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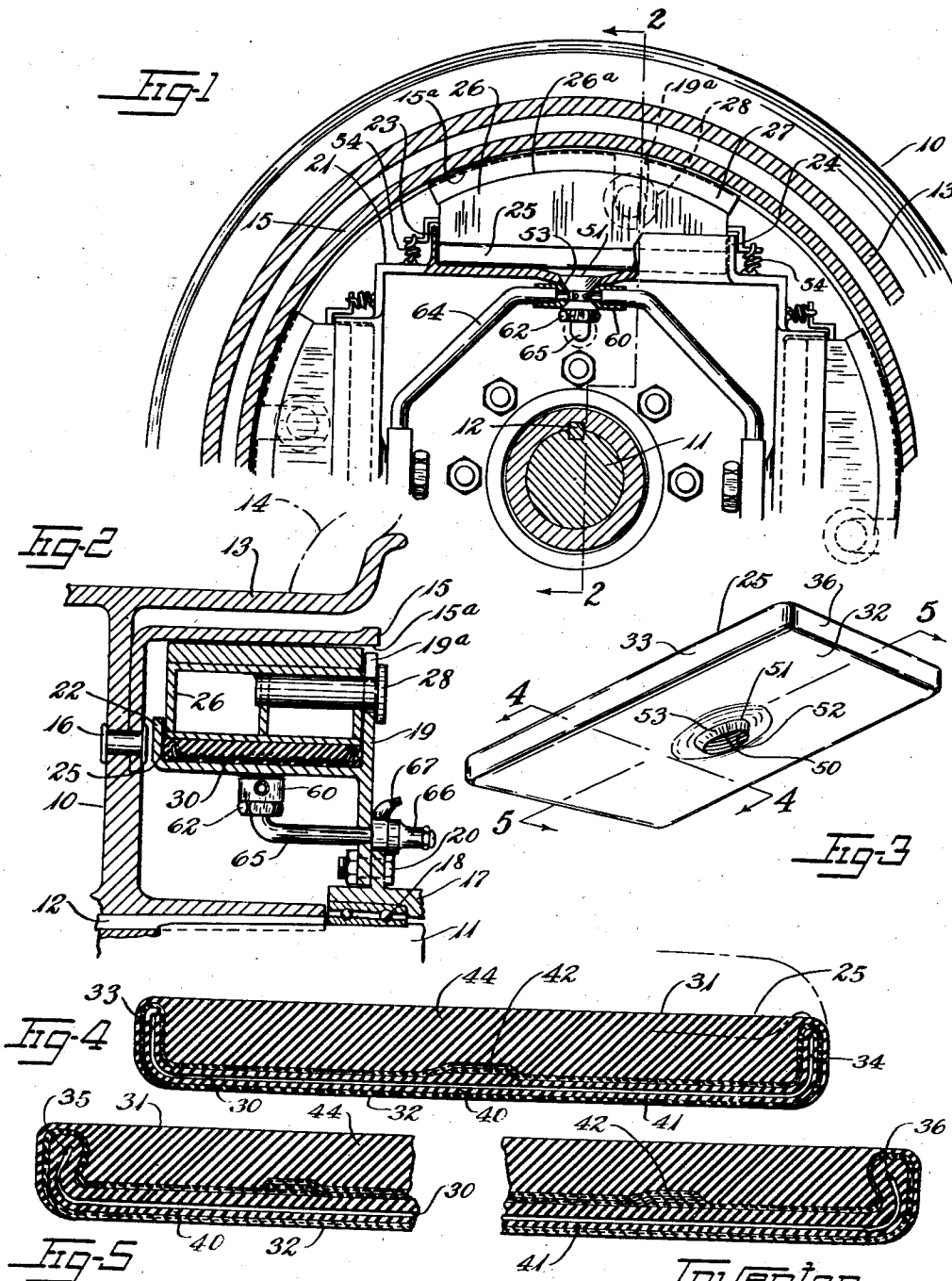
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2,431,937

EXPANDER

Filed Sept. 11, 1943

2 Sheets-Sheet 1



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Fig-6

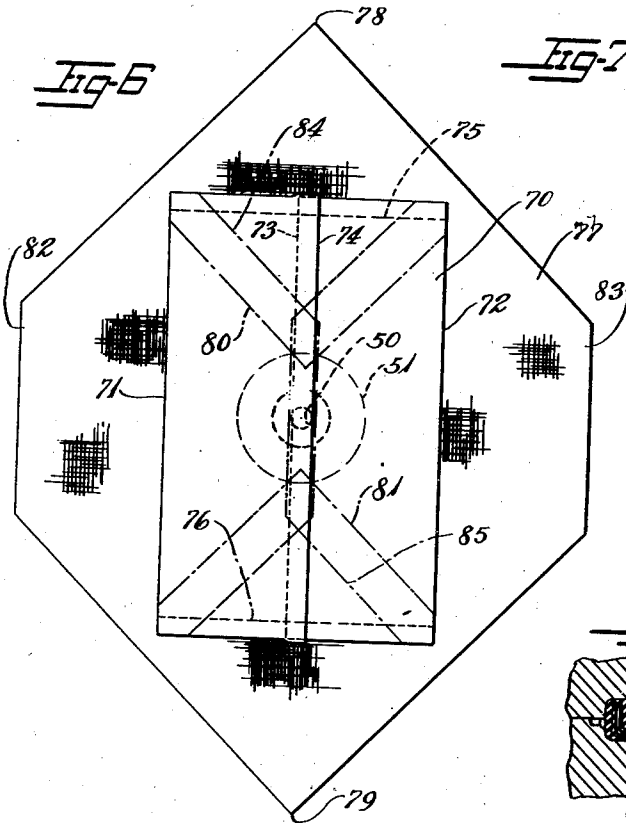


Fig-7

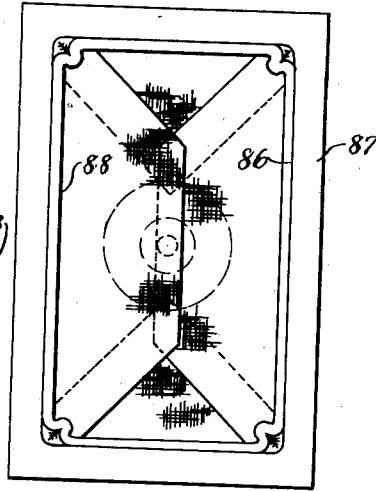


Fig-8

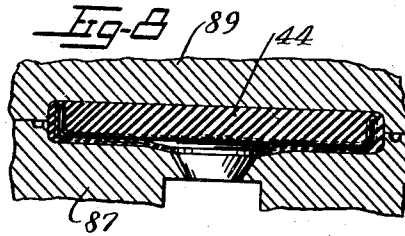


Fig-9

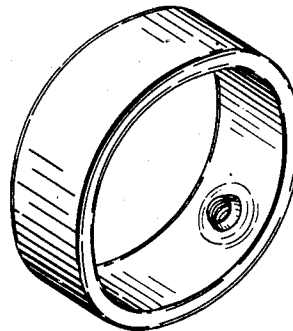
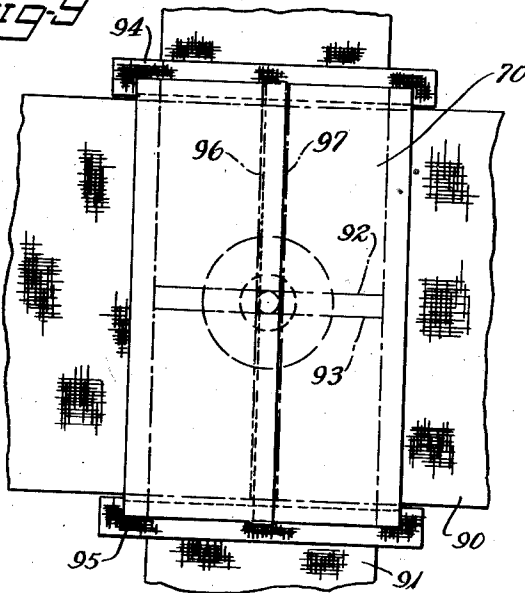


Fig-10

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EXPANDER

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8 Claims. (Cl. 137—156)

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This invention relates to inflatable expanders for providing pressure to movable parts and is especially useful in brakes, clutches, and the like.

The principal objects of the invention are to provide to a high degree uniform pressure over the face of the expander; to provide effective reinforcement of the expander while permitting a high degree of movement under inflation; to provide protection of the inflatable member from heat; to provide a structure in which the fluid cavity is located remote from the pressure-applying face of the expander and has radial extensions at its sides extending well toward said face of the expander; to provide an expander having a fluid cavity of pronounced U-shape in cross section; to provide for obtaining reliable operation under heavy service, and to provide for facility of manufacture and assembly.

These and other objects will appear from the following description and the accompanying drawings.

Of the drawings,

Fig. 1 is a side elevation, partly in section, showing a vehicle wheel brake embodying expanders constructed in accordance with and embodying the invention, a portion only of the brake being shown.

Fig. 2 is a cross-section thereof taken on line 2—2 of Fig. 1, a portion of the tire being shown by dot and dash lines.

Fig. 3 is a perspective view of the expander.

Fig. 4 is a cross-sectional view thereof taken on line 4—4 of Fig. 3.

Fig. 5 is a cross-sectional view thereof taken on line 5—5 of Fig. 3.

Fig. 6 is a plan view of a partly constructed expander illustrating a step in the method of manufacture.

Fig. 7 is a base view of a form with a partly constructed expander therein illustrating another step in the method of manufacture.

Fig. 8 is a cross-sectional view of a mold with the finished expander therein, parts being broken away.

Fig. 9 is a plan view showing a modified method of manufacture, parts being broken away.

Fig. 10 is a perspective view of an annular expander constructed in accordance with and embodying the invention.

In accordance with the invention the expander is provided with a relatively thick operating wall and relatively thin reactive walls separated by a shallow cavity extending generally parallel to the walls and continuing radially at its margins toward the working face of the operating wall. The

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cavity is entirely sealed by a flexible resilient impervious layer which in turn is reinforced by a textile material which is looped radially at the margins to enclose the radial extensions of the cavity, and the space between the looped extensions is filled by resilient heat-resisting material to provide a working face of the desired form, the construction being such that the cavity throughout its extent parallel to the working face is disposed remote therefrom, preferably within the fourth of the entire thickness of the expander nearest the side remote from such face, and the radial extensions of the cavity extend into the fourth of such thickness nearest the working face. In one of the illustrated forms of the invention, the expander is provided in the form of a rectangular pad and in another illustrated form of the invention in the form of an annular tube.

Referring to the drawings and first to Fig. 1 which illustrates a brake structure embodying a plurality of pad expanders, the numeral 10 designates a wheel which is secured to an axle shaft 11, as by a key 12. The wheel has a rim 13 for receiving a tire 14 and also carries the brake drum 15 secured thereto as by rivets 16. The brake drum has a braking face 15a of cylindrical form extending parallel to the axis of the axle shaft.

The axle shaft extends rotatably through a stationary axle 17 from which it is supported as by ball bearings 18. The stationary axle 17 has a brake disc 19 secured thereto as by bolts 20. The brake disc is provided with a polygonal brake support 21 the outer polygon faces of which each have radially extending sidewalls 22 and end walls 23, 24 defining with the brake disc outwardly facing rectangular cavities for seating the expanders 25, and for guiding brake shoes 26 seated on the expanders and adapted to be moved radially of the axle by expansion of the expanders. Brake shoes 26 each have an outwardly arcuate face 26a to which is secured a brake lining 27. The brake shoes 26 are additionally guided in their radial movement by guide pins 28 secured to the shoes and fitting in radial slots 19a formed in the brake disc. Automatic return of the brake shoes is effected by coil springs 54 mounted with one end fixed to the support and the other end fixed to the brake shoe.

Each expander 25 is formed of rubber or other rubber-like resilient material and is of rectangular shape having a fluid cavity 30 extending parallel to its working face 31 and its back face 32, the cavity 30 has upturned marginal extensions 33, 34, 35, 36 extending toward the working face

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at the side margins of the expander. Preferably the main cavity 30 is located relatively near the back face of the expander and preferably within the lower one-fourth of the total thickness of the expander as viewed in Figs. 4 and 5, while its radial extensions extend well toward the working face 31 and preferably within the upper one-fourth of the total thickness of the expander. The cavity and its radial extensions are sealed by a thin layer 40 of pliable, extensible, impervious rubber-like material, preferably of a material having high resistance to oil or other expanding liquid. For reinforcing the impervious layer about the cavity, at least one layer of square woven rubberized fabric or other suitable textile material 41 is arranged to extend parallel to the impervious layer completely surrounding the same. The reinforcing fabric 41 extends along the back face of the expander and then upwardly at the margins of the expander where it is reversed in direction about the upwardly directed extensions of the cavity and then downwardly therealong and parallel to the working face with its margins spliced as at 42 to each other, preferably along the center of the expander. This provides a telescoped construction at the margins of the expander which permits great radial deformation thereof. Within the cavity at the face of the expander formed by the upwardly directed extensions of the impervious layer and fabric, a filling 44 of resilient rubber or other rubber-like material is provided and extends to the working face of the expander. The arrangement is such that upon inflation the thick operating wall provided by the filler 44 and impervious layer and reinforcing fabric above the fluid cavity is moved outwardly by inflation of the expander by a substantially equal amount from its center outwardly to a position close to its margins. The impervious layer and the fabric reinforcement thereof effecting a relative rolling movement of their outwardly looped portions at the margins of the expander about the outwardly directed extensions of the cavity, and the resilient nature of the filler 44 permitting such rolling movement by lateral tensioning of the filler which assists in keeping the working face flat. The expanded condition is indicated for example in broken lines in Fig. 4.

For inflating the expander an aperture 50 is provided through its back wall and communicating with the cavity 30, preferably at the center of the backing wall and this aperture is provided with means for connecting the expander to a source of fluid pressure. For this purpose, a metal fitting 51 internally threaded as at 52 and having a conical sealing face 53 on its outer surface is imbedded in the rubber-like material and bonded thereto as by a bond resulting from vulcanization to provide a fluid-tight connection. The connector fittings 51 of the expanders may be connected to each other as shown in Fig. 1 so as to operate in unison. For this purpose metallic coupler fittings 60 are provided to seat against the conical faces 53 of the connector fittings and tapered union bolts 62, adapted to engage the threads of the expander fitting and seal the coupling fittings 60 thereto are provided to clamp the coupler to the fitting. Pipes 64 connect the coupler fittings 60 to each other and a pipe 65 at one of the fittings extends to a bleeder valve 66 which has a pipe connection 67 for connecting the system to a source of pressure fluid, such as the brake operating cylinder (not shown) ordinarily provided on the vehicle. The arrangement is

such that all of the expanders of the brake may be supplied with fluid from a single source.

A convenient method of constructing the expander shown in Fig. 3 is illustrated in Figs. 6 to 8 and is as follows: A rectangular sheet 70 of unvulcanized rubber-like material suitable for providing the impervious layer 40 is folded along parallel lines 71, 72 to form an envelope-like structure with its margins 73, 74 in overlapping relation at the center of one face of the envelope. These margins are cemented and seamed and the ends of the tubular structure thus provided are turned under as at 75, 76 to close the ends of the envelope-like structure and are cemented and seamed together. The face of the envelope-like structure opposite the medial seam is apertured to receive the connector fitting 50 which has been previously vulcanized to a disc 51 which is cemented to the face of the envelope about the aperture. The envelope so formed is then placed upon a hexagonal sheet 77 of rubberized square woven fabric. The sheet of fabric is arranged with its warp threads extending in the direction of opposite points 78, 79 of the fabric sheet and its filler threads at right angles thereto. An aperture is cut in the center of the fabric to clear the connector fitting 50 and the back of the rubber envelope is cemented to the face of the fabric in the position shown in Fig. 6. Thereafter, the extending tabs of fabric at the points 78, 79 are cemented and folded over the face of the envelope of rubber-like material assuming the positions indicated by the dash and dot lines 80, 81. After these are pasted in place, the tabs 82, 83 are folded along the edges 71, 72 of the envelope and are cemented in overlapping relation over the envelope and over the first tabs applied thereto as indicated by the dot and dash lines 84, 85. The rubberized fabric reinforcement now completely encloses the rubber envelope and the partly formed article is constructed of greater length and width than the desired expander.

The partly constructed article so formed is then forced into the cavity 86 of a form or mold 87, the margins of the article which normally overlap the mold beyond the cavity being turned up vertically toward the mouth of the mold cavity as indicated at 88 by equal amounts around each edge of the cavity. The filling 44 of resilient rubber-like material is then placed in the cavity over the fabric enclosed rubber layer and between the upwardly turned margins thereof and is molded in place by the application of heat and pressure between mold members 87 and 89 as indicated in Fig. 8. During vulcanization the connector fitting is securely bonded to the rubber material and the layer of rubber-like material, and the fabric reinforcement and the rubber filling are properly vulcanized and bonded to each other to provide an integral unit.

In the modified construction illustrated in Fig. 9 the envelope-like structure 71 is identical with that shown in Fig. 6. The fabric reinforcing material is applied, however, in the form of rectangular strips 90, 91 each substantially equal in width to the length and width respectively of the rubber envelope. The strip 90 is pasted over the back face of the envelope and its ends are then folded over the working face thereof overlapping at the dot and dash lines 92, 93. Additional reinforcing strips 94, 95 of rubberized fabric may be applied about the short edges of the rubber envelope to reinforce the seamed edges thereof. The strip 90 is then pasted over the article on the back face thereof at right angles to the

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strip 91, and its ends are pasted over the working face overlapping each other as indicated at dot and dash lines 96, 97 thereby completely enclosing the rubber envelope in the fabric reinforcing material. Thereafter, the procedure of manufacture of the expander is the same as that described in the method illustrated in Figs. 6 and 7, the reinforced rubber envelope being forced into a forming cavity of the mold to fold its margins upwardly and the rubber filling being placed within the cavity formed by the upwardly directed margins.

In the annular form of expander shown in Fig. 10 the expander is in the form of a tube having a continuous inflation cavity, the cross section of the tube being similar to the cross section shown in Fig. 4 with the operating face at the outer face of the tube and backing face at the inner face of the tube the fluid cavity being parallel to these faces substantially throughout their width and being well toward the inner circumference to provide a relatively thick operating wall and a relatively thin back wall, as described with reference to the first embodiment, the cylindrical portion of the fluid cavity being preferably within the inner fourth of the radial depth of the tube nearest its back face and having radial continuations of the cavity at the side margins of the tube extending radially toward its working face and preferably into the outer one-fourth of the thickness of the tube.

The expander has decided advantages over other forms of expanders in that due to the telescoped marginal walls of the impervious layer and its reinforcing fabric, radial extension at the margins of the expander is made possible and the working face may be projected during inflation by substantially equal amounts across its face and through an extensive range.

These and other variations may be made without departing from the scope of the invention as it is defined by the following claims.

I claim:

1. A fluid-operated expander comprising a resilient impervious envelope defining a shallow inflation cavity having substantially parallel operating and back walls, said walls having their inner faces located in that quarter of the thickness of the expander nearest its back face, said walls extending in a direction away from said back face at margins of the expander to provide reversed portions of the envelope defining marginal continuations of said cavity extending toward the operating face of the expander and into the quarter of the thickness of the expander nearest its operating face, a filling of rubber-like material between the reversed portions of the envelope providing an operating face and a flexible reinforcement about said envelope.

2. A fluid-operated expander of rectangular shape comprising a resilient impervious envelope defining a shallow inflation cavity having substantially parallel operating and back walls, said walls having their inner faces located in that quarter of the thickness of the expander nearest its back face, said walls extending in a direction away from said back face at margins of the expander to provide reversed portions of the envelope defining marginal continuations of said cavity extending toward the operating face of the expander and into that quarter of the thickness of the expander nearest its operating face and extending around the entire periphery of the expander, a filling of rubber-like material between the reversed portions of the envelope

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providing an operating face, and a flexible reinforcement about said cavity and between said envelope and said filling.

3. A fluid-operated expander comprising a resilient impervious envelope defining a shallow inflation cavity having substantially parallel operating and back walls, said walls having their inner faces located in that quarter of the thickness of the expander nearest its back face, said walls extending in a direction away from said back face at margins of the expander to provide reversed portions of the envelope marginal continuations of said cavity extending toward the operating face of the expander and into that quarter of the thickness of the expander nearest its operating face, a reinforcing layer of fabric extending about the outer faces of the envelope and conforming to said cavity, and a filling of rubber-like material between the reversed portions of the fabric reinforced envelope providing an operating face.

4. A fluid-operated expander bag of rectangular shape comprising a resilient impervious envelope defining a shallow inflation cavity having substantially parallel operating and back walls, said walls having their inner faces located in that quarter of the thickness of the expander nearest its back face, said walls extending in a direction away from said back face at margins of the expander bag to provide reversed portions of the envelope defining marginal continuations of said cavity extending toward the operating face of the expander bag and into that quarter of the thickness of the expander bag nearest its operating face and extending around the entire periphery of the expander bag, a reinforcing layer of fabric extending about the outer faces of the envelope and conforming to said cavity, and a filling of rubber-like material between the reversed portions of the fabric reinforced envelope providing an operating face.

5. A fluid-operated expander comprising a body of rubber-like material having in a cross-section thereof a U-shaped inflation cavity having a base portion and substantially parallel limb portions extending therefrom in the same direction with a portion of the body therebetween, and a layer of reinforcing fabric closely surrounding the exterior walls of said cavity and conforming to said U-shaped cavity in said cross section including inner and outer faces of said limb portions thereof.

6. A fluid-operated expander comprising a resilient impervious layer defining a closed inflation cavity, and a fabric reinforcement completely surrounding the layer and substantially parallel thereto, said impervious layer and said reinforcement being angularly folded and reversed on themselves at margins of the expander opposite each other and about the entire periphery of the expander to provide in a cross-section of the expander substantially parallel folds thereof defining between said folds an outwardly open recess at one face of the expander, and a filling of resilient rubber-like material in said recess providing a working face.

7. A fluid-operated expander of polygonal shape comprising a resilient impervious envelope defining a shallow inflation cavity, and a fabric reinforcement on the outer face of said envelope completely surrounding the envelope, said envelope and said reinforcement being angularly folded and reversed on themselves at margins of the expander opposite each other and about the entire periphery of the expander to provide

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in a cross section of the expander substantially parallel folds thereof defining between said folds an outwardly open recess at one face of the expander, and a filling of resilient rubber-like material in said recess providing a working face.

8. A fluid-operated expander comprising a resilient impervious envelope defining a shallow inflation cavity having substantially parallel operating and back walls and parallel margins opposite each other, a flexible reinforcement about said envelope and closely conforming thereto, the opposite margins of said envelope and said reinforcement being folded away from said back wall to provide substantially parallel marginal folds defining an outwardly open recess there-

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between, and a filling of resilient rubber-like material in said recess providing a working face.
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