Nov. 24, 1959 S. VORECH 2,914,240

AIR COMPRESSOR

Filed April 7. 1955 3 Sheets-Sheet 1

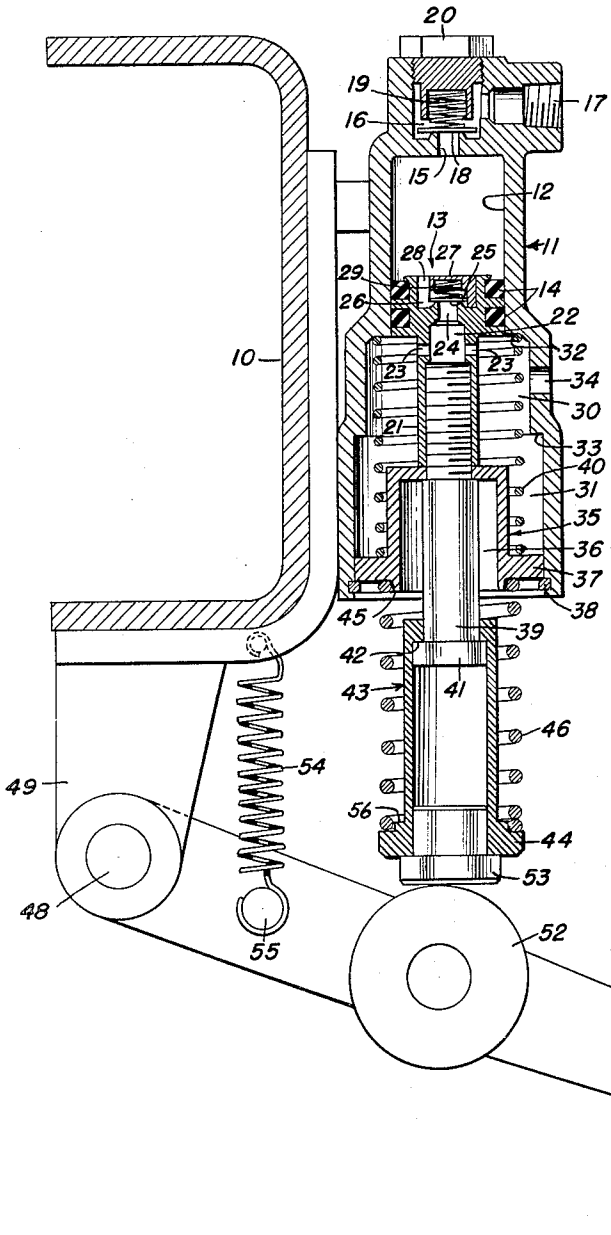

FIG. 1

INVENTOR

STEPHEN VORECH, DECEASED
BY MARGARET VORECH,
ADMINISTRATRIX

BY Scrivener & Parker

ATTORNEYS

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AIR COMPRESSOR

Filed April 7, 1955 3 Sheets-Sheet 2

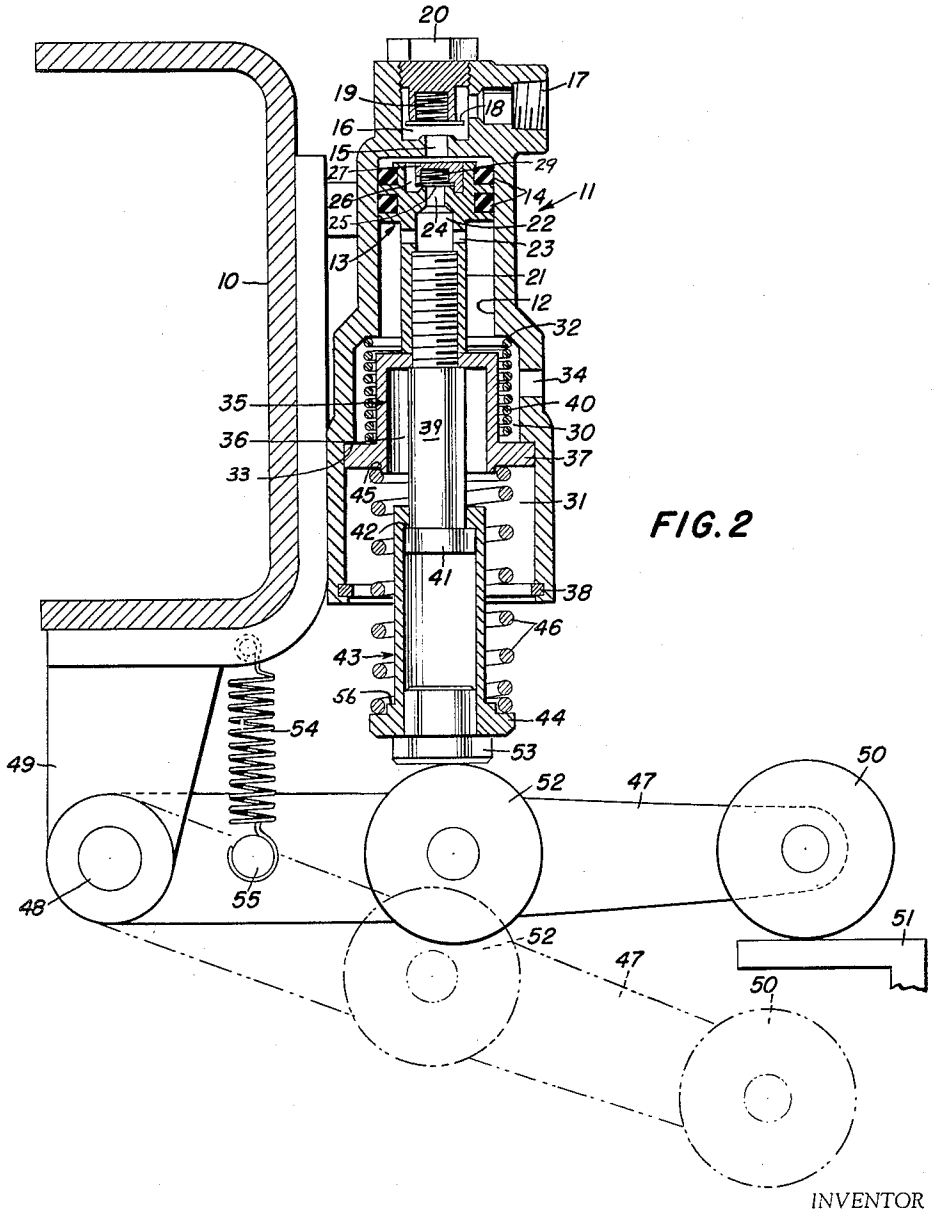

FIG. 2

INVENTOR

STEPHEN VORECH, DECEASED
BY MARGARET VORECH,
ADMINISTRATRIX

BY Scrivener & Parker

ATTORNEYS

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AIR COMPRESSOR

Filed April 7. 1955 3 Sheets-Sheet 3

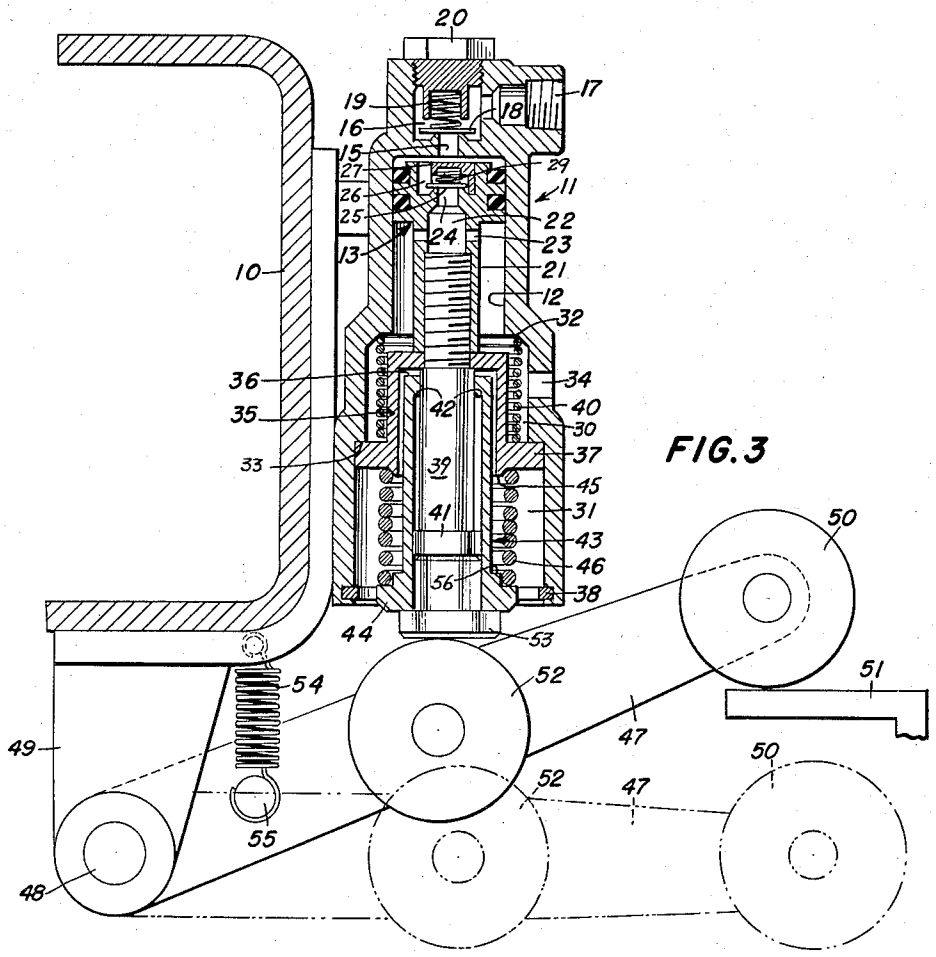

FIG. 3

INVENTOR

STEPHEN VORECH, DECEASED
BY MARGARET VORECH,
ADMINISTRATRIX

BY Scrivener & Parker

ATTORNEYS

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2,914,240

AIR COMPRESSOR

Stephen Vorech, deceased, late of Elyria, Ohio, by Margaret Vorech, administratrix, Elyria, Ohio, assignor to Bendix-Westinghouse Automotive Air Brake Company, Elyria, Ohio, a corporation of Delaware

Application April 7, 1955, Serial No. 499,852

7 Claims. (Cl. 230—34)

This invention relates to air compressors and more particularly to an improved air compressor of the type operated by the relative movement between a vehicle frame and an axle part.

One object of the present invention is to provide an improved air compressor of the above type which is particularly adapted for supplying air to air horns or other equipment on automotive vehicles.

Another object of the invention is to provide an air compressor of the above type which has associated therewith improved actuating means for operating the compressing means.

Another object of the invention is to provide an air compressor of the above type which readily compensates itself for variations in the relative movement between the frame and axle part due to road action on the vehicle.

Still another object of the invention is to provide an air compressor of the above type which mechanically predetermines the maximum pressure output without a sacrifice of volumetric efficiency and also eliminates the necessity for a separate pressure governing device usually associated with compressor installations.

Other objects and their attendant advantages will become apparent as the following detailed description is read in conjunction with the accompanying drawings wherein:

Fig. 1 is a vertical sectional view of the compressor of the present invention;

Fig. 2 is a change position view similar to Fig. 1 but showing the actuating means of the compressor at about one-half of its limit of movement; and

Fig. 3 is a change position view similar to Fig. 2 but showing the compressor actuating means at the upper end of its limit of movement.

A compressor embodying the invention is illustrated in Fig. 1 wherein the frame **10** which may be a portion of a vehicle crank-case on some other portion adjacent an axle has secured thereto a compressor casing member member **11** containing at its upper end a compression cylinder **12** containing a piston member **13** having usual sealing rings **14** of any suitable substance. The cylinder portion **12** of the compressor has at its upper end an outlet port **15** communicating with a valve chamber **16** which in turn communicates through opening **17** with a conventional storage tank (not shown). The outlet port **15** is controlled by a discharge or outlet valve **18** of the disc type which is normally retained in its closed position by the existing air pressure in the storage tank and by a spring **19** interposed between the upper surface of the valve and a recessed valve chamber closure member **20**. The spring **19** serves to retain the valve **18** closed until a predetermined pressure above existing storage tank pressure is reached in the cylinder **12** at which time the force of the spring is overcome and the valve **18** unseated to permit the passage of compressed air to the storage tank.

The piston **13** is reciprocated by actuating means, later described in detail, responsive to the relative movement between the vehicle axle and the frame portion **10** to which the compressor casing **11** is attached. The piston **13** is operatively connected to the actuating means by a hollow piston rod **21** which may be threadedly attached at its lower end to a member of the actuating means later described. The upper portion of the hollow piston rod **21** forms an inlet chamber **22** which is communicated with atmospheric pressure through lateral openings **23**. The upper end of chamber **22** is provided with an inlet port **24** which is normally closed by a disc valve **25** operating in a recess **26** formed in a type inlet valve closure member **27** secured in the upper face of the piston **13**. The recess **26** is communicated with the interior of cylinder **12** by vertical passageways **28** and the valve **25** is normally retained closed by a light spring **29** interposed between the upper surface of said valve and the upper wall of the recess. The spring **29** is designed to permit valve **25** to open when the piston has started its down-stroke and the pressure in cylinder **12** has dropped to just below atmospheric. Upon this occurrence atmospheric air passes through openings **23** into inlet chamber **22** whence it proceeds via inlet port **24** and vertical passageway **28** to the interior of cylinder **12** which is thus recharged for the next succeeding up-stroke of piston **13**.

The compressor casing **11** below the cylinder **12** bells outwardly to provide an upper chamber **30** which is an extension of a larger lower chamber **31**. The upper chamber **30** is separated from the cylinder **12** by a shoulder **32** and the lower chamber **31** is separated from the upper by a second shoulder **33**. An opening **34** through the wall of casing **11** subjects the chambers at all times to atmospheric pressure.

The chambers **30** and **31** cooperate with the piston actuating means which comprise in part a cup-shaped member **35** having a cylindrical cavity **36** and lateral flanges **37** of a size to slidingly operate in the lower chamber **31** between the shoulder **33** and an annular retaining ring **38** seated in a groove about the lower inner surface of the chamber. The member **35** is fixed to the piston rod **21** through the medium of an elongated shouldered bolt-like member **39** which is threaded into the piston rod to clamp the upper wall of the cup-shaped member **35** between the shoulder of member **39** and the lower end of piston rod **21**. The cup-shaped member **35** and hence piston **13** are normally retained in the position shown in Fig. 1 by a return spring **40** interposed between the upper surface of flange **37** and the upper shoulder **32** of upper chamber **30**.

The bolt-like member **39** projects downwardly through cavity **36** and extends beneath casing **11** where an enlarged head **41** integral with member **39** is engaged by an annular flange **42** integral with a sleeve member **43** slidable with respect to member **39** and having an external diameter of a size enabling the sleeve to enter the cavity **36** of the cup-shaped member **35** as occasion demands. The sleeve **43** has an outwardly projecting flange **44** and the cup-shaped member **35** has a lateral flange **37**. Interposed between flanges **44** and **37** is a compression spring **46** which normally tends to retain the sleeve **43** in its extended position of Figure 1. The flange **37** may be provided with an annular lip **45** and the flange **44** may be provided with an upwardly extending shoulder **56** for the purpose of providing a guide at each end of the spring **46** to maintain concentricity of the spring with respect to the adjacent elements. In accordance with the invention and for reasons to become apparent, the initial preload strength of the spring **46** is greater than the collapsed or final strength of the return spring **40**.

The spring **46** of Fig. 2 is initially preloaded to a force slightly higher than the final desired force on the piston **13** as determined by the desired final tank pressure

and the collapsed force of the return spring **40**. Spring **46** under this condition serves the purpose of a pressure governing device as increased pressures above the established maximum cause partial compression of the spring **46**.

In accordance with the invention, relative motion between sprung parts of the vehicle is transmitted to the piston **13** through the medium of an actuating lever **47** having one end pivoted at **48** to a bracket **49** fixed to the same portion **10** of the vehicle as the casing **11**. The opposite end of the lever **47** mounts a roller **50** engaging a bracket **51** which forms an axle part and is preferably mounted on the axle of the vehicle, it being understood that the portion of the vehicle mounting bracket **51** has relative motion to the portion of the vehicle mounting the pivoted end of the lever **47**, said relative motion being usually the result of road action on the vehicle. Intermediate the ends of lever **47** is a second roller **52** which engages a bearing cap member **53** secured in the lower end of the aforedescribed sleeve **43**, the intermediate roller **52** being retained in engagement with the cap **53** by a tension spring **54** fixed at one end to the frame **10** and at the other to a suitable projection **55** on lever **47**.

The movement of lever **47** between the extreme positions of Fig. 1 and Fig. 3, and hence the motion imparted to the compressor parts through the action of the intermediate roller **52** on sleeve **43**, is preferably a function of the compression travel limits of usual shock absorbers employed on vehicles. The normal position of the actuating lever **47** is shown in Fig. 1 with roller **50** in contact with axle bracket **51**, and intermediate roller **52** in contact with cap **53** of sleeve **43**. The distance between the position of axle roller **50** in Fig. 1 and the position of roller **50** in Fig. 3 represents the compression travel limits of the shock absorbers and the distance between the positions in Figs. 1 and 3 of the intermediate roller **52** indicates the limits of travel of sleeve **43**. However, in accordance with the invention, the compression stroke of piston **13** is considerably less than the limits of travel above described in order that the compressor will compensate itself for variations in relative movement between the frame and axle part resulting from variations in road action on the vehicle. This will become apparent as the description of operation of the compressor proceeds.

In operation, when the axle bracket **51** moves from the position of Fig. 1 towards the position of Fig. 3, intermediate roller **52** acts on cap **53** to move sleeve **43** upwardly thereby imparting through spring **46** movement to cup-shaped member **35** and attached piston rod **21**. Since the spring **46** has greater strength or loading than return spring **40** the latter only is collapsed during the initial movement of the actuating lever from the position of Fig. 1 to that of Fig. 2. As the piston **13** approaches the top of its stroke, pressure in cylinder **12** increases until it balances the existing pressure behind discharge valve **18** at which time the valve lifts from its seat to permit the escape of air from the cylinder to the storage tank. At this juncture, the parts of the compressor take the positions illustrated in Fig. 2. At the end of the stroke, valve spring **19** forces the valve back to its seat, thus preventing back-flow of air to the cylinder. With the lever **47** at the position of Fig. 2 further upward movement of the piston **13** is prevented due to impingement of the upper surface of flange **37** of cup-shaped member **35** with shoulder **33**, the latter shoulder thus functioning as a stop means. As the lever **47** continues to move from the position of Fig. 2 to the position of Fig. 3, further motion of the piston rod being now stopped by the shoulder **33** as aforesaid, the heavy spring **46** commences to collapse and sleeve **43** slides with respect to the bolt-like member **39**. As the lever **47** continues upwardly the sleeve **43** enters the cavity **36** of cup-shaped member **35** and at the extreme upper limit of sleeve movement, the upper side of bearing cap **53** strikes the lower surface of the enlarged head **41** of bolt-like member **39** to provide a stop for sleeve **43**. At this stage all the elements of the compressor take the position shown in Fig. 3.

Upon completion of upward movement of the various elements of the compressor and after the axle-bracket **51** has started its downward movement, the piston **13** remains at the top of its stroke while the lever **47** is returning to the position of Fig. 2 under the influence of spring **46** whereat the flange **42** of sleeve **43** engages the head **41** of member **39**. As the lever **47** and its attached rollers continue from the position of Fig. 2 to that of Fig. 1, return spring **40** and compressed clearance-air force piston **13** back towards the end of its suction stroke. When the pressure in the cylinder drops to slightly below atmospheric, air flows through opening **34** in the wall of casing **11** and thence through the inlet chamber and ports in the piston rod **21** lifting inlet valve **25** from its seat to charge the cylinder **12**. At the end of the suction stroke valve spring **29** forces valve **25** to its seat, trapping the air in the cylinder in readiness for the next compression stroke.

It is contemplated that during the "rebound" stroke of the shock absorbers of the vehicle, axle bracket **51** would in all probability move downwardly faster than lever **47** can be returned by spring **46**. However, under these conditions tension spring **54** maintains contact at all times between intermediate roller **52** and the bearing cap **53**.

It is believed that from the description herein it will be readily apparent as to the manner in which the compressor compensates itself for variations in road action on the vehicle. For relatively mild road action wherein the lever **47** is not moved beyond the position of Fig. 2, the compressor nevertheless delivers one full compression stroke. Where the road action is much more severe than this so that the shock absorbers travel their designed limits and the lever **47** moves to the position of Fig. 3, the compressor delivers a full compression stroke but without danger of over-travel of the piston **13** in its cylinder **12**. For any degree of movement intermediate the positions of Figs. 2 and 3 the compressor in like manner delivers a full-stroke and thus the compressor may be said to compensate itself for the variations in relative movement between the frame and axle part. After repeated compression strokes, assuming no air is being used, the tank pressure will finally reach a predetermined maximum as determined by the initial preload of the spring **46** where increased pressure on the piston **13** will cause a proportional compression of the spring **46** thereby limiting the maximum pressure output of the compressor. For lever movement between positions of Figs. 1 and 2, the compressor will still deliver, though such delivery will, of course, be dependent upon the back pressure exerted from the storage tank on the discharge valve **18**. However, by varying the length of lever **47**, or the position of the rollers thereon, or the position and length of the mounting brackets, the compressor may be made to deliver a full compression stroke for any desired degree of relative movement between the sprung parts of the vehicle. Furthermore, by variations in design of the type just described, the stroke of the compressing means may be lengthened or shortened any desired amount. This renders the actuating means of the invention adaptable to any known type of compressing means such as a diaphragm, piston ring type, etc., and hence the invention is not intended to be restricted exclusively to the piston type compressor shown and described.

The present invention provides an inexpensive road-action operated compressor having a minimum of moving parts which, due to its improved actuating means, is readily adaptable to any type of vehicle and any type of road condition which might be encountered by a vehicle. As pointed out above, the invention is susceptible of many

variations and modifications without departing from the scope and spirit of the appended claims.

What is claimed is:

1. In a vehicle having relatively movable frame and axle parts, an air compressor operable upon relative movements of said parts, comprising a cylinder carried by said frame part, a member movable in opposite directions in said cylinder to compress air, means connected with said member and including a first spring for moving said member in one direction, other means including a second spring for moving said member in the opposite direction, the loading of said second spring being greater than that of the first named spring, a lever having one end pivoted to said frame part and the other end operatively connected with said axle part, and means operatively connecting the lever intermediate its ends with said other means.

2. In a vehicle having relatively movable frame and axle parts, an air compressor operable upon relative movements of said parts, comprising a cylinder carried by said frame part, a member movable in opposite directions in said cylinder to compress air, means connected with said axle part and including a first spring for moving said member in one direction, stop means connected with the cylinder for limiting the movement of said member in said one direction, means including a second spring operatively connected with said member for moving said member in the opposite direction, the loading of said first spring being greater than the loading of said second spring, said first spring being compressed by said moving means upon engagement of said member with said stop means.

3. In a vehicle having relatively movable frame and axle parts, an air compressor operable upon relative movements of said parts, comprising a cylinder carried by said frame part, a member movable in opposite directions in said cylinder to compress air, a lever having one end pivoted to said frame part and the other end operatively connected with said axle part, a first spring operatively connecting said lever and said member, motion of said lever in one direction being imparted to said member through said spring, means including a second spring for moving said member in the opposite direction, a stop in the cylinder for limiting the movement of said member in the first direction, the loading of said first spring being greater than the loading of said second spring whereby said first spring is distorted by the movement of said lever only after engagement of said member with said stop.

4. In a vehicle having relatively movable frame and axle parts, an air compressor operable upon relative movement of said parts comprising a cylinder carried by said frame part, a piston in said cylinder, inlet and outlet valves associated with said cylinder, a member connected to said piston and extending exteriorly of said cylinder, a second member connected to said first member and provided with a flange, a return spring interposed between one side of said flange and the end of said cylinder, a lever having one end pivoted to said frame part and the other end operatively connected with said axle part, means including a second spring interposed between an intermediate portion of said lever and the opposite side of said flange, the loading of said second spring being greater than the loading of said first spring, said second spring serving to transmit movement of said lever in one direction to said flange and said piston, and a stop in the cylinder engageable by said flange upon predetermined travel in said one direction to limit the stroke of said piston, said second spring being thereafter collapsed upon further movement of said lever in said one direction whereby the lever may have greater travel than the stroke of said piston.

5. In a vehicle having relatively movable frame and axle parts, an air compressor operable upon relative movement of said parts comprising a cylinder carried by said frame part, a piston in said cylinder, inlet and outlet valves associated with said cylinder, a first member connected to said piston and having an extended portion, a second member connected to said first member above said extended portion and having a flange, a sleeve slidable on said extended portion and having a flange at its lower end, a return spring interposed between one end of said cylinder and one side of said first named flange, a second spring interposed between the other side of said first named flange and the flange on said sleeve, the loading of said second spring being greater than the loading of said first spring, a lever having one end pivoted to said frame part and the opposite end operatively connected to said axle part with its intermediate portion operatively connected with the other side of said flange on said sleeve, and a stop in the cylinder engageable by said first named flange upon its being moved a predetermined distance by the action of said lever on said second spring, said second spring being thereafter collapsed to enable continued movement of said lever a greater distance than the movement of said piston by the sliding of said sleeve on the extended portion of said piston rod.

6. The compressor in accordance with claim 5 and including a tension spring connected between said frame part and said lever to retain the intermediate portion of said lever in engagement at all times with said sleeve.

7. In a vehicle having relatively movable frame and axle parts, an air compressor operable upon relative movements of said parts, comprising a cylinder carried by said frame part, a member movable in opposite directions in said cylinder to compress air, means connected with said member and including a first spring for moving said member in one direction, other means operatively connected with said axle part and including a second spring for moving said member in the opposite direction, the loading of said second spring being greater than that of the first named spring, and loading of said second spring being approximately equal to the maximum desired output force of said movable member.

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