United States Patent

[11] **3,599,760**

[72] Inventor **Jack W. Moss**
Wichita Falls, Tex.

[21] Appl. No. **789,475**
[22] Filed **Jan. 7, 1969**
[45] Patented **Aug. 17, 1971**
[73] Assignee **Wichita Clutch Company, Inc.**
Wichita Falls, Tex.

[54] **SPRING SET FLUID RELEASE BRAKE**
2 Claims, 9 Drawing Figs.

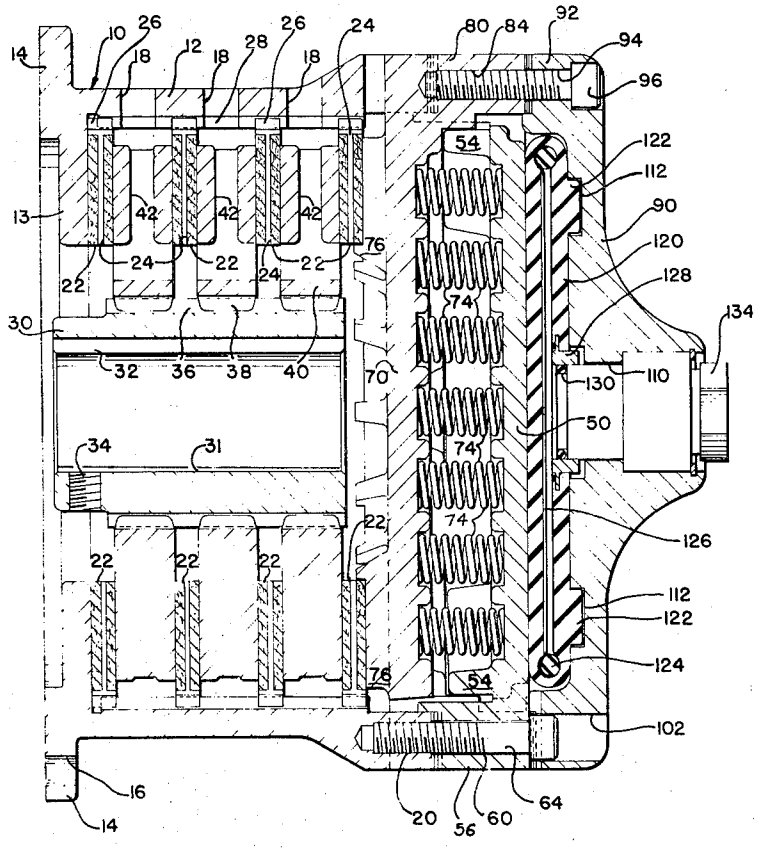
[52] **U.S. Cl.** **188/170,** 188/72.3
[51] **Int. Cl.** **F16d 65/24,** F16d 55/22
[50] **Field of Search** ..... 188/72.3, 170, 152.86 A

[56] **References Cited**
UNITED STATES PATENTS

2,584,191	2/1952	Danly et al.	188/170
2,698,676	1/1955	Eason	188/170
2,417,855	3/1947	Barish	188/152 (.86 A) X
2,541,707	2/1951	Lyman	188/152 (.86)

Primary Examiner—Duane A. Reger
Attorneys—Wayland D. Keith and Roy W. Butrum

ABSTRACT: A body means is fixed against rotation and has a plurality of friction plates operatively connected therewith to cooperate with friction plates secured to a rotatable member. A backplate means is secured to the body means. A pressure plate means is secured to a holding plate means, the pressure plate means and holding plate means being axially movable. A plurality of springs is positioned between the backplate means and the pressure plate means for moving the pressure plate means toward brake set position. An axially expansible pancake-type airtube is positioned between the backplate means and the holding plate means for moving the pressure plate means and the holding plate means in a brake release direction against the force of the springs.

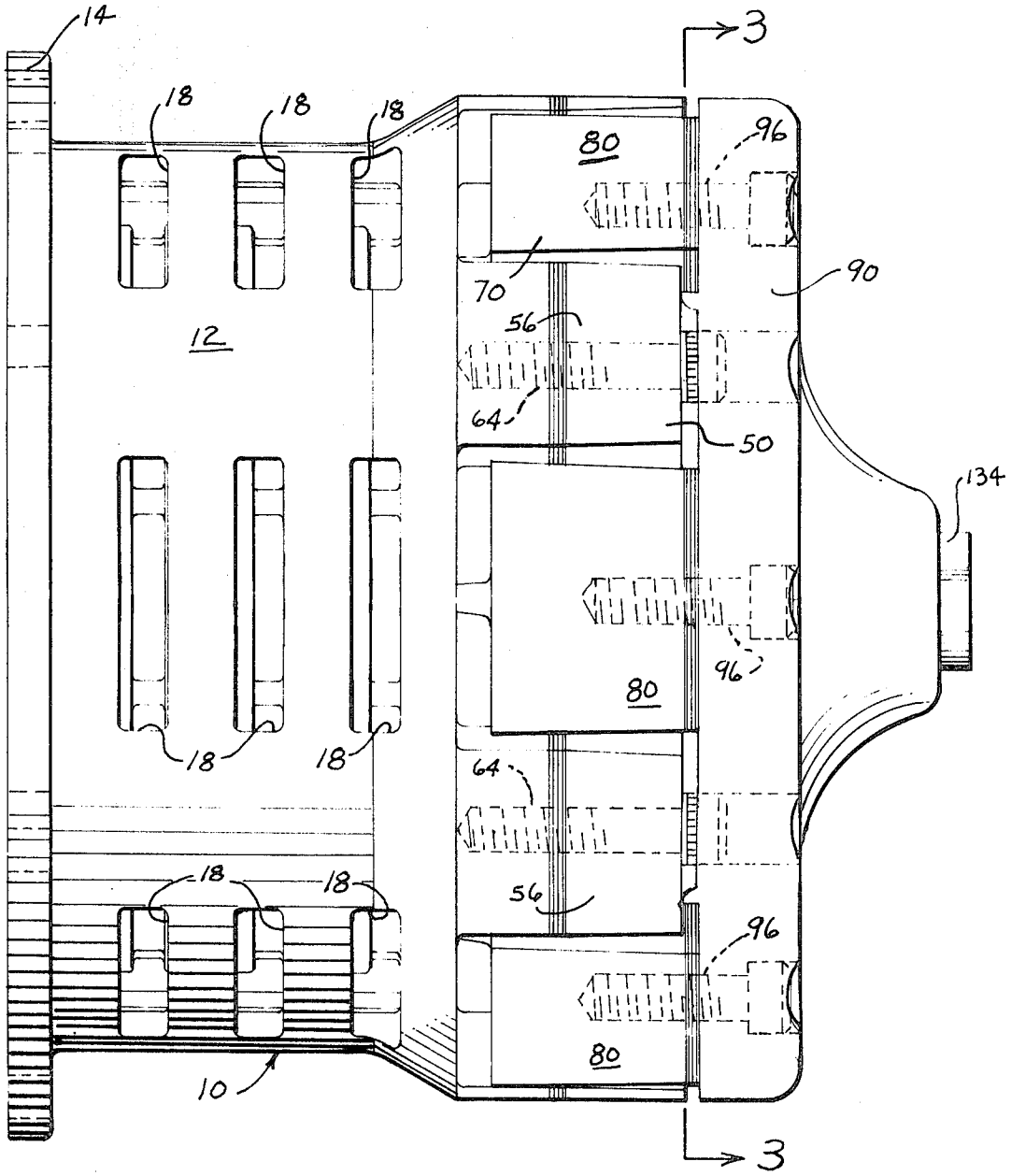


PATENTED AUG 17 1971

3,599,760

SHEET 1 OF 4

FIG. 1



JACK W. MOSS
INVENTOR.

BY
Wayland D. Keith
HIS AGENT

FIG. 2

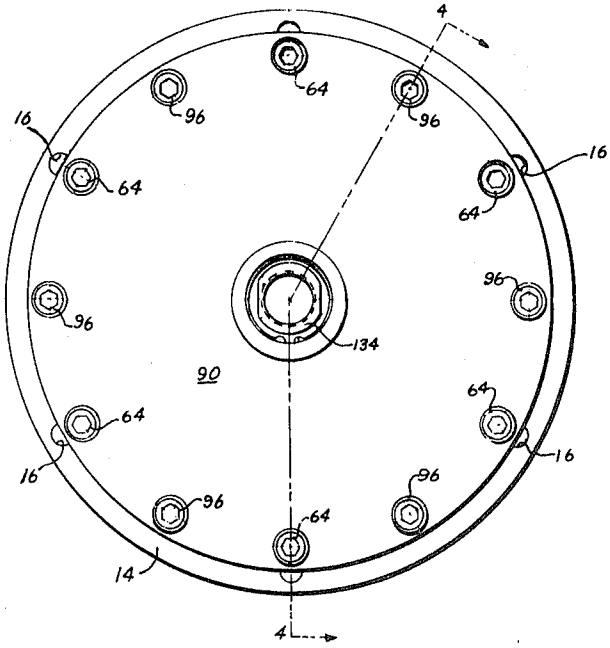


FIG. 3

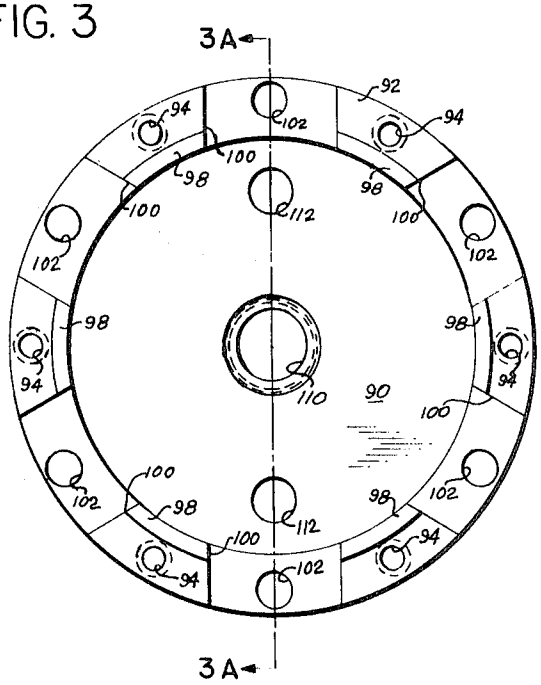
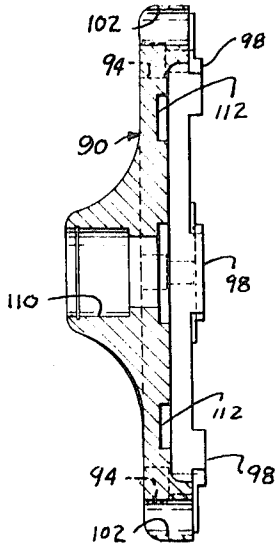


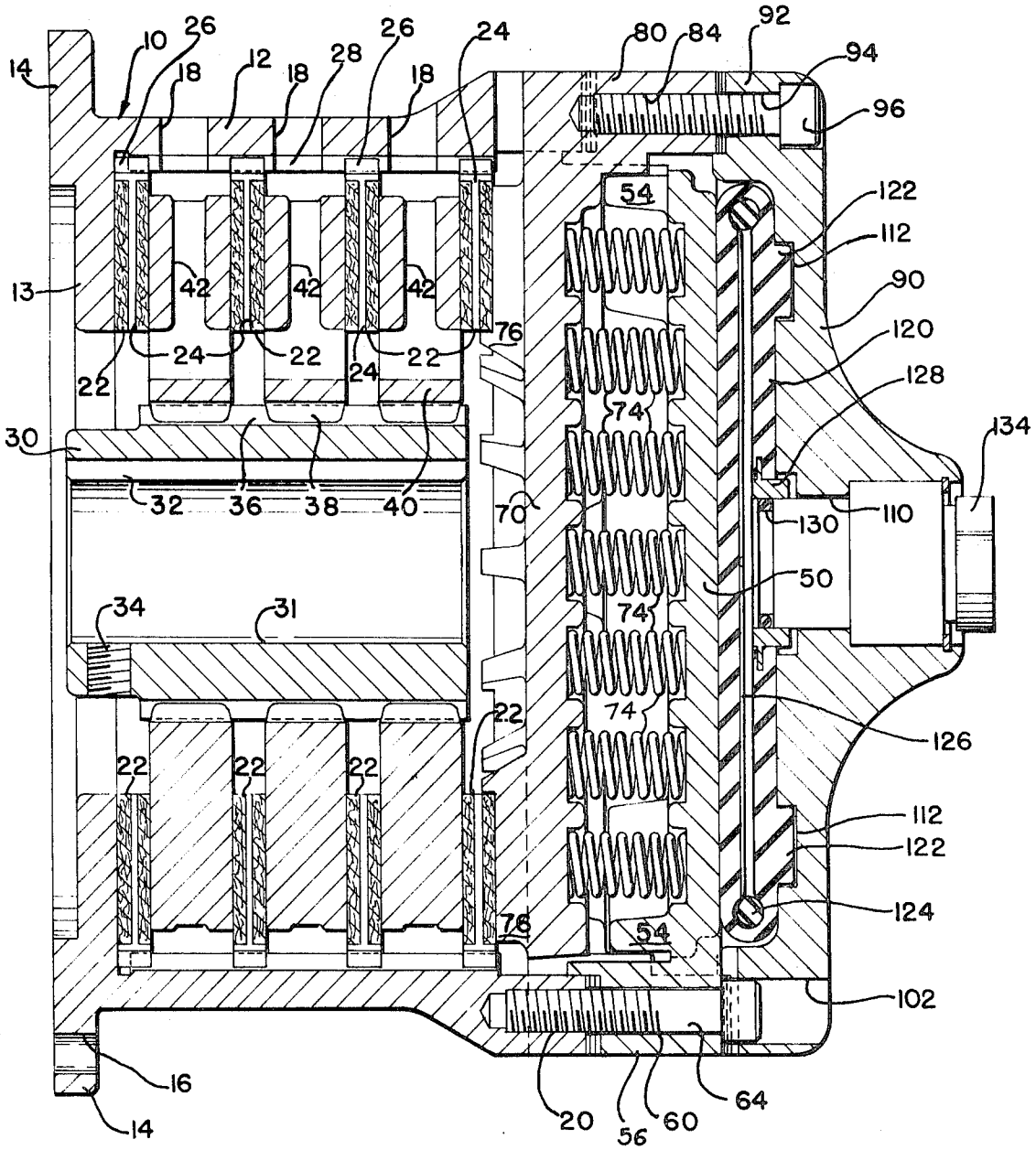
FIG. 3A



JACK W. MOSS
INVENTOR.

BY
Wayland D. Keith
HIS AGENT

FIG. 4



JACK W. MOSS
INVENTOR.

BY
Wayland D. Keith
HIS AGENT

FIG. 5

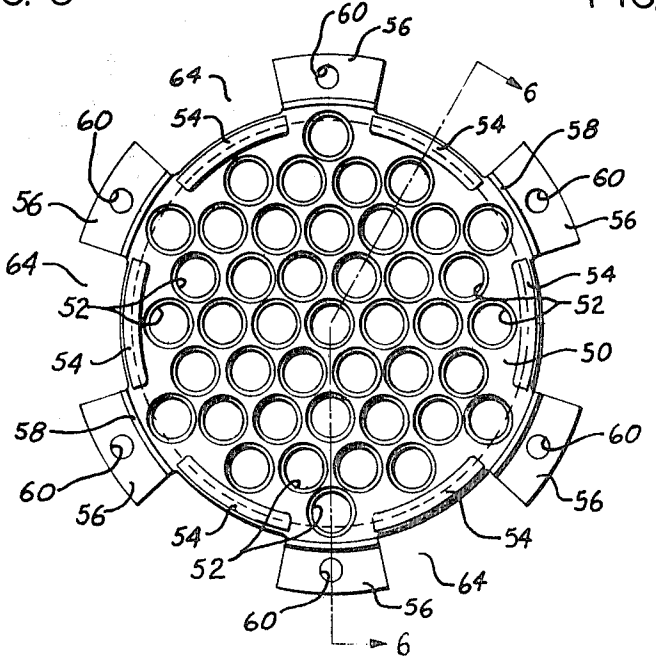


FIG. 6

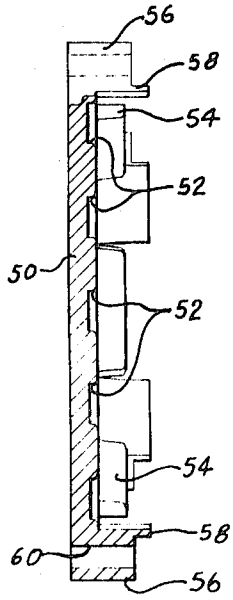


FIG. 7

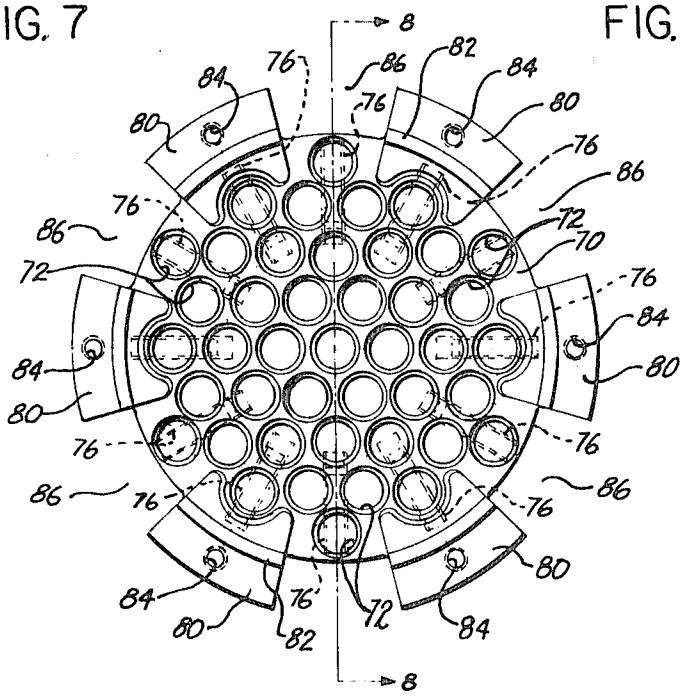
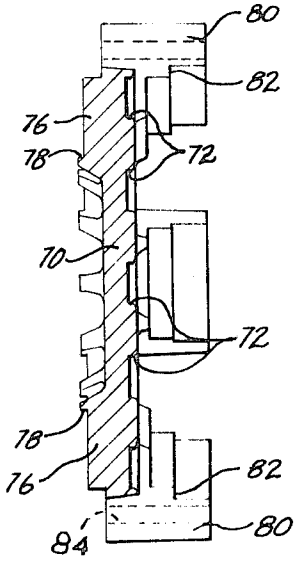


FIG. 8



JACK W. MOSS
INVENTOR.

BY

Wayland D. Keith
HIS AGENT

SPRING SET FLUID RELEASE BRAKE

BACKGROUND OF THE INVENTION

The present invention relates to a so-called multiple-disc-type brake which is set by suitable springs and released by fluid pressure.

It is desirable to provide a brake of this type which is as compact as possible and which is furthermore simple and inexpensive in construction yet sturdy and reliable in operation and requiring a minimum of maintenance.

It is difficult to provide an effective fluid operating means in a brake incorporating the above-mentioned desired design characteristics. Prior art brakes of this type have either employed rather bulky and expensive fluid motors for releasing the brake or constructions which do not provide satisfactory operating characteristics.

SUMMARY OF THE INVENTION

A body means is fixed against rotation and has a first plurality of friction plates operatively connected therewith. A rotatable means has a second plurality of friction plates operatively connected therewith which cooperate with the first plurality of friction plates in a well-known manner.

A backplate means is secured to the body means, and a pressure plate means which is secured to a holding plate means is mounted for axial movement with respect to the backplate means. A plurality of springs are disposed between and in engagement with the backplate means and the pressure plate means for normally urging the pressure plate means in a direction to set the brake.

A fluid operating means is positioned between the backplate means and the holding plate means for moving the pressure plate means and the holding plate means in a brake release direction. The fluid operating means comprises an axially expansible flexible diaphragm which is a pancake-type airtube. With this construction, the fluid operating means provides an effective fluid pressure area over the entire diametrical area of the airtube thereby affording an enlarged area as compared with an annular tube, for example, and ensuring maximum efficiency of operation when moving the brake in a release direction.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation of a brake according to the present invention;

FIG. 2 is an end view, on a reduced scale, of the brake shown in FIG. 1;

FIG. 3 is a sectional view on a reduced scale taken substantially along line 3–3 of FIG. 1 looking in the direction of the arrows;

FIG. 3A is a sectional view taken on the line 3A–3A of FIG. 3, looking in the direction indicated by the arrows, and on the same scale as FIG. 3;

FIG. 4 is a sectional view on an enlarged scale taken substantially along line 4–4 of FIG. 2 looking in the direction of the arrows;

FIG. 5 is an elevation of the backplate means of the brake, on a reduced scale;

FIG. 6 is a sectional view taken substantially along line 6–6 of FIG. 5 looking in the direction of the arrows;

FIG. 7 is an elevation of the pressure plate means of the brake, on a reduced scale; and

FIG. 8 is a sectional view taken substantially along line 8–8 of FIG. 7 looking in the direction of the arrows.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference characters designate corresponding parts throughout the several views, as seen most clearly in FIGS. 1 and 4, the brake includes a body means indicated generally by reference numeral 10 and including a substantially cylindrical wall portion 12 and an annular rear wall 13 having a peripherally extending radially, outwardly directed flange 14 formed integral therewith. A plurality of holes 16 are formed through flange 14, at spaced points therearound, for receiving bolts or the like whereby the body can be affixed to any suitable supporting structure so that the body means is held against rotation.

The wall 12 of the body means has a plurality of elongated slots 18 formed therethrough, these slots enabling air to circulate within the brake so as to cool the brake during operation. The forward end of the body means is provided with a plurality of circumferentially spaced tapped holes 20 in the end edge thereof, for a purpose hereinafter described.

A first plurality of generally annular friction plates 22, of conventional construction, are provided, these friction plates having passages 24 formed therein to permit air to circulate through the plates to cool them during operation. The outer peripheries of friction plates 22 have external teeth 26 formed thereon which engage longitudinally extending internal teeth 28 formed on the inner periphery of wall 12 of the body means, whereby friction plates 22 are adapted to move longitudinally with respect to the body means but are held against rotation with respect thereto.

A generally cylindrical hub means 30 has a central bore 31 extending longitudinally therethrough. A longitudinally extending radially inwardly directed key 32 is provided within the hub, and a radially extending threaded hole 34 is adapted to receive a set screw or the like. The hub is adapted to be drivingly interconnected with a suitable rotating member such as a shaft or the like, through the intermediary of the key 32 and a screw threaded within hole 34 in a well-known manner.

The outer periphery of the hub means is provided with longitudinally extending external teeth 36 which are adapted to engage internal teeth 38 formed on the inner peripheries of a second plurality of annular friction plates 40. Friction plates 40 have passages 42 formed therein to permit air to circulate through the plates to cool them during operation. The second plurality of friction plates 40 are nested between adjacent ones of said first plurality of said friction plates 22 so as to provide a conventional multiple-disc-type arrangement.

Referring now to FIGS. 5 and 6 of the drawings, the backplate of the brake includes a central flat disclike portion 50, having a plurality of generally cylindrical spaced holes 52 formed in one surface thereof, these holes each being adapted to receive one end of a compression spring as hereinafter described. A plurality of spaced stop portions 54 are formed integral with portion 50 and extend longitudinally of the backplate, these stop portions serve to interengage the pressure plate hereinafter described. These stop portions are of generally arcuate configuration and are illustrated as being six in number, as seen most clearly in FIG. 5.

A plurality of bosses 56, also shown as being six in number, extend radially outwardly of the central disclike portion 50 of the backplate, each of these bosses also extending longitudinally of the backplate and including a relatively thin arcuate portion 58 extending beyond the remainder of the associated boss. Each of these bosses has a hole 60 formed therethrough, these holes 60 being aligned with the holes 20 formed in the end of the body means 10. A bolt 64 extends through each of holes 60 formed in the bosses on the backplate and is threaded into one of the tapped holes 20 formed in the body means whereby the backplate is fixedly secured to the body means.

As seen in FIG. 5, it will be noted that a plurality of recesses 64 are defined between adjacent ones of the bosses 56 on the backplate, each of these recesses being disposed radially outwardly of one of the stop portions 54.

Referring now to FIGS. 7 and 8, the pressure plate of the brake includes a flat disclike central portion 70 having a plurality of generally cylindrical holes 72 formed in one face thereof. These holes 72 are identically spaced to the holes 52 formed in the backplate and each hole is adapted to receive the end of one of the compression springs disposed between these two plates. When the backplate and pressure plate are disposed in assembled relationship with respect to one

another, a plurality of compression springs **74** are provided as seen most clearly in FIG. **4**, the opposite ends of these springs being positioned within the aforementioned holes in the plates, the springs serving to urge the pressure plate away from the backplate and toward brake set position.

The face of the pressure plate, opposite to that within which the holes **72** are formed, is provided with a plurality of spaced radially directed lugs **76** each one of which defines a longitudinally extending shoulder **78**. These lugs **76** are adapted to engage the adjacent friction disc **22**, the shoulders **78** fitting within the inner periphery of the associated friction disc.

A plurality of spaced bosses **80**, shown as being six in number, extend radially outwardly of the central disclike portion **70** of the pressure plate, these bosses also extending longitudinally of the pressure plate. Each of these bosses has an arcuate cutout **82** formed therein, and a tapped hole **84** is provided in each boss. The bosses are spaced from one another so as to define a plurality of recesses **86** between adjacent ones of the bosses.

In the assembled relationship of the backplate and the pressure plate, as seen in FIG. **4**, the bosses formed on the backplate fit within the recesses provided on the pressure plate, while the bosses formed on the pressure plate fit within the recesses provided at the outer periphery of the backplate. This arrangement enables the pressure plate to move longitudinally with respect to the backplate.

As seen most clearly in FIGS. **2**, **3** and **4**, a holding plate **90** includes a longitudinally extending peripheral flange **92** having a first plurality of counterbored holes **94** formed therethrough. Bolts **96** extend through these counterbored holes and into the tapped holes **84** formed in the aforementioned pressure plate whereby the holding plate and the pressure plate are secured to one another and are adapted to move as a unit.

As seen in FIG. **3**, longitudinally extending arcuate portions **98** are formed on the holding plate integral with flange **92** at spaced portions disposed radially inwardly of the counterbored holes **94**. These spaced portions **98** are separated from one another by milled out radially extending recesses **100**. Cylindrical holes **102** are formed through the holding plate at the central part of each of the recesses **100**, holes **102** providing access openings for gaining access to the aforementioned bolts **64** whereby the bolts **64** may be threaded into and out of operative position through the openings **102** if so desired.

The holding plate **90** is provided with a longitudinally extending counterbored hole **110** formed through the central part thereof, and the inner face thereof is provided with a pair of diametrically opposite generally cylindrical holes **112** for a purpose hereinafter described.

A fluid operating means is interposed between the backplate and the holding plate The fluid operating means in the present invention comprises an axially expansible flexible diaphragm in the form of a pancake-type airtube **120**, formed of a suitable elastomeric material such as rubber or the like. This airtube is provided with a pair of disclike lugs **122** which snugly fit within the holes **112** of the holding plate whereby the airtube is properly supported and held in the operative position illustrated.

An annular O-ring **124** is supported in the outer part of the interior of the airtube so as to reduce the volume thereof. Shallow grooves **126** are disposed 90° apart on the bottom of the airtube.

The open end of the airtube is fixedly secured to an annular member **128** which in turn is sealed by an annular seal **130** with respect to a fitting **134** which is adapted to be suitably interconnected with any source of fluid pressure such as air or the like. A variable pressure control valve (not shown) of conventional construction may be employed for controlling the air pressure admitted into the interior of the airtube.

In the absence of the air pressure within the airtube, springs **74** will urge the pressure plate means to the left as seen in FIG. **4**, thereby causing the first and second plurality of friction plates to tightly engage one another and setting the brake. On the other hand, when pressure is applied to the interior of the airtube, the holding plate and the pressure plate will be caused to move to the right against the force of the springs to thereby release the brake. Stop portions **54**, on the backplate, will engage the pressure plate, after a predetermined amount of movement in the release directions, so as to limit the movement of the pressure plate toward the backplate. By controlling the amount of air pressure within the airtube, the brake may be engaged to any degree desired.

It is apparent that the brake arrangement of the present invention is very compact and simple and inexpensive in construction, and yet, at the same time, is quite sturdy and reliable in operation and requires a minimum of maintenance. The airtube has an effective fluid pressure area over the entire diametrical area of the tube and enables the brake to be operated in a most efficient manner.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, and since the scope of the invention is defined by the appended claims, all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents are therefore intended to be embraced by those claims.

What I claim is:

1. A spring set, fluid pressure release brake which comprises;

a. a hollow body means having circumferentially spaced teeth around the interior thereof,
   1. said hollow body means being fixed against rotation,

b. a plurality of friction plates, each having circumferentially spaced teeth fitted within said hollow, toothed body means in relatively nonrotatable, driving relation but being axially slidable with respect thereto,

c. a backplate fixedly secured to said body means,
   1. said backplate having a plurality of bosses formed thereon,
   2. said backplate having a plurality of recesses defined between said bosses,

d. a pressure plate mounted for axial movement relative to said backplate, said pressure plate and said backplate being nonrotatable relative to each other,
   1. said pressure plate having a plurality of spaced-apart bosses formed thereon,
   2. said pressure plate having a plurality of recesses defined between said bosses,
   3. the bosses of said pressure plate being received within the recesses defined in said backplate to permit longitudinal movement therebetween but to prevent relative rotational movement therebetween,

e. a plurality of compression springs positioned intermediate said backplate and said pressure plate and being in engaged relation therewith to normally urge said pressure plate into engagement with at least one of said friction plates to selectively hold said body means and said friction plates in braking relation,

f. a holding plate, having a cavity formed therein, fixedly secured to said pressure plate for rotation therewith,

g. a fluid-pressure-operated tube, forming a closed envelope, fitted within said cavity in said holding plate and being in bearing relation with said backplate and said holding plate to effect relative axial movement therebetween, upon introduction of fluid pressure into said closed envelope to effect the disengagement between said pressure plate and at least one said friction plate to release said brake against the pressure of said compression springs.

2. A spring set, fluid pressure release brake, as defined in claim **1** wherein

a. said backplate has a plurality of spaced-apart stop portions formed thereon for engaging said pressure plate to limit the axial movement of said pressure plate in a brake release direction.