March 11, 1969 C. A. DAMM 3,431,824

EJECTOR ASSEMBLY WITH LOCKABLE STORE-ENGAGING PRESSER FOOT

Filed July 31, 1967 Sheet 1 of 2

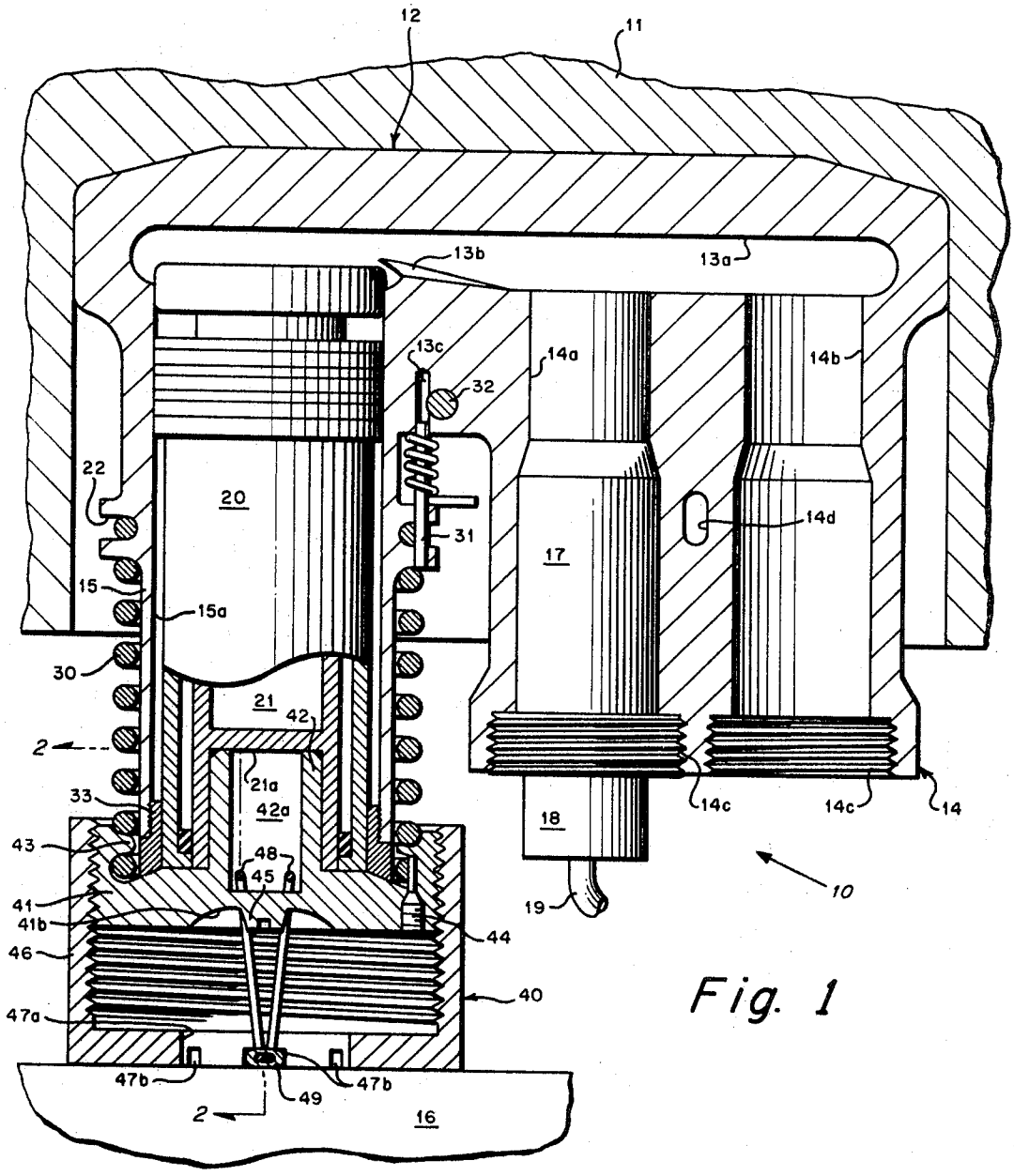


Fig. 1

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Fig. 2

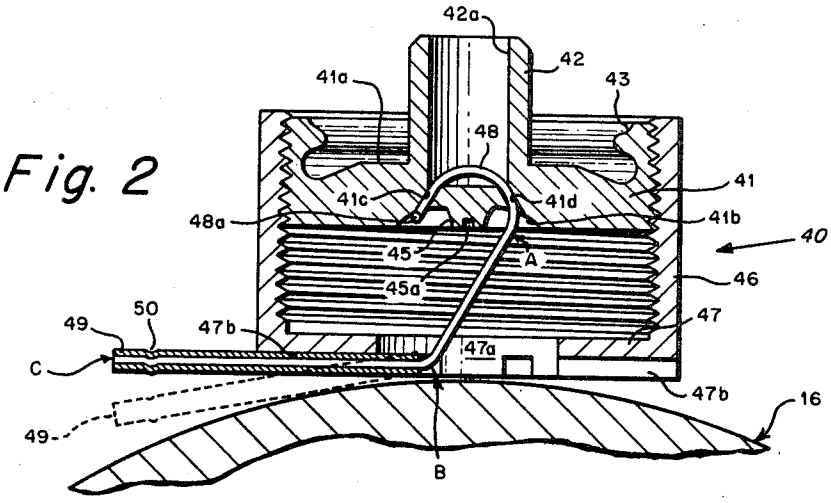


Fig. 3

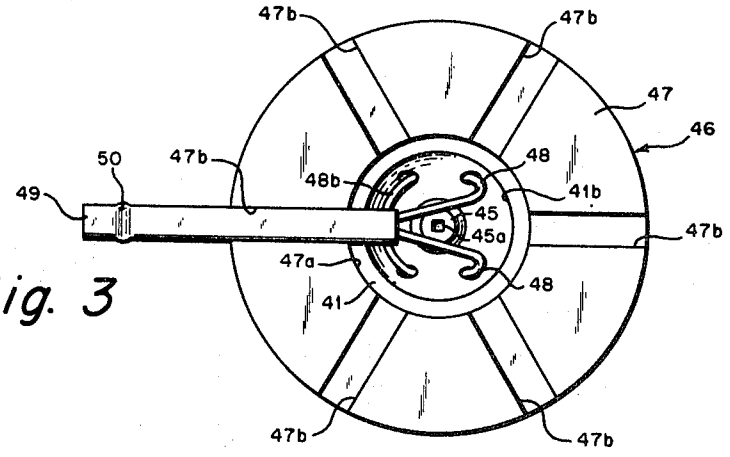
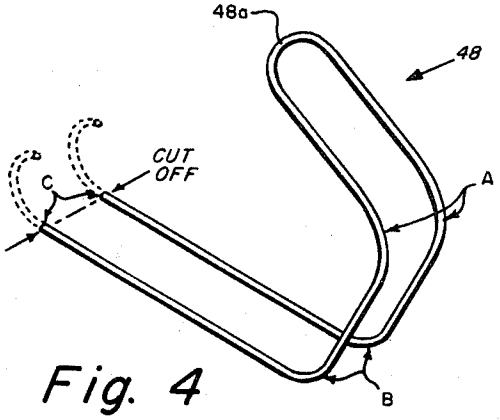


Fig. 4



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EJECTOR ASSEMBLY WITH LOCKABLE STORE-ENGAGING PRESSER FOOT

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Int. Cl. F01b 31/00, 9/00; F41f 5/02

ABSTRACT OF THE DISCLOSURE

A pyrotechnically actuatable ejector device for separating stores from store releasing racks including an integrally cast casing having pyrotechnic cartridge receiving chambers and a telescoping piston receiving chamber interconnected by a combustion chamber and including a piston carried, spring retracted, presser foot assembly which is adjustable for positioning adjacent a store suspended from the rack. A spring element is connected to a relatively non-rotatable portion of the presser foot assembly, extends through a threadably received presser foot and is urged by spring force into a radial groove formed in the store adjacent surface of the presser foot to prevent further rotation of the presser foot.

Background of invention

Ejector assemblies are conventionally used with an aircraft bomb rack for effecting a separation of a store from the rack upon releasement of the store. Unless the presser foot of the ejector assembly is positioned in close adjacency to or in engagement with the releasably suspended store, the store may be dented or otherwise damaged by the presser foot upon actuation of the ejector. Known structures for positioning the presser foot adjacent the store frequently are unable to function properly because of the vibration to which the store, the rack and the ejector assembly are subjected during flight. Additionally, adjustment of the presser foot for variously configured stores may change the compression ratio of known pyrotechnic ejector assemblies.

Summary of invention

It is the general purpose of this invention to provide an improved ejector assembly having a presser foot which can be locked in a position closely adjacent a releasably suspended store in spite of vibration to which it may be subjected. Briefly, the purpose may be accomplished by providing an adjustable presser foot assembly which is carried by the extendable end of an ejector piston and which includes a spring element having one end fixed relative to the piston and the other end extending through the assembly and normally urged into locking engagement with a relatively adjustable portion of the presser foot assembly.

Brief description of drawing

FIG. 1 represents a cross-sectional view in elevation of an improved ejector assembly including an adjustable, lockable presser foot assembly;

FIG. 2 represents a cross-sectional view in elevation of the presser foot assembly taken generally along line 2—2 of FIG. 1, portions of the ejector assembly being omitted;

FIG. 3 represents an inverted plan view of the store-adjacent surface of the presser foot assembly of FIG. 2; and

FIG. 4 represents an isometric view of a spring element performed for incorporation into the presser foot assembly of FIG. 2.

Description of preferred embodiment

As shown in FIG. 1, the vertically arranged ejector assembly, generally designated as **10**, is removably secured to a bomb rack **11** such as of the type described in U.S. Patent No. 3,036,852 for a "Stores Rack" issued May 29, 1962, to C. W. Mullison. The ejector **10** includes a bifurcated casing **12** having a body portion **13** from which a belled, dual chambered breech **14** and a cylindrical piston sleeve **15** extend downward toward a store **16** which has been releasably secured to the rack **11** by means not shown herein. The breech **14** includes a parallel pair of cylindrical chambers **14***a* and **14***b* which are formed therein to receive pyrotechnic cartridges such as **17** and which extend therethrough into the body portion **13** from respective threaded, larger diametered, cylindrical recesses such as **14***c*. The threaded recesses such as **14***c* are each adapted for receiving an ignition cap such as **18** which functions to fire the cartridge **17** for generating explosive gases in response to an electrical command signal applied thereto through a lead **19**. The sleeve **15** has formed therein a cylindrical piston chamber **15***a* which extends therethrough into the body portion **13** and is of a size to receive a piston **20** of the type having an inner, further extendable, telescoped piston member **21**. The body portion **13** includes formed therein a combustion chamber **13***a* which connects the cartridge chambers **14***a* and **14***b* with the piston chamber **15***a*. The body portion **13** also includes an internal ramp **13***b* which protrudes into the chamber **13***a* intermediate its junctions with the piston chamber **15***a* and the adjacent cartridge chamber **13***a* and which inclines upwardly therefrom both toward the piston chamber **15***a* and toward the longitudinal side of the chamber **14***a*. The ramp **13***b* functions to cause a cyclone-like flow of the explosive gases adjacent the inner terminus of the piston chamber **15***a* which gases emanate from the cartridge chambers **14***a* and **14***b* and spiral downward to actuate the telescoped piston **20**. The sleeve **15** also includes a parallel pair of externally projecting helical threads **22** which extend peripherally thereabout adjacent the junction of the sleeve **15** with the body portion **13**. As shown in the above-indicated patent to Mullison, the body portion **13** of the casing **12** may include poppet valves, not shown, and an actuating piston, not shown, for causing the rack **11** to release the store **16**.

While other materials are suitable, the casing **12** conveniently and inexpensively may be investment cast from maraging steel and thereafter subjected to pressure tests using a suitably configured pressure jig adapted for connection to the sleeve **15**, as by connection to the threads **22**, and to the belled breech **14**, as by connection to an aperture **14***d* extending through the breech **14** transversely of and between the cartridge chambers **14***a* and **14***b*. Thereafter, the casing **12** may be age hardened by subjection for two or three hours to a temperature of about 900° F.

The helical threads **22** projecting from the sleeve **15** have a sufficient length for receiving one and a half turns of one end of a coil spring **30** which is coaxially received about the sleeve **15** and which has a notch formed in each of its ends. A spring-loaded locking-pin **31** is slidingly received by the upper spring notch through adjacent, aligned apertures extending through the threads **22** for securing the spring **30** to the sleeve **15**. The pin **31** is withdrawable into an aligned bore **13***c* formed in the body portion **13** when a bore obstructing, removable pin **32**, which normally secures the assembly **10** to the rack **11**, has been withdrawn from its locking position. A tubular piston stop member **33** of brass is threaded into the open end of the sleeve **15**, and its upper end, which pro-

jects inwardly of the sleeve, functions to limit the outward excursion of the piston **20** under pressure. The inwardly beveled lower end of the stop member **33** functions to buffer the spring driven inward excursion of a lockable presser foot assembly, generally designated as **40**, which is carried by the telescoped piston member **21** and is connected to the lower end of the coil spring **30**.

More particularly, the presser foot assembly **40** includes a threaded, cylindrical connecting member **41** having a coaxial boss portion **42** which extends upwardly therefrom and is received within a coaxial recess **21***a* formed in the extendable end of the telescoped piston member **21**. A weight reducing, cylindrical recess **42***a* extends coaxially into the boss portion **42**. The connecting member **41** includes an annular recess **41***a* coaxially disposed about the boss **42** which defies surfaces for abutting engagement of the member **41** with the end of the telescoped piston member **21** and with the beveled stop **33** and radially terminates in a helical thread **43** adapted for receiving one and a half turns of the lower end of the coil spring **30**. The spring **30** is secured under tension to the member **41** by a countersunk set screw **44** which extends across the lower spring notch. As shown in FIG. 2, the store facing surface of the member **41** also includes an annular recess **41***b* which defines a coaxial protuberance **45** having a wrench receiving socket **45***a* formed therein. Two pairs of coplanar, upwardly extending, converging bores, such as the pair of bores **41***c* and **41***d* which extend from the recess **41***b* to the recess **42***a*, are formed in the member **41** on opposite sides of the protuberance **45**. The member **41** also may be investment cast in maraging steel.

A tubular presser foot **46** is internally threaded for an adjustable connection to the longitudinal periphery of the member **41** and includes at its store adjacent end an inwardly extending annular flange **47** which defines a circular aperture **47***a* and which is movable from a withdrawn position abutting the member **41** to a fully extended position by rotating or unscrewing the tube **45**. Since the coil spring **30** tends to clamp the member **41** to the stop member **33** and prevent rotation of the member **41** relative to the sleeve **15**, the foot **46** may be adjusted to a withdrawn position to prevent obstructing the loading of a store **16** unto the rack **11** and then may be unscrewed to the desired position of close adjacency to or engagement with the store **16**, the compression ratio of the assembly **10** being the same for stores of various sizes or configurations since the piston **20** is not moved thereby from its withdrawn position. The store adjacent surface of the flange **47** of the foot **46** includes six symmetrically positioned, radially extending grooves **47***b*, as shown in FIG. 3.

In order to prevent relative rotation of the foot **46** from its adjusted position adjacent the store **16**, a preformed, bifurcated spring element **48** has each of its side members threaded through a respective one of the pairs of the bores, such as **41***c* and **41***d* in the member **41**, the free ends of the sides extending through the aperture **47***a* in the foot **46** and being confined together within an oval tube **47** which is crimped as at **50**. The tube **49** is normally urged by spring action of the element **48** to engage the flange **47** and be received by grooves **47***b* and projects outwardly of the foot **46** in a plane normal to the longitudinal axis, not shown, of the store **16**.

More particularly, referring to FIG. 4, before incorporation into the assembly **40**, the thrice bent parallel sides of the preformed spring element **48** normally lie in respective parallel planes and extend from an intermediate connecting portion **48***a* having a curvature for substantially conforming to the periphery of the protuberance **45** between the openings of the bores such as **41***c*. The portions of the sides of the element **48** extending from the intermediate portion **48***a* to a first acute bend at A are long enough to be threaded through respective first bores in a pair such as **41***c* through the recess **42***a* and through

respective second bores, such as **41***d*, in the pairs, the bend at A being positionable adjacent the recess **41***b*. The second preformed bends at B in each of the sides of the element **48** are of a size and are spaced from the bends at A a sufficient distance to assure that the free ends of the element **48** extending from the bends at B when confined together will urge the tube **49** into one of the grooves **47***b* in the flange **47** whether the tubular presser foot **46** has been fully extended or fully withdrawn. The free ends of the sides of the element **48** terminate in third bends at C which have a curvature substantially conforming to that defined by the pairs of converging bores such as **41***c* and **41***d* to assure that the element **48** may be readily threaded through the member **41**, the bends at C being clipped off after the element **48** has been threaded.

The oval tube **49** is long enough to extend substantially to the bends at B and draws the free ends of the sides of the element **48** together to form a converging configuration of the side portions which extend from the bores such as **41***d* and through the bends at A and B and to the inner end of the tube **49**. Since relative movement of the free ends of the sides of the element **48** is prevented by the crimp at **50** of the tube **49**, the converging configuration of the element **48** tends to limit the tube to movement in a plane normal to the longitudinal axis of the store **16**. Consequently, locking of the presser foot **46** in a selected orientation is further assured.

In using the lockable presser foot assembly **40**, the free end of the tube **49** is pressed downwardly causing a portion of the spring element **48** to engage the adjacent periphery of the store **16**. Thereupon the tubular presser foot **46** may be unscrewed toward engagement with the store **16** until further rotation thereof is prevented by reason of entrapment of the tube **49** between the store **16** and the foot **46** adjacent one of the grooves **47***b* in the annular flange **47**. The foot **46** is then so positioned that, when the end of the tube **49** is released, the spring action of the element **48** causes the tube **49** to move upwardly to align itself within the groove **47***b*. The element **48** thereby prevents further rotation of the presser foot **46** even though it may be subjected to severe vibration. In using the ejector assembly **10** with stores of relatively small diameter, the tubular foot **46** may easily be unscrewed far enough to engage a longitudinal portion of the store periphery since the tube **49** projects outwardly of the foot **46** in a plane normal to the store axis and since the spring adjacent portion of the flange **47** will be spaced from the store **16**.

It should be understood, of course, that the foregoing disclosure relates only to a preferred embodiment of the invention and that numerous modifications or alterations may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. Apparatus comprising:

a piston sleeve adapted for connection to a rack;

a piston slidably received within said sleeve and movable under pressure toward one end of said sleeve;

a presser foot assembly connected to said piston, said assembly including a connecting member connected to said piston and a relatively movable presser foot which is threadably connected to said connecting member and is adjustably positionable closely adjacent a store; and

a spring element having one portion connected to said connecting member of said presser foot assembly and having another portion thereof movable under spring action to lockingly engage means on said relatively movable presser foot to positively maintain the angular and axial positioning of said relatively movable foot.

2. Apparatus according to claim **1** wherein:

said means on said relatively movable presser foot is a groove formed therein for receiving said other portion of said spring element.

3. Apparatus according to claim 2 further including:

a coil spring coaxially arranged about said sleeve and having its ends connected respectively to said sleeve and to said connecting member normally urging said connecting member into engagement with said one end of said sleeve.

4. Apparatus according to claim 2 wherein:

a free end of said other portion of said spring element protrudes outwardly of said relatively movable presser foot, said other portion being movable from engagement with said foot in a plane normal to a longitudinal axis of a store carried by a rack.

5. Apparatus according to claim 2 wherein said relatively movable presser foot includes:

a tube having one end threadably connected to said connecting member and having an annular flange which extends inwardly from the other end of said tube and defines a coaxial aperture through which said spring element extends from said connecting member, said groove radially extending across surface of said flange positionable adjacent a store.

6. Apparatus according to claim 5 wherein:

said spring element includes a pair of side portions which divergingly extend from said other portion of said element and are connected in spaced relation to said connecting member.

7. Apparatus according to claim 6 wherein:

said connecting member has formed therein in spaced relation first and second passageways extending therethrough; and

said spring element includes an intermediate portion from which said side portions extend through a respective one of said first and second passageway to said other portion of said element.

8. Apparatus according to claim 7 wherein:

said side portions include extended ends forming said other portion of said element; and

said apparatus further includes an elongated tubular member within which are juxtaposed said extended ends of said side portions in fixed relation to each other.

9. Apparatus according to claim 8 wherein:

a store adjacent surface of said connecting member includes a recess, both ends of each of said first and second passageways communicating therewith; and

said side portions of said spring element each have preformed therein first and second spaced apart bends, said first bends being positioned adjacent the egress of said side portions from said connecting member and said second bends being positioned adjacent the innermost end of said elongated tubular member.

10. Apparatus according to claim 9 wherein:

said apparatus further includes a tensioned coil spring coaxially arranged about said sleeve and having one end connected to said connecting member, the other end of said coil having a notch formed in the periphery thereof;

said sleeve includes spaced from said one end thereof an external helical thread for receiving said other end of said coil spring, said thread having a transverse aperture formed therein, said notch registering with said transverse aperture; and

said apparatus further includes a spring loaded pin removably positioned to extend through said aperture and across said notch.

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