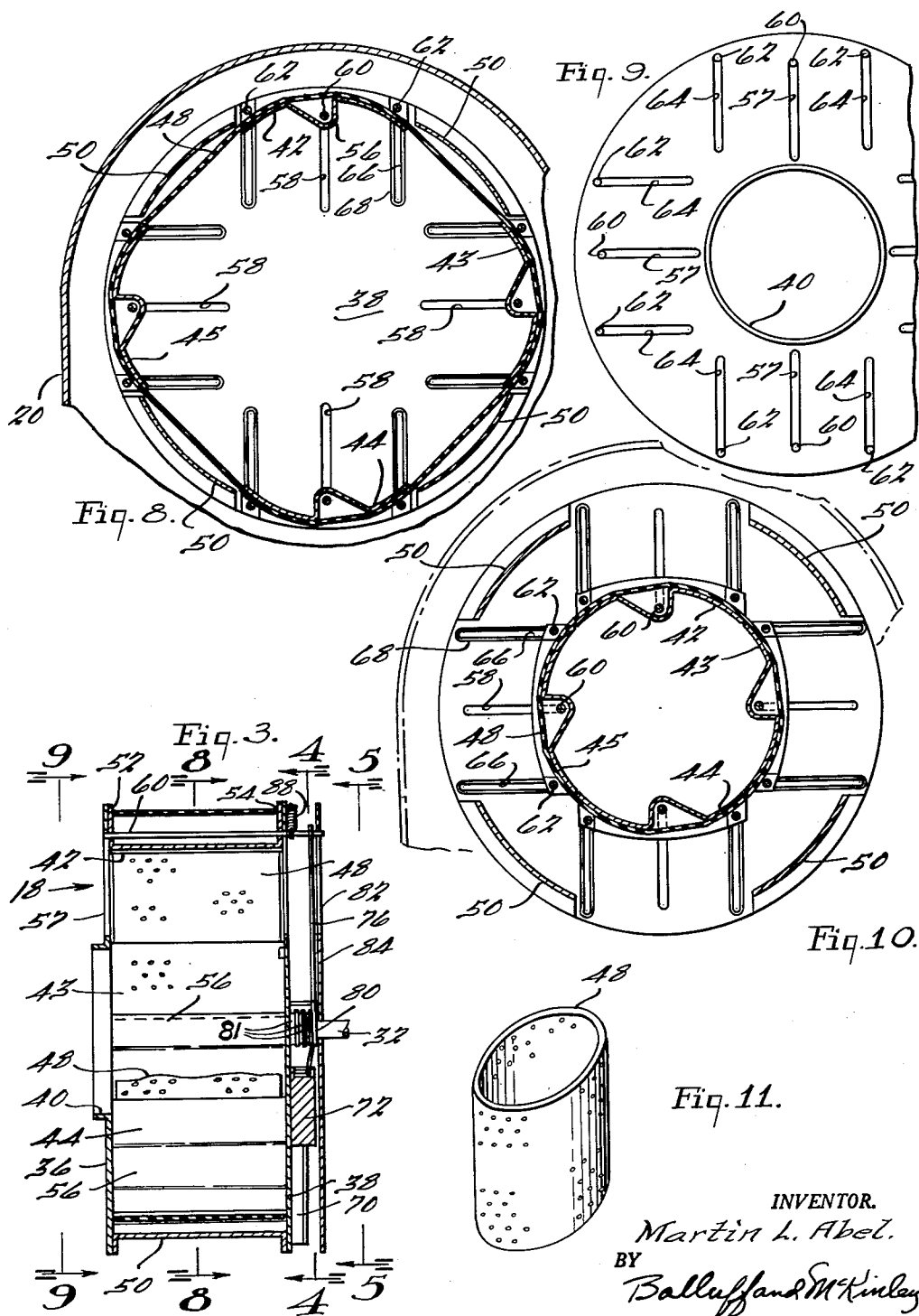
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2 Sheets-Sheet 2



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2,953,009

WASHING MACHINE

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Filed Oct. 25, 1957, Ser. No. 692,460

19 Claims. (Cl. 68—24)

This invention relates to washing machines and more particularly to a combination washing machine and drier in which washing, extracting and drying operations are provided for by a single machine.

Washing machines capable of performing extracting and drying operations have heretofore been proposed, but such machines have proven unsatisfactory in several respects. Machines of this type including a relatively large diameter drum rotatable on a horizontal axis are known in the art, and the washing and drying operations may be carried out in such machines at relatively low speed operation. Unless most of the water is extracted from the articles prior to the drying operation, the drying operation must be unduly prolonged if substantial drying is to be obtained. In order to obtain efficient extraction of the water in the articles, it is necessary to rotate the receptacle or drum at a substantially higher number of revolutions per minute than during the washing and drying operations. At the higher drum speeds, however, excessive vibration results from the fact that the articles will not be uniformly distributed around the interior of the drum and the resulting unbalance of the drum, acting through such large diameter, produces considerable vibration, noise and wear on the bearings and other parts of the machine.

According to the present invention, the machine is provided with a single rotatable receptacle or drum in which the washing, extracting and drying operations are carried out. The drum, however, is provided with a peripheral wall which is expansible and contractible in accordance with the speed of rotation of the drum so that the drum may be maintained in its large diameter or expanded position during the washing and drying operations which are carried on at low drum speeds. A speed responsive means is rotatable with the drum and, when the drum is rotated at high speeds, the speed responsive means acts to contract the peripheral wall of the drum to its smaller diameter so that at such high drum speeds, which are required for efficient extracting operations, any unbalance of the articles within the drum will be minimized to very substantially reduce vibrations and consequent wearing out of the bearing surfaces.

A principal object of the invention, therefore, is to provide a new and improved combination washer and drier.

Another object of the invention is to provide a washing machine having a rotatable washing receptacle provided with an expansible and contractible peripheral wall.

A further object of the invention is to provide a machine of the type described in which the diameter of the rotatable drum may be reduced when the drum is rotated at high speed and increased when the drum is rotated at a lower speed.

Another object of the invention is to provide a combination washing machine and drier having automatically operative speed responsive means associated with the rotatable washing and drying receptacle to automatically decrease the diameter of the drum when the latter is

rotating at high speeds, such as during an extracting operation.

A further object of the invention is to provide a machine of the type described which is capable of efficiently carrying out washing and drying operations with a minimum of vibration and wear on the bearings and other parts of the machine.

Other and further objects of the invention will be apparent from the following description and claims and may be understood by reference to the accompanying drawings, of which there are two sheets, which by way of illustration show a preferred embodiment of the invention and what I now consider to be the best mode in which I have contemplated applying the principles of my invention. Other embodiments of the invention may be used without departing from the scope of the present invention as set forth in the appended claims.

In the drawings:

Fig. 1 is a perspective view of a combination washing machine and drier of the type described;

Fig. 2 is a side elevational view of the machine;

Fig. 3 is a vertical sectional view taken on line 3—3 of Fig. 4;

Fig. 4 is a view taken on line 4—4 of Fig. 3;

Fig. 5 is a view taken on line 5—5 of Fig. 3;

Fig. 6 is a fragmentary sectional view taken on line 6—6 of Fig. 4;

Fig. 7 is a fragmentary sectional view taken on line 7—7 of Fig. 4;

Fig. 8 is a sectional view taken on line 8—8 of Fig. 3;

Fig. 9 is a view taken on line 9—9 of Fig. 3;

Fig. 10 is a view similar to Fig. 8 but showing the drum in its contracted position for an extracting operation; and

Fig. 11 is a perspective view of the perforated rubber wall forming a part of the drum.

The combination washing machine and drier 10 described herein includes an outer casing 12 having a front panel 14 provided with an access door 16 through which articles may be inserted into and removed from the machine. As shown in Fig. 2, a washing receptacle or drum 18 is located within a tank 20 adapted to contain the wash water, the level of which is indicated at 22. The water is supplied to and drained from the tank 20 in a conventional manner. The drum 18 is rotatable on a horizontal axis and is driven from an electric motor 26 through a belt 28 and a pulley 30 fixed on the drum shaft 32, which is supported within a bearing 34 mounted on the tank 20.

The drum 18 includes opposed end walls 36 and 38 in the form of circular sheet metal discs. The front wall 36 of the drum is provided with a circular access opening 40, and the back wall 38 is secured on the drive shaft 32. The peripheral wall of the drum includes four similarly shaped movable wall sections 42, 43, 44 and 45 and a perforated rubber annulus or cylinder 48. The drum further includes four arcuate wall segments 50 extending between and secured to the end walls 36 and 38 at their peripheries and equally spaced around the drum.

Each of the wall sections 42, 43, 44 and 45 includes a flange 52 slidable against the front wall 36 of the drum and a flange 54 at its other end engaging the back wall 38 of the drum. Each wall section has an arcuate extent of about 45° and includes a rib 56 to provide the tumbling action during the washing and drying operation.

The end wall 36 is provided with four radially extending slots 57 and the back wall 38 is provided with four radial slots 58 aligned with the slots 57 in the front wall 36. Each wall segment 42, 43, 44 and 45 has a rod 60 secured thereto and projecting through the end flanges 52 and 54. The rods 60 have their opposite ends

received within the slots 57 and 58 provided in the end walls 36 and 38.

Each of the wall sections 42-45 is further provided with a pair of rods 62 received at one end in slots 64 formed in the end wall 36 and at their other ends in slots 66 formed in elongated ribs 68 on the end wall 38 with the head 69 of each rod 62 flush with the outer side of the end wall 38, as illustrated in Fig. 7. The wall sections 42-45 are thus guided for movement toward and away from the center of the drum by the engagement of rods 60 and 62 in slots 57, 58, 64 and 66, the wall being shown in its large diameter or expanded position in Fig. 8 and in its retracted position in Fig. 10.

The rubber cylinder 48 passes around the outside of the wall sections 42-45 and is disposed inwardly of the fixed arcuate wall portions 50, as illustrated in Fig. 8. The cylinder 48 is stretched when the wall of the drum is in its expanded position and is provided with a series of perforations over its entire surface so that the wash liquid can freely pass through the wall of the drum. The wall segments 42-45 may also be provided with a series of apertures in order to permit efficient extraction of water from the articles in the drum during an extracting operation.

The peripheral wall of the drum comprising the wall sections 42-45 and the annular rubber cylinder 48 is automatically positioned in either its expanded or contracted position in accordance with the speed of rotation of the drum. One form of speed responsive means for contracting the wall to its smaller diameter is illustrated in Figs. 3 and 4. As shown in Fig. 4, the end wall 38 is provided with four channel-shaped guides 70 spaced 90° apart. Slidable weights 72, 73, 74 and 75 are each confined within one of the guides 70. Flexible cables 76, 77, 78 and 79 are attached at one end to the weights 72, 73, 74 and 75, respectively, and are then passed around one of the grooves 81 in a pulley 80 and secured at their other ends to the rods 60 of wall sections 42, 43, 44 and 45, respectively.

The rods 60 are also received within radial slots 82 formed in a circular plate 84 which is rotatable with the drum 18. The pulley 80 is freely rotatable on the drive-shaft 32.

The movable wall sections are normally maintained at the outer ends of their guide slots 57, 58, 64 and 68 by a pair of springs 88 connected to each rod 60, one of the springs 88 being secured to the end wall 38 and the other to the plate 84. The springs 88 are strong enough to prevent the weights 72, 73, 74 and 75 from moving outwardly in the guides 70 when the drum is rotated at relatively low speeds of the order of about 50 r.p.m. at which the drum is rotated during the washing and drying operations. However, when the drum is rotated at high speeds of the order of about 500 r.p.m. required for the extracting operation, the centrifugal force acting on the weights will cause them to move outwardly in the guides 70 and contract the wall segments 42-45 to the position shown in Fig. 10. At this reduced diameter the articles will substantially fill the interior of the drum so that the drum at such time will be substantially balanced and any slight out of balance that might occur will not cause any substantial vibration because of the relatively small diameter of the drum. The drum can therefore be operated at substantially higher speeds without excessive vibration during the extracting operation than would be possible with a machine in which the drum size is fixed. The machine would, of course, be provided with suitable controls for timing the several operations carried out by the machine and for automatically increasing or decreasing the drum speed as required. Since the extracting operation can be carried out at high speed by virtue of the present invention, the extracting operation can be performed in greatly reduced time so that a complete cycle of operations, including washing, extracting and then

drying, can be carried out in less time than is possible with presently known combination machines of this type.

The essential feature of the present invention is the provision of a rotatable drum which is expandable and contractible, and it is not intended that the invention be limited to the specific speed responsive means illustrated in the drawings for positioning the peripheral wall of the drum in its expanded or contracted position. Therefore, while I have illustrated and described a preferred embodiment of my invention, it is understood that this is capable of modification, and I therefore do not wish to be limited to the precise details set forth but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. In a washing machine, a receptacle comprising a rotatable drum having opposed end walls, said drum having a contractible and expandable peripheral wall supported by said end walls and movable between an expanded, larger diameter position and a contracted, smaller diameter position, yieldable means for maintaining said peripheral wall in its larger diameter position during rotation of said drum at and below a predetermined speed, and means responsive to the speed of rotation of said drum and connected to said peripheral wall for moving the same to its smaller diameter position at speeds above said predetermined drum speed.

2. In a washing machine, a receptacle comprising a rotatable drum having opposed end walls, said drum having a contractible and expandable peripheral wall supported by said end walls and movable between an expanded, larger diameter position and a contracted, smaller diameter position, means urging said peripheral wall toward its smaller diameter position, and means responsive to the speed of rotation of said drum and connected to said peripheral wall for moving said peripheral wall to the other of said positions at a predetermined drum speed.

3. In a washing machine, a receptacle for effecting washing and extracting operations in the sequence named during a cycle of operation, said receptacle comprising a rotatable drum having a contractible and expandable peripheral wall provided with a series of openings therein for the passage of water therethrough, and means for moving said peripheral wall between an expanded, larger diameter position for washing operations and a contracted, smaller diameter position for the extracting operation.

4. A washing machine according to claim 3 including spring means urging said wall toward its larger diameter position, and speed responsive means for moving said wall to its smaller diameter position against the force of said spring means.

5. In a combination washing machine and extractor, a washing receptacle comprising a drum rotatable on a horizontal axis and having opposed end walls, one of which end walls has an opening through which articles may be inserted into and removed from said drum, said drum having a contractible and expandable peripheral wall movably supported from said end walls, a motor for rotating said drum, weight means movably mounted on said drum and movable outwardly from the axis of said drum in response to centrifugal force, and means connecting said peripheral wall to said weight means for contracting said peripheral wall as said weight means moves outwardly in response to centrifugal force.

6. In a combination washing machine and extractor, a receptacle comprising a drum rotatable on a horizontal axis and having opposed end walls, said drum having a contractible and expandable peripheral wall movably supported from said end walls, a motor for rotating said drum, weight means movably mounted on one of said end walls and movable outwardly thereover in response to centrifugal force, and means connecting said peripheral wall to said weight means for contracting said pe-

ripheral wall as said weight means moves outwardly in response to centrifugal force.

7. In a combination washing machine and extractor, a washing receptacle comprising a drum having a contractible and expansible peripheral wall, means for rotating said drum at different speeds during a cycle of operation, weight means movably mounted on said drum and movable in response to centrifugal force, means connecting said peripheral wall to said weight means, and spring means urging said peripheral wall to its expanded position and having a force sufficient to prevent movement of said weight means at low drum speeds, said weight means being movable by centrifugal force against the force of said spring means to contract said wall to said smaller diameter at high drum speeds.

8. In a washing machine, a washing receptacle comprising a drum rotatable on a horizontal axis, said drum having a contractible and expansible peripheral wall, means for rotating said drum at different speeds during a cycle of operation, centrifugally responsive means connected to said peripheral wall and movably mounted on said drum for contracting said peripheral wall to a smaller diameter as said centrifugally responsive means moves in response to centrifugal force, and spring means urging said peripheral wall to its expanded position and having a force sufficient to prevent movement of said centrifugally responsive means at low drum speeds.

9. In a combination washing machine and extractor, a washing receptacle comprising a drum rotatable on a horizontal axis and having opposed end walls, one of which end walls has an opening through which articles may be inserted into and removed from said drum, said drum having a contractible and expansible peripheral wall, means for rotating said drum at low speed during washing operations and at high speed during an extracting operation, weight means movably mounted on one of said end walls and movable outwardly thereover in response to centrifugal force, means connecting said peripheral wall to said weight means in such manner as to contract said peripheral wall to a smaller diameter as said weight means moves outwardly in response to centrifugal force at high drum speeds, and spring means urging said peripheral wall to its expanded position and having a force sufficient to prevent outward movement of said weight means at low drum speeds.

10. In a combination washing machine and extractor, a washing receptacle comprising a drum rotatable on a horizontal axis and having opposed end walls, said drum having a contractible and expansible peripheral wall, means for rotating said drum at different speeds during a cycle of operation, speed responsive means connected to said peripheral wall for contracting said peripheral wall to a smaller diameter at a predetermined drum speed, and spring means urging said peripheral wall to its expanded position and having a force sufficient to prevent contraction of said wall below said predetermined drum speed.

11. In a combination washing machine and extractor, a receptacle comprising a rotatable drum, said drum having a plurality of circumferentially spaced fixed peripheral wall segments and a plurality of movable wall sections each disposed between an adjacent pair of said fixed wall segments, an expansible and contractible perforated rubber cylinder passing around the outer side of said movable wall sections and inwardly of said fixed wall segments, and means for moving said movable wall sections and said cylinder between an expanded larger

diameter position and a contracted smaller diameter position.

12. A machine according to claim 11 wherein said means for moving said wall sections and cylinder includes spring means urging said movable wall sections to said expanded position and means responsive to the speed of rotation of said drum for moving said movable wall sections to said contracted position.

13. In a washing machine, a washing receptacle comprising a rotatable drum, said drum having an expansible and contractible peripheral wall, said peripheral wall having openings therein for the passage of water there-through, and means connected to said wall for moving all portions of said wall between an expanded larger diameter position and a contracted smaller diameter position.

14. A machine according to claim 13 wherein said peripheral wall includes a plurality of movable wall sections and an expansible and contractible perforated cylinder surrounding said wall sections.

15. A machine according to claim 14 wherein said means for moving said wall sections to said expanded position comprises a spring means.

16. A machine according to claim 13 wherein said means for moving said wall to said contracted position comprises a means responsive to the speed of rotation of said drum.

17. In a washing machine, a washing receptacle comprising a drum rotatable on a horizontal axis, said drum having an expansible and contractible peripheral wall, spring means urging said wall to an expanded large diameter position, and speed responsive means connected to said wall and operable in response to the speed of rotation of said drum for contracting said wall to a smaller diameter when said drum is rotated above a predetermined speed.

18. In a washing machine, a washing receptacle comprising a drum rotatable on a horizontal axis, said drum having opposed end walls and a peripheral wall comprising a plurality of circumferentially spaced wall sections movably supported from said end walls, means for guiding said wall sections for movement over said end walls between an expanded larger diameter position and a contracted smaller diameter position, spring means urging said wall sections to said expanded position, and speed responsive means connected to said wall sections for moving the same to said smaller diameter position above a predetermined drum speed.

19. In a washing machine, a washing receptacle comprising a drum rotatable on a horizontal axis, said drum having a peripheral wall comprising a plurality of circumferentially spaced movable wall sections and an expansible and contractible perforated rubber cylinder passing around the outer side of said wall sections, means for guiding said wall sections for movement between an expanded larger diameter position and a contracted smaller diameter position, means connected to said wall sections for moving the same to said smaller diameter position, and spring means urging said wall sections to said expanded position.

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