My invention relates to landing gear for aircraft which is retractable and extendible through the operation of one or more rams. When the landing gear is extended and the pistons of the rams are likewise extended, the pistons are exposed to the accumulation of sand, dust and dirt, in such quantity as to cause the pistons when retracted to jam in the cylinders, and thus prevent them from being extended to lower the landing gear. With the landing gear so locked against operation a “belly” landing of the aircraft becomes imperative, and the usual disastrous consequences result.

It is a purpose of my invention to provide a protective covering for the ram pistons so that sand, dirt, or any other foreign matter cannot be deposited on the pistons to cause jamming thereof, and thus failure in operation of the landing gear from this cause is eliminated.

It is also a purpose of my invention to provide a protective covering for a ram piston which is in the form of a boot so constructed as to be extendible and contractible with projection and retraction of the piston so as to at all times completely cover and thus effectively protect the piston against sand and other foreign matter.

A further purpose of my invention is the provision of a boot constructed of flexible material which is pleated to allow free and unrestricted axial extension and contraction thereof, so that it at no time interferes with the normal operation of the ram piston.

Another purpose of my invention is the provision of a boot which is divided lengthwise to allow application thereof to the landing gear ram without the necessity of removing the landing wheel or any other part of the landing gear.

I will describe only two forms of protecting boots for the ram pistons of landing gear, each embodying my invention and will then point out the novel features thereof in claims.

In the accompanying drawing:

Fig. 1 is a view showing in side elevation a simple form of landing gear for aircraft, having applied to the ram thereof one form of boot embodying my invention.

Fig. 2 is an enlarged fragmentary view showing the boot of Fig. 1, and how it is secured to the ram cylinder.

Fig. 3 is a view showing in side elevation another form of boot embodying my invention.

Fig. 4 is an enlarged plan view of the boot shown in Fig. 3.

Similar reference characters refer to similar parts in each of the several views.

Referring specifically to the drawing, and particularly to the form of my invention shown in Figs. 1 and 2, the ram piston protecting device comprises a boot made up of a multiplicity of sections or annuli each in the form of a flat continuous ring 15 made of leather, canvas or any other suitable material, which is both flexible and impervious to sand, dirt, or any other granular material which may cause the piston and cylinder to jam or become locked against relative linear movement.

As will be clear from an inspection of Fig. 2, the boot is formed by securing the inner marginal edges of adjacent rings 15 to each other by stitching 16 or in any other suitable manner, and the outer marginal edges of adjacent rings to each other by stitching 17, or by any other suitable means. By this manner of assembling the several rings, a boot body of tubular form is provided which is pleated circumferentially to allow free axial extension or prolongation, and likewise free axial contraction or collapsing.

Again as shown in Fig. 2, the terminal rings 15 at opposite ends of the boot body have their outer edges secured to collars 18 and 19, respectively, by stitching 20 or by any other suitable means. These collars are likewise constructed of leather, canvas, or other suitable flexible and impervious material, and are designed for engagement by suitable clamps C and C' respectively, to secure the ends of the boot to the cylinder piston, respectively, of a ram.

In the present instance, I have shown clamps of conventional form in that each embodies a split band 21 of metal having terminal ears 22 through which a bolt 23 extends for constraining the band and securing the respective collar 18 or 19 to the cylinder or piston.

In Fig. 1 is shown a simple form of landing gear for aircraft of the retractable type, and wherein a wheel 24 has its axle 25 provided with a sleeve 28 which is secured to the lower end of a piston 27 operating in a cylinder 28 suitably mounted on the aircraft, and adapted to be supplied with pressure fluid for extending the piston to lower the wheel 24, or retracting the piston to elevate the wheel.

The boot of Fig. 2 as applied to the landing gear, employs the clamp C to secure the collar 18 to the sleeve 28, which latter being fixed to the piston 27 moves with the piston. The other end of the boot is secured to the lower end of the cylinder 28 by the clamp C' engaging the collar 19. To place the boot body in covering relation to the piston it is necessary because of the fact that the boot is an integral unit, to remove the sleeve and wheel from the piston.

With the boot applied to the ram as described, extension of the piston from the cylinder to lower the wheel, causes the boot body to be elongated or extended to completely cover the piston as so extended. As the surface of the piston is highly polished to have a fluid tight fit in cylinder, it will be clear that should any sand, dirt, or other granular matter accumulate on the piston...
while extended the piston becomes jammed when drawn back into the cylinder, and thus is prevented subsequent extension of the piston and lowering of the wheel for landing. By maintaining the piston completely covered as is effected by the boot, the surface of the piston cannot become contaminated with sand or other matter, and thus its intended operation is insured.

In the retracted position of the piston the boot, because of its pleated and flexible form readily folds or collapses about the piston so that retraction of the piston is impeded by the boot. An important advantage arising from the construction of my boot, is that whether extended or collapsed, it maintains the same internal diameter, and as this diameter is in excess of the diameter of the piston, the boot at no time contacts the piston to remove lubricant therefrom or interfere with its movement.

Referring now to Figs. 3 and 4, I have here shown another form of protecting boot which is characterized by being divided or split lengthwise so that it can be applied to the piston and cylinder without the necessity of removing any part of the landing gear.

In this form of boot each section of the tubular boot body is likewise in the form of a flat ring of leather or other flexible and impervious material, but each ring is formed of two arcuate parts 25 and 30, with each part in excess of a semicircle. One of the ends of the two parts are secured in abutting relation to each other by stitching 31, and as each part is in excess of a semicircle, the other ends 32 thereof are disposed in overlapped relation to each other, and thus the internal contour of the section is that of a circle.

The several sections comprising the tubular body of this form of boot are secured one to the other in the manner shown as those of the first form of boot described herein, so that the body is circumferentially pleated and thus extensible and foldable in a like manner. Also, the ends of the boot body are likewise provided with collars 33 and 34 made of the same material as the body sections, but each collar is split and of a diameter such that when secured by stitching 35 at its inner edge to the outer edge of the adjacent body section, its overlapped ends are transversely aligned with the overlapped ends of the body sections. Thus the boot is divided or split from end to end so that it can be opened and placed about the cylinder and the piston without disturbing any part of the landing gear.

To secure the divided boot in tubular form about the parts of the ram, any suitable means which is flexible so as not to interfere with extension and collapse of the boot, may be employed. In this instance I use a single length of cord 36 which is trained through suitable perforations in the overlapped ends of the sections and collars, and then tied so as to secure the overlapped ends against separation.

As in the first form of boot, the same clamps C and C' may be employed to secure the collars 33 and 34 tightly about the cylinder and piston sleeve so that the boot body collapses and expands with extension and retraction of the piston, and thus at all times covers and protects the piston against contamination by sand and other granular matter.

Although I have herein shown and described only two forms of protecting boots for aircraft landing gear, each embodying my invention, it is to be understood that various changes and modifications may be made herein without departing from the spirit of my invention and the spirit and scope of the appended claims.

I claim:

1. A protecting boot of the character described, comprising a plurality of flat annuli of flexible and impervious material, each annulus being formed of two arcuate sections secured permanently to each other at one of their confronting ends in abutting relation, while their other ends are disposed in overlapped relation, and adjacent annuli being secured at their outer edges to each other and at their inner edges to each other, whereby a circumferentially pleated and tubular body is formed; split collars secured to the ends of said body and having their ends overlapped at a point corresponding to the overlapped ends of said annuli; and means engageable with the overlapped ends of said annuli and said collars for detachably securing said body and said collars in circular form.

2. A protecting boot for the rams of retractable landing gear for aircraft, comprising a tubular body permanently pleated circumferentially so that it is axially extensible and contractible, and divided lengthwise from end to end with the edges of the divisions overlapping each other circumferentially; and means extending through said overlapped edges and longitudinally of said body for securing said body in tubular form, said means being flexible to allow complete contraction in pleated form of said body, and detachable from said edges to allow opening of the body for detachment from a ram.

3. A protecting boot for the rams of retractable landing gear for aircraft, comprising a tubular body permanently pleated circumferentially so that it is axially extensible and contractible, and divided lengthwise from end to end with the edges of the divisions overlapping each other; and a single lace extending through said overlapped edges for securing said body in tubular form.

4. A protecting boot of the character described, comprising a plurality of flat annuli of impervious material, means for securing the confronting outer edges of adjacent annuli to each other and the inner edges of adjacent elements to each other to form a tubular body permanently pleated circumferentially, each annulus formed of two arcuate sections secured permanently to each other at one of their confronting ends, while their other ends are disposed in overlapped relation; said material and said securing means being of flexible material; and a lace extended through said overlapped ends for detachably securing said body in tubular form.

5. A protecting boot of the character described, comprising a plurality of flat annuli of impervious material, means for securing the confronting outer edges of adjacent annuli to each other and the inner edges of adjacent elements to each other to form a tubular body of permanently pleated form circumferentially, each annulus formed of two arcuate sections secured permanently to each other at one of their confronting ends by stitching, while their other ends are disposed in overlapped relation; said material and said securing means being of flexible material; and means engageable with the overlapped ends of said annuli for detachably securing said body in tubular form, said means being flexible to allow complete axial collapsing of said body while maintaining its circumferentially pleated form.

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