April 22, 1941. J. E. O'DELL ET AL 2,239,300

PNEUMATIC CUSHION

Filed May 27, 1939 2 Sheets-Sheet 1

Fig. 1.

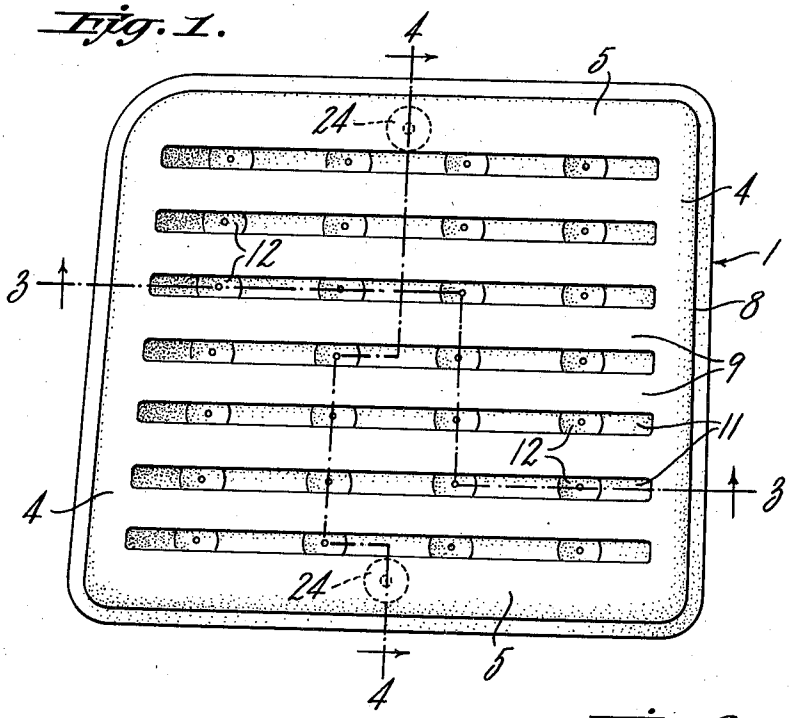
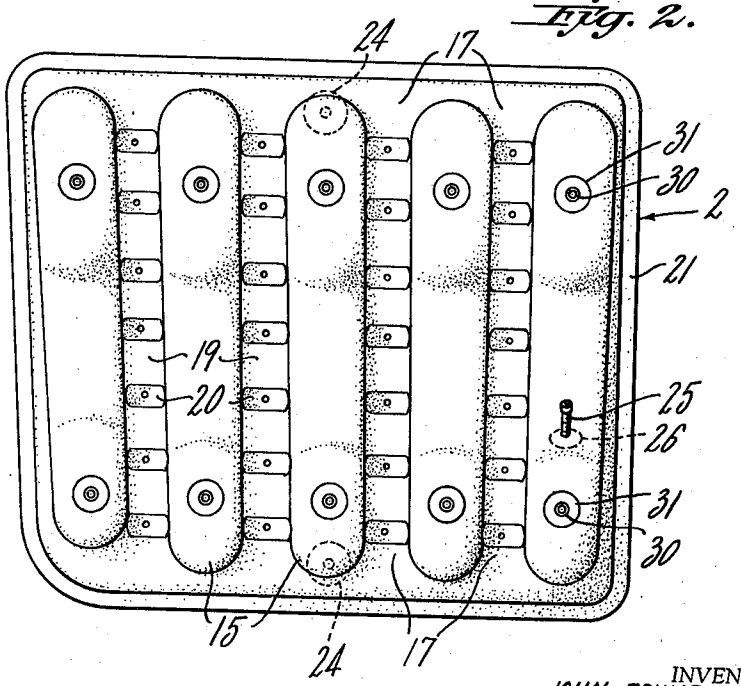


Fig. 2.



INVENTORS
JOHN EDWARD O'DELL
CLAUDE DODDS MASON

BY Gourley & Bradley

ATTORNEYS

April 22, 1941. J. E. O'DELL ET AL 2,239,300

PNEUMATIC CUSHION

Filed May 27, 1939 2 Sheets-Sheet 2

Fig. 3.

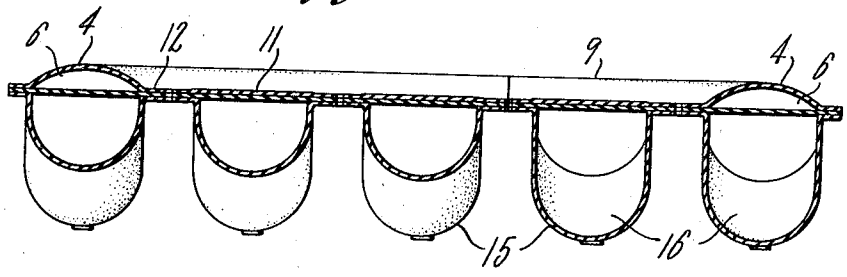


Fig. 4.

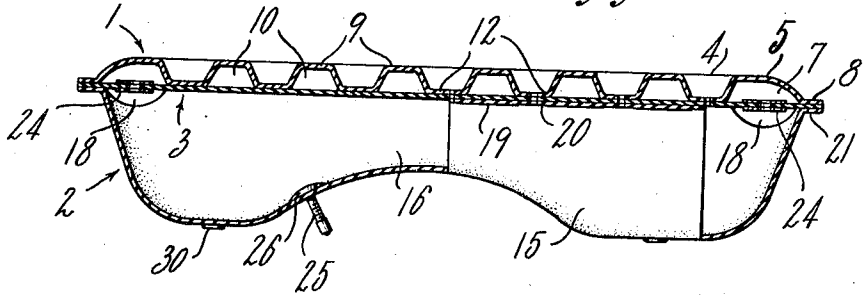


Fig. 5.

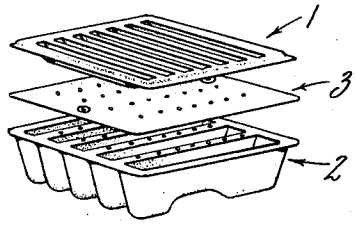
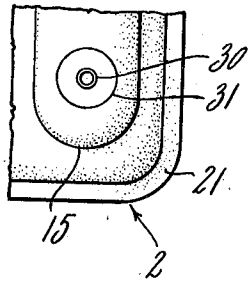


Fig. 6.



INVENTORS
JOHN EDWARD O'DELL
CLAUDE DODDS MASON

BY Townley & Bradley

ATTORNEYS

Patented Apr. 22, 1941 2,239,300

UNITED STATES PATENT OFFICE

2,239,300

PNEUMATIC CUSHION

John Edward O'Dell and Claude Dodds Mason, Mishawaka, Ind., assignors to United States Rubber Company, New York, N. Y., a corporation of New Jersey

Application May 27, 1939, Serial No. 276,034

8 Claims. (Cl. 155—179)

Our invention relates to pneumatic cushions and in particular it relates to inflatable pneumatic cushions for use within seats, mattresses and the like for improving the supporting and yielding qualities thereof.

Heretofore, pneumatic cushions for use in seats, mattresses and the like have been constructed of two walls of rubber composition having their free edges and a plurality of spaced intermediate portions secured together to form an inflatable enclosure. The cushions of such construction, when inflated for use, had a plurality of outwardly projecting and interconnected air chambers formed in each wall of the enclosure which produced a very strong and yieldable cushion.

However, it was found that a cushion of such construction was not entirely satisfactory as it had objectionable "rolling" and "spreading" characteristics when in use. When one part of the cushion was subjected to a vertical pressure, a yielding of that part and a bulging of other parts of the cushion resulted in an unstable condition whereby the cushion had a tendency to roll the supported object from its surface. This cushion of earlier construction also had a tendency to spread laterally when in use with the result that the cushion, and accordingly the seat or mattress in which it was constructed, lost its normal inflated shape and assumed a distorted and irregular shape which was undesirable from appearance and construction standpoints.

Our invention substantially eliminates such difficulties and objectionable features and produces more desirable yielding and supporting qualities by providing an inflatable pneumatic cushion comprising two walls of predetermined shape and an intermediate reenforcing diaphragm secured together to form an enclosure which allows a substantially unrestrained yielding action in a vertical direction but which reduces materially the "rolling" and "spreading" actions experienced in cushions of the former construction. In carrying out our invention, the top and bottom walls are constructed and arranged with a plurality of spaced, elongated and substantially parallel air chambers projecting outwardly from opposite sides of a reenforcing diaphragm and with the air chambers of one wall angularly disposed relative to the air chambers of the other wall. The bottom wall is provided with a plurality of securing means intended for attachment to a supporting surface. The reenforcing diaphragm tends to hold all parts of the cushion attached to the diaphragm from shifting laterally while the securing means upon the bottom of the cushion prevents parts attached to the supporting surface from leaving the supporting surface when an adjacent part of the cushion is depressed; with the result that the diaphragm and securing means of our pneumatic cushion produce a very stable and yet highly resilient or yieldable pneumatic cushion which is substantially free from the "rolling" and "spreading" characteristics previously referred to.

In the drawings:

Fig. 1 is a top plan view of our improved pneumatic cushion;

Fig. 2 is a bottom plan view thereof;

Fig. 3 is a transverse sectional view taken substantially on the section line 3—3 of Fig. 1;

Fig. 4 is a transverse sectional view taken substantially on the section line 4—4 of Fig. 1;

Fig. 5 is a perspective exploded view of the component parts of our pneumatic cushion; and

Fig. 6 is an enlarged fragmentary view of a portion of the bottom wall of our pneumatic cushion.

Referring to the drawings, we show a preferred embodiment of our invention in which the numeral 1 indicates generally a top wall and numeral 2 indicates generally a bottom wall formed of rubber composition or like flexible air-impervious material. Numeral 3 indicates generally a reenforcing diaphragm of rubberized fabric interposed between the top and bottom walls and arranged to extend to all of the free or marginal edges thereof. The walls 1 and 2 and the intermediate diaphragm 3 are secured together, preferably by vulcanization, along their respective free edges and at a plurality of spaced intermediate points to form an inflatable enclosure having a plurality of interconnected air chambers.

The top wall 1 of our pneumatic cushion is shaped so as to comprise a pair of side channels 4 and a pair of transversely extending end channels 5 projecting upwardly from the diaphragm 3 to form interconnected side and end air chambers 6 and 7, respectively, in the wall 1 adjacent the free edges thereof. The outer free edges of the wall 1 are formed as an attaching flange 8 which serves to firmly secure the outer walls of the channels 4 and 5 to the diaphragm 3. A plurality of spaced upwardly projecting cross-channels 9 are arranged to extend transversely of the wall 1 and join the side channels 4 to define air chambers 10 which communicate with the side chambers 6 at the sides of the cushion. Connecting webs 11 are formed by portions of the wall 1 between adjacent cross-channels 9 and extend from side channel to side channel so that spaced

intermediate portions 12 of the webs 11 may be firmly vulcanized or otherwise attached to the reenforcing diaphragm 3.

The bottom wall 2 of our pneumatic cushion is formed so as to comprise a plurality of downwardly projecting spaced and longitudinally extending channels 15, which define air chambers 16 extending substantially the full longitudinal dimension of the cushion, and connect at their opposite ends with end wall portions 17 defining intermediate air chambers 18 interconnecting adjacent longitudinal chambers 16. Connecting web portions 19 are provided in the wall 2 between the channels 15 and are arranged so that portions 20 thereof may be attached firmly to the diaphragm when the walls 1 and 2 are brought together upon opposite sides of the diaphragm 3 to form the completed cushion. The outer edges of the wall 2 are formed as a peripheral flange 21 for attachment with the free edges of the diaphragm 3.

The intermediate reenforcing diaphragm 3 between the top and bottom walls 1 and 2 is provided with apertures 24 to allow air within the pneumatic cushion to flow freely from one side of the diaphragm to the other and thereby equalize the air confined within the cushion. The diaphragm 3 and apertures 24 are formed by cementing layers of rubber composition to each side of a sheet of woven rubberized fabric in which have been formed a plurality of holes. Where each hole occurs the layers adhere firmly together and the apertures 24 are formed in these layers of rubber composition inwardly of the edges of the fabric. In this way the threads of the fabric are completely sealed and no air can escape through the fabric to the outside. While the diaphragm 3 is shown as being constructed of rubberized fabric, it will be apparent to those skilled in the art that other materials having suitable characteristics might be substituted in lieu of rubberized fabric.

The wall 2 is provided with a conventional inflating valve stem 25 having a base 26 of rubber composition firmly secured to said wall so that all parts of the cushion can be conveniently inflated from a single source and at one time. A plurality of snap fasteners 30 having reenforcing webs or bases 31 of rubberized fabric are secured to the spaced air channels 15 of the wall 2 so that the cushion may be easily but firmly secured in place upon a supporting surface when in use. Such snap fasteners may be used at the opposite ends of any or all of these air channels 15 as desired, but in practice we have found it desirable to employ them at both ends of each of said channels.

The walls 1 and 2 are positioned at opposite sides of the reenforcing diaphragm 3 in such a manner that the air chambers 10 and intermediate webs 11 of the top wall are angularly disposed, preferably at 90°, with respect to the air chambers 16 and intermediate webs 19 of the bottom wall, so that portions 12 and 20 thereof may be firmly pressed into engagement with opposite sides of the diaphragm 3 during assembling operations.

In the manufacture of our cushion, we have found it convenient to form the top and bottom walls 1 and 2 by dipping complementary top and bottom molds of preferred shape or shapes into suitable plastic rubber composition and then bringing the complementary faces of the top and bottom molds, so covered with rubber composition, together on opposite sides of an apertured layer of rubberized fabric which is to form the reenforcing diaphragm 3 and then pressing the molds firmly together. At this time steam, compressed air or an inert gas is injected into the inner chambers thus formed within the walls 1 and 2 to hold these walls firmly against the molds while the entire assembly is subjected to a vulcanizing process, such as vulcanizing heat, so that a composite pneumatic cushion structure is formed thereby. The walls 1 and 2 are thus vulcanized to opposite sides of the diaphragm 3 along their peripheral edges and at a plurality of laterally and longitudinally spaced intermediate portions indicated by the numerals 12 and 20 in the top and bottom walls respectively.

In the formation of the bottom wall, we have found it desirable to temporarily secure the snap fasteners 30 and reenforcing webs 31 in the bottom dipping mold before it is submerged into the rubber composition so that plastic rubber composition will adhere to all exposed parts thereof to form the wall 2 and then the valve stem 25 and base 26 are cemented to the inside of the wall 2. When these parts are subsequently subjected to vulcanizing heat, or the like, they are vulcanized together to form a strong and integral structure. In employing this method the possibilities of separation of the valve stem or snap fasteners from portions of the bottom wall 2 during subsequent use of the pneumatic cushion are substantially eliminated.

The reenforcing diaphragm, when secured to the free edges of the top and bottom walls and to a plurality of intermediate spaced portions, prevents the "spreading" and "rolling" conditions experienced in pneumatic cushions of former construction. The diaphragm tends to prevent all horizontal stretching or "spreading" in the cushion and retains the cushion in a predetermined shape at all times. Accordingly, this maintains the shape of the seat or mattress in which it is used in a similar well defined and predetermined shape. When the cushion is secured in place by the snap fasteners 30, these fasteners and the reenforcing diaphragm materially limit the bulging action of the cushion and thereby produce a much more stable and uniformly yieldable cushion than cushions of former constructions. This increased stability in the cushion tends to eliminate the "rolling" and "spreading" action heretofore referred to and thereby allows the use of lesser inflation pressures with the results that more desirable supporting and yielding qualities may be obtained by the inflatable pneumatic cushion of our invention.

While we have described above a preferred form of our pneumatic cushion and method of producing same, it will be readily apparent to those skilled in the art that variations might be made in this cushion or other methods might readily be employed in constructing same without departing from the spirit of our invention or scope of the appended claims.

Having thus described our invention, what we claim and desire to protect by Letters Patent is:

1. A pneumatic cushion comprising upper and lower walls of air impervious material secured together along their respective marginal edges to form an inflatable enclosure, each of said walls having a plurality of spaced, outwardly projecting portions formed therein, a reenforcing diaphragm interposed between said walls and firmly secured to portions thereof intermediate said outwardly projecting portions at a plurality of spaced points, and means for inflating said walls simultaneously.

2. A pneumatic cushion comprising upper and lower shaped walls of rubber composition and an intermediate reenforcing diaphragm of rubberized fabric secured together along their respective marginal edges to form an inflatable enclosure, said walls also being secured to opposite sides of said diaphragm at a plurality of spaced intermediate points and normally extending outwardly at relatively steep angles from their points of attachment with the diaphragm so as to define a plurality of outwardly projecting interconnected air chambers in each of said walls, the height of each individual air chamber being equal to at least one-third of the width thereof and the inherent uninflated shape of said walls being substantially the same as the normal inflated shape thereof, and means for inflating the said chambers simultaneously.

3. A pneumatic cushion comprising upper and lower walls of air impervious material and an intermediate apertured reenforcing diaphragm secured together along their respective marginal edges for forming an inflatable enclosure, each of said walls having a plurality of spaced and outwardly projecting channel portions formed therein, intermediate portions of said walls between said spaced channel portions being firmly secured to opposite sides of said reenforcing diaphragm at a plurality of spaced points, and means for inflating said channel portions simultaneously.

4. A pneumatic cushion comprising upper and lower walls of air impervious material and an intermediate apertured reenforcing diaphragm secured together along their respective marginal edges for forming an inflatable enclosure, said walls each having a plurality of spaced, substantially parallel, outwardly projecting channels formed therein, the channels of one wall being disposed in angular relation to the channels of the other wall, intermediate portions of the upper and lower walls between said spaced channels being firmly secured to opposite sides of said reenforcing diaphragm, and means for inflating said channels simultaneously.

5. A pneumatic cushion comprising upper and lower walls of air impervious material and an intermediate apertured reenforcing diaphragm secured together along their respective marginal edges for forming an inflatable enclosure, said walls each having a plurality of spaced, substantially parallel, outwardly projecting channels formed therein and provided with a plurality of cross channels arranged to interconnect said substantially parallel channels, the substantially parallel channels of one wall being angularly disposed relative to the substantially parallel channels of the other wall, intermediate portions of the upper and lower walls between said spaced substantially parallel channels being firmly secured to opposite sides of said reenforcing diaphragm, and means for inflating all of said channels simultaneously.

6. A pneumatic cushion comprising upper and lower walls of air impervious material and an intermediate apertured reenforcing diaphragm secured together along their respective marginal edges for forming an inflatable enclosure, said walls each having a plurality of spaced, substantially parallel, outwardly projecting and interconnected channels formed therein, the channels of one wall being disposed in angular relation to the channels of the other wall, intermediate portions of the upper and lower walls between said spaced substantially parallel channels being firmly secured to opposite sides of said reenforcing diaphragm, each of said lower channels being provided with securing means for attachment with a supporting surface, and means for inflating all of said channels simultaneously.

7. A pneumatic cushion comprising upper and lower walls of rubber composition and an intermediate apertured reenforcing diaphragm of a rubberized fabric vulcanized together along their respective marginal edges for forming an inflatable enclosure, each of said walls having a plurality of spaced, substantially parallel and outwardly projecting channels formed therein and being provided with a plurality of cross channels interconnecting said substantially parallel channels, the substantially parallel channels of one wall being angularly disposed relative to the substantially parallel channels of the other wall, intermediate portions of the upper and lower walls between said spaced substantially parallel channels being firmly vulcanized to opposite sides of said reenforcing diaphragm, each of the said substantially parallel channels of the lower wall being provided with a plurality of snap fasteners attached thereto for securing the cushion in place upon a supporting surface, and means for inflating all of said channels simultaneously.

8. A pneumatic cushion comprising upper and lower shaped walls of air impervious material and an intermediate reenforcing diaphragm secured together along their respective marginal edges for forming an inflatable structure, said walls each having a plurality of spaced, substantially parallel outwardly projecting channels formed therein, the channels of one wall being disposed in angular relation to the channels of the other wall, intermediate portions of the upper and lower walls between said spaced channels being firmly secured to opposite sides of said reenforcing diaphragm and normally extending outwardly at relatively steep angles from their points of attachment with the diaphragm so as to define between said diaphragm and each channel an outwardly projecting air chamber of substantial height, the normal uninflated shape of said walls and said diaphragm being substantially the same as the inflated shape thereof, and means for inflating said pneumatic cushion.

JOHN EDWARD O'DELL.
CLAUDE DODDS MASON.