March 12, 1940. H. L. WELKER ET AL 2,193,750

AIR CUSHION AND PROCESS FOR MAKING THE SAME

Filed Aug. 18, 1936

Fig. 1.

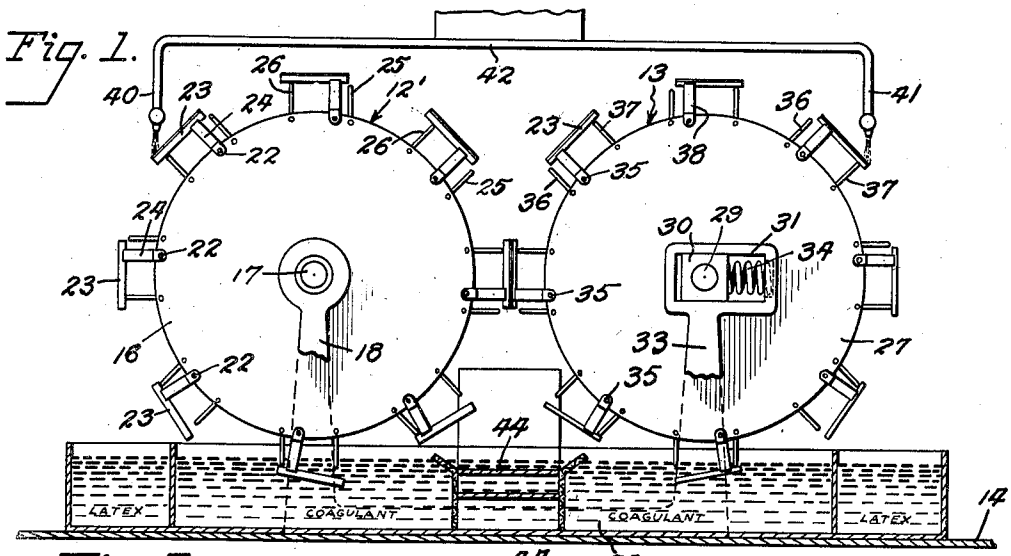


Fig. 2.

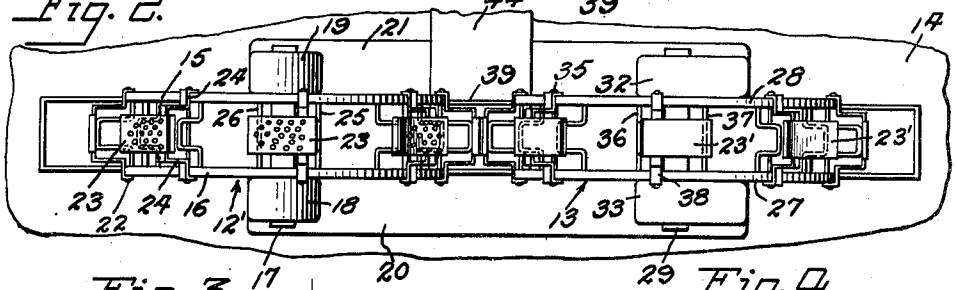


Fig. 3.

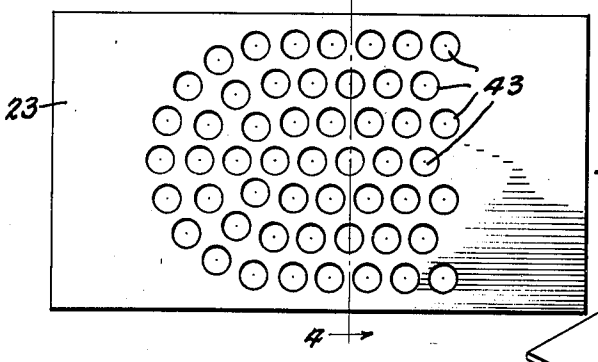


Fig. 4.

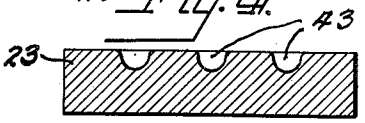


Fig. 7.

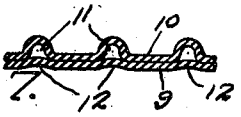


Fig. 5.

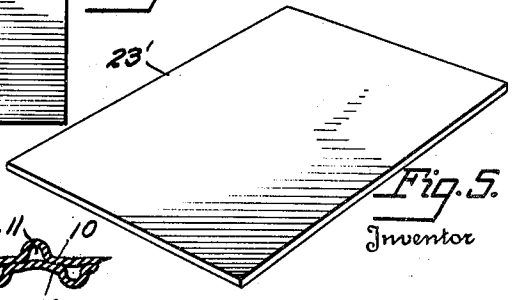


Fig. 6.

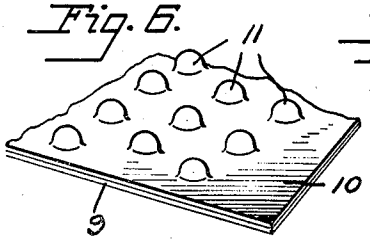
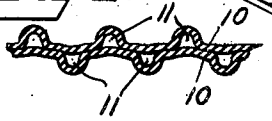


Fig. 8.



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AIR CUSHION AND PROCESS FOR MAKING THE SAME

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6 Claims. (Cl. 18—59)

This invention relates to a new and useful air cushion, and to processes and apparatus for making the same.

In air cushions as heretofore manufactured, a single air cell, or a number of communicating air cells, inflated by pumps, have been employed as the means for giving shape to the cushions as a whole. The effect of this construction is to cause collapse and displacement of the cushions at the parts to which weight may be applied, leaving the other parts of the cushion distorted and under increased pressure. The desired effects of air cushioning in devices of this type are therefore greatly diminished.

The main object of the present invention is to provide an air cushion with a large number of cells, each of which is independent of all the other cells, and in which the air in each cell is trapped under pressure greater than atmospheric pressure.

Another object of the invention is to provide an air cushion having a large number of independent air cells formed in such manner as seal the air permanently therein and to eliminate the necessity for inflation by mechanical devices.

A further object is to provide a process and apparatus for manufacturing air cushions in which each of a plurality of cells contain air under compression, and in which each of the cells is independent of all of the other cells.

A further object of the invention is to provide a process and apparatus by which cushions of the character referred to can be very cheaply and rapidly manufactured.

Other objects of the invention will become apparent as the detailed description thereof proceeds.

In the drawing:

Figure 1 is a side elevation of an apparatus adapted to carry out the process of manufacturing air cushions of the type referred to, parts thereof being broken away, and other parts shown in section, to illustrate details of construction;

Figure 2 is a top plan view of the apparatus shown in Figure 1;

Figure 3 is a plan view of a mold designed for use in forming one of the elements of the air cushions referred to;

Figure 4 is a section taken on the line 4—4 of Figure 3;

Figure 5 is a perspective view of one of two plates adapted for use in the process of manufacturing one form of the air cushion;

Figure 6 is a broken perspective view of an air cushion manufactured by use of the plates shown in Figures 3, 4, and 5;

Figure 7 is a cross-section through the cushion shown in Figure 6; and

Figure 8 is a cross-section through another form of the air cushion as manufactured by the use of a pair of plates similar to the plate shown in Figures 3 and 4.

In the form of the invention shown in Figures 6 and 7 of the drawing, the cushion comprises a sheet 9 of rubber having one face thereof suitably cemented or secured to the rear face of a sheet 10 of rubber, in which air cells 11 have been formed. Preferably, the sheets 9 and 10 are made from rubber latex and the sheet 9 is secured to the sheet 10 to seal the air in the cells 11 while the two sheets are somewhat tacky and capable of being secured to each other by mere pressure.

It has been found in manufacturing a cushion of this type from rubber latex, that this latex during vulcanization shrinks considerably and places the air in each cell under pressure. This shrinkage and compression is evident from the fact that in the finished article the plain sheet 9 after being secured to the sheet 10 and in finished form exhibits a series of depressions 12 opposite each of the cells 11.

The form of the article shown in Figures 6 and 7 is the simplest form. However, the cushioning effect may be greatly enhanced by securing two sheets 10 back to back, but with the air cells 11 of the two sheets staggered, as shown in Figure 8 of the drawing. In this form, the cushioning effect is doubled without adding materially to the expense of manufacturing. For some uses, such as might be involved in the manufacture of fillers between the inner and outer soles of shoes, the form of the invention shown in Figures 6 and 7 might be preferred. For deep cushions requiring a number of layers of the air cell structures, the form of the invention shown in Figure 8 would be preferable for layers between two outer layers of the type shown in Figures 6 and 7.

While the process of manufacturing these air cushions might be carried out by hand, it is preferable to use an apparatus in which the process can be carried out rapidly and cheaply. This is especially desirable since the process involves the use of coagulant which would be injurious to the hands of an operator; and also because the process requires that the two molds involved in the process shall be dipped in rubber latex as soon as possible after being coated with coagulant, and that the latex coatings of these molds shall be

caused to adhere to each other within a very short period of time after their formation. A suitable apparatus for this purpose is shown in Figures 1 and 2 of the drawing.

The apparatus referred to comprises a pair of rotatable members 12' and 13 mounted to rotate in opposite directions in bearings formed on standards supported by a floor or base 14. The member 12' comprises a pair of discs 15 and 16 suitably secured to a shaft 17, journaled in bearings formed in the upper ends of standards 18 and 19 supported by base plates 20 and 21, which rest on the floor 14. A series of pivot rods 22 extend across the space between the discs 15 and 16. These rods are equiangularly spaced around the discs and each serves to support a mold 23, such as is shown in Figure 3 of the drawing, by means of the U-shaped pivot bracket 24, suitably secured to the rear face of the mold. Stops 25 and 26 on opposite sides of the pivot rods 22 extend between the discs 15 and 16 to limit the swinging movements of the molds.

The member 13 comprises the discs 27 and 28 suitably secured to a shaft 29 rotatably mounted on a journal box 30 which slides in slots 31 formed in the upper ends of standards 32 and 33, which extend upwardly from the base plates 20 and 21. The journal box 30 is yieldingly pressed in its supporting slots 31 toward the shaft 17 of the member 12', by means of the compression springs 34 suitably secured in the slotted upper ends of the standards 32 and 33.

The discs 27 and 28 have a series of pivot rods 35 extending between them, and equiangularly spaced around their common axis. A pair of stops 36 and 37 are also secured on opposite sides of each rod 35 between the discs 27 and 28 to limit the movements of mold plates 23', pivoted to the pivot rods 35 by means of the U-shaped brackets 38.

The two members 12' and 13 are designed to limit the swinging movement of the molds on these members are so arranged as to come in exact registration with each other when they pass through a line joining the axes parallel of the shafts 17 and 29. The sliding movement of the shaft 29 is provided to permit the necessary yielding movement between the members 12 and 13 when the molds on each of the members come in contact with each other. The stops which limit the swinging movement of the mold on each of the members 12' and 13 are designed to position the molds properly to receive their latex coatings and to cause the separation of the adhering coatings from the molds after the elements thereof have been caused to contact with and adhere to each other.

The discs of the members 12' and 13 are arranged to rotate past the outer sides of a tank 39 containing a coagulant for rubber latex, and the pivot rods 22 and 35 are arranged so that the molds 23 and 23' supported thereby shall dip into the coagulant during each rotation of the members 12 and 13. Upon emergence from the coagulant tank 39, the molds 23 and 23' are coated with rubber latex discharged through nozzles 40 and 41 located in such position as to cause the latex to flow along the surfaces of the molds 23 and 23'. These nozzles 40 and 41 extend from a manifold 42 which is connected to any suitable source of supply of rubber latex. It is also essential that the nozzles 40 be arranged so as to apply the latex to the mold 23 in such position that the latex shall coat but not fill up the recesses 43 in the molds 23.

As the members 12' and 13 rotate to apply coagulant to the molds and then to apply latex to the coagulant coated molds, the molds eventually reach the position in which the coatings of latex contact and are pressed together by the action of the springs 34 against the journal boxes 30 for the shaft 29. This contact position is shown in Figure 1 of the drawing and evidently occurs when the molds pass through a line joining the shafts 17 and 29. Continuing rotation of the members 12' and 13 causes the molds 23 and 23' to separate as they move below the line joining the shaft 17 and 29, and this separation of the molds causes the adhering latex coatings to drop onto an endless conveyor 44, arranged in the coagulant tank. The conveyor 44 is mounted to move at such distance below the level of coagulant as to ensure a final coating of coagulant to the latex cushions dropped into the tank. After this final coating of coagulant, the rubber cushions are removed by the conveyor belt, to be suitably vulcanized or otherwise cured.

The process of manufacturing the form of cushion illustrated in Figure 8 is identical with that described. In this case, however, two molds 23 are used instead of one mold 23 and a plain mold 23'. The two molds referred to must be staggered on the members 12 and 13 in order to provide a staggered arrangement in both directions of their air cells.

The latex, or rubber, of the air cells in these cushions serves as a spring. In the usual type of air cushion, the air is trapped in a material that is practically unstretchable, and the cushion takes the shape of the object resting upon it, and the outside dimensions of the cushion are not materially affected. In the air cells of the present invention, the outside dimensions are actually increased, and the spring action results from the resilience of the latex itself and the sharp shrinkage of the cohering sheets of latex due to immersion in the coagulant and subsequent curing or vulcanization, and this resilience depends, of course, on the thickness of the latex and the size of the cell.

What we claim is:

1. An air cushion comprising two sheets of resilient material having air retaining recesses formed therein, said sheets being secured to each other to form a compound sheet having air retaining cells extending in staggered relation from opposite sides thereof.

2. An air cushion comprising a pair of similar sheets of rubber having air retaining recesses formed in one face of each sheet, said sheets being secured to each other with their recesses in staggered relation to prevent escape of air from the recesses.

3. An air cushion comprising a pair of sheets of rubber, each of said sheets having air retaining cells formed thereon, the wall of each of said cells being of substantially the same thickness as said sheet and projecting from one side thereof, said sheets being secured to each other with their recesses in staggered relation to form a compound sheet having the cells extending in opposite directions and containing air under pressure greater than atmospheric pressure.

4. A process of manufacturing a rubber air cushion which comprises providing a pair of sheets of unvulcanized rubber latex with air retaining cells projecting from one side of each sheet, at least the side opposite the projections being tacky, applying the same tacky sides of said sheets to each other with their respective cells

in staggered relation to each other and then vulcanizing the composite sheet to cause shrinkage thereof and compression of the air in said cells.

5. The process of manufacturing a rubber air cushion comprising forming a sheet of unvulcanized rubber latex with an air retaining cell projecting from one side of said sheet, to form a projecting side and a recess side, the projecting cell being of substantially the same thickness as the sheet from which it projects, at least the recess side of the sheet being tacky, and applying a second sheet of unvulcanized tacky rubber latex to the recess side to seal the air in said cell and then vulcanizing the composite sheet to cause shrinkage thereof and compression of the air in said cells.

6. A process of manufacturing a rubber air cushion which consists in forming a pair of sheets of unvulcanized rubber latex with air retaining recesses projecting from one side of each sheet and with at least the opposite recessed side being tacky, applying the tacky recessed sides of said sheets to each other to seal air in the cells and then vulcanizing the composite sheet thus formed to amalgamate the sheets and shrink the cells to compress the air therein.

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