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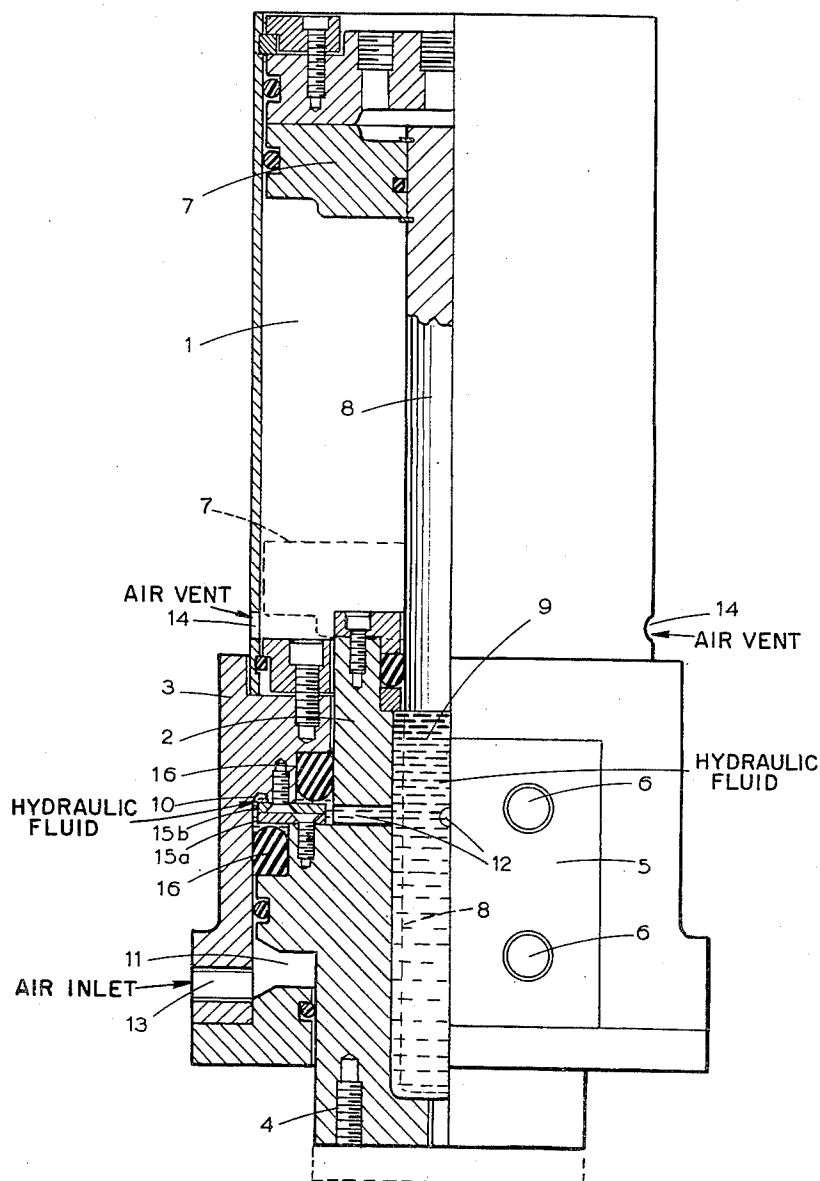
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COMBINED AIR AND HYDRAULIC PISTON AND CYLINDER DEVICES

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3 Sheets-Sheet 2

FIG. 2.



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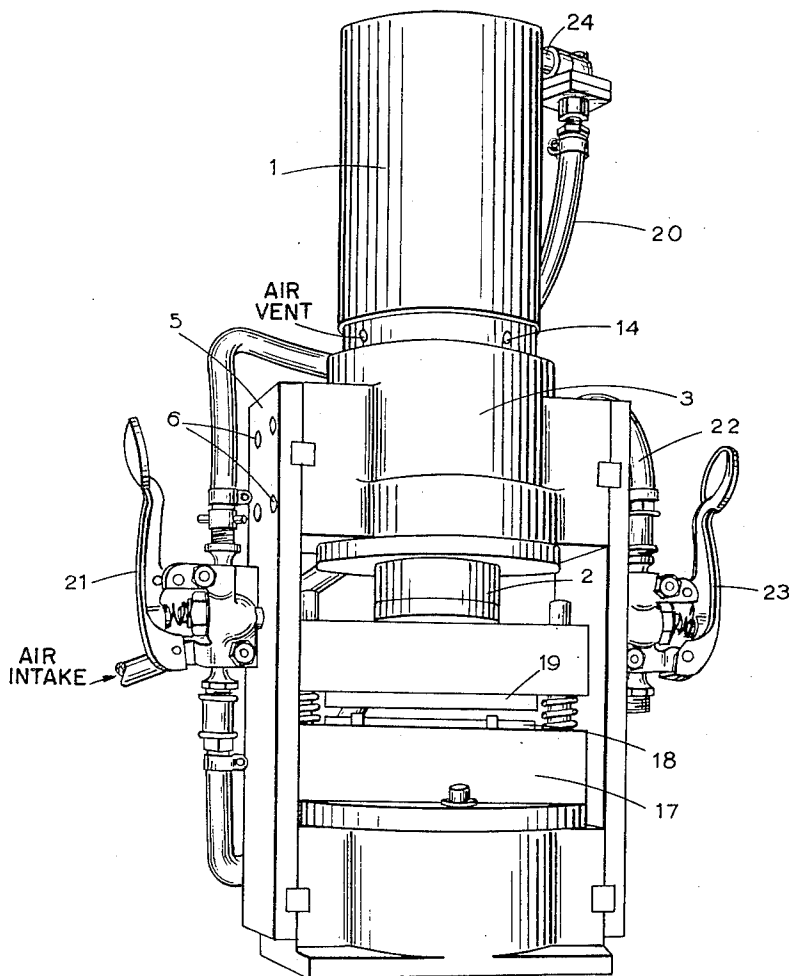
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FIG. 3.



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COMBINED AIR AND HYDRAULIC PISTON AND CYLINDER DEVICES

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2 Claims. (Cl. 60—54.5)

The subject of the present invention is a combined air and hydraulic piston and cylinder device which can be applied to operate a machine or tool in much the same way as the normal air cylinder but has the advantage that with a moderate diameter air piston high forces can be transmitted on the working stroke, which forces, if air alone were used, would involve large diameter air cylinders.

In accordance with the present invention there is mounted on a cylinder having a piston adapted to be operated by air under pressure, a work ram connected to a moving part of the machine or tool and having a central bore in which the piston rod moves, said work ram being embraced by a pressure pot mounted on a stationary part of the machine or tool, the work ram and pressure pot forming an annular chamber in communication with the bore of the work ram, into which hydraulic liquid in the work ram is forced by the piston rod on the working stroke of the piston, and forming a second annular chamber for admission of air under pressure to return the work ram and the piston to the retracted position.

One form of the invention is illustrated in the accompanying drawings in which:

FIG. 1 is an outside elevation of the device and FIG. 2 is a half side elevation half section at right angles to FIG. 1, while FIG. 3 is a perspective view showing the device applied to a small bench press.

Referring to the drawings 1 denotes the air cylinder on which is mounted a work ram 2 embraced by a pressure pot 3 which is secured to a stationary part of the machine or tool and in which the work ram 2 is adapted to be displaced. The work ram 2 is provided at its outer end with means such as stud holes 4 for attachment to the part of the machine or tool to be operated. The pressure pot 3 is provided with means such as flat surfaces 5 with stud holes 6 for the attachment of the pressure pot 3 to a stationary part of the machine or tool. The piston 7 of the cylinder 1 has a piston rod 8 which operates as a small hydraulic ram in a small bore 9 in the work ram 2. The work ram 2 and the pressure pot 3 present two annular chambers 10 and 11. The annular chamber 10 is in communication with the bore 9 of the work ram by means of radial passages 12 which serve to deliver the hydraulic liquid to the chamber 10 on the working stroke of the piston 7. The annular chamber 11 has an inlet 13 for admission of air under pressure to return the work ram 2 to its retracted position and by displacement of the hydraulic liquid to return the piston 7 to the retracted position. 14 indicates vents in the wall of the cylinder 1 for the escape of air in front of the piston on its working stroke.

As shown the annular chamber 10 contains an assembly of spacer rings 15a, 15b and high-pressure sealing rings 16 to form a pressure-tight annular chamber, the space between the spacer rings 15a, 15b and the rings 16 being in communication with the central bore by way of the passages 12 in the work ram. The spacer ring 15a is secured to the work ram 2 while the spacer ring 15b is secured to the bottom of the pressure pot 3. These rings 15a and 15b serve to retain the sealing rings in position.

In FIG. 3 showing the device applied to a small bench press, 17 indicates a base which supports the fixed die 18 while 19 is the movable die operated by the ram 2.

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indicates an air supply line to the piston to drive the latter on its working stroke. This supply line is shown as controlled by a valve 21 while 22 indicates an air supply line controlled by a valve 23 for retracting the piston.

In lieu of the construction illustrated the work ram 2 may rest on an annular pressure ring or tyre moulded in rubber-like material supported within the pressure pot 3 and forming an annular chamber similar to chamber 10, the interior of such ring or tyre being connected by passages with the small central bore in which the piston rod of the air cylinder operates.

In a further modification the annular chamber 10 may be occupied by a flexible diaphragm assembly within which is a pressure-tight space in communication with the small central bore of the work ram.

In operation of the form of the device illustrated when air pressure is applied through an inlet 24 behind the air piston 7 it descends and the piston rod 8 acts to force hydraulic liquid in the small bore 9 through the oil passages 12 into the annular chamber 10. Under this fluid pressure the work ram 2 which is connected to the moving part of the machine or tool moves with a working force which is multiplied by the ratio between the effective area of the piston rod 8 and the effective area of the annular chamber 10.

At the end of the working stroke, shown by the dotted line positions of the piston 7 and piston rod 8 in FIG. 2, the work ram 2 and air piston 7 are returned to the position shown by applying air pressure to the outer annular chamber 11 the effective area of which provides a force sufficient to cause the work ram to ascend, and by displacement of hydraulic fluid to return the air piston 7 to the higher-most position.

I claim:

1. A combined air and hydraulic piston and cylinder device for operating a movable part of a machine, comprising a pressure pot having a cylindrical inner surface mounted on a stationary part of the machine and including means for connecting the pressure pot to the stationary part of the machine, a work ram mounted in the pressure pot for axial reciprocation therein and having a cylindrical outer surface spaced from the inner cylindrical surface of the pressure pot, means at the end of the work ram adjacent the machine for connecting it to the movable part of the machine to be operated, an air operated cylinder connected to the other end of the work ram and reciprocable therewith, said work ram having a central bore extending thereto and opening toward said cylinder, a piston in the cylinder adapted to be operated by air under pressure, a piston rod attached to the piston in said cylinder and projecting therefrom into the bore in the work ram, an annular sealing means fixed to the pressure pot at its end adjacent the cylinder and slidably sealed with respect to the outer cylindrical surface of the work ram, a second annular sealing means fixed to the outer cylindrical surface of the work ram intermediate the ends thereof and slidably sealed with respect to the inner cylindrical surface of the pressure pot, said two annular sealing means in conjunction with the inner cylindrical surface of the pressure pot and the outer cylindrical surface of the work ram defining an annular chamber for containing hydraulic fluid, a passageway extending from the inner end portion of the bore in the work ram to said annular chamber between said two annular sealing means and providing communication between the bore in the work ram and said annular chamber between the work ram and the pressure pot, and a hydraulic fluid contained in said bore, said passageway and said annular chamber, said piston rod during a working stroke forcing hydraulic fluid in the bore of the work ram through the passageway into said annular chamber thereby moving the work ram in the di-

rection of the machine and effecting operation of the movable part of the machine.

2. A combined air and hydraulic piston and cylinder device for operating a movable part of a machine, comprising a pressure pot having a cylindrical inner surface mounted on a stationary part of the machine and including means for connecting the pressure pot to the stationary part of the machine, a work ram mounted in the pressure pot for axial reciprocation therein and having a cylindrical outer surface spaced from the cylindrical inner surface of the pressure pot, means at the end of the work ram adjacent the machine for connecting it to the movable part of the machine to be operated, an air operated cylinder connected to the other end of the work ram and reciprocable therewith, said work ram having a central bore extending thereinto and opening toward said cylinder, a piston in the cylinder adapted to be operated by air under pressure, a piston rod attached to the piston in said cylinder and projecting therefrom into the bore in the work ram, a first annular sealing means fixed to the pressure pot at its end adjacent the cylinder and slidably sealed with respect to the outer cylindrical surface of the work ram, a second annular sealing means fixed to the outer cylindrical surface of the work ram intermediate the ends thereof and slidably sealed with respect to the inner cylindrical surface of the pressure pot, a third annular sealing means fixed to the pressure pot at its end adjacent the machine and slidably sealed with respect to the outer cylindrical surface of the work ram, said first and second annular sealing means in conjunction with the inner cylindrical surface of the pressure pot and the outer

cylindrical surface of the work ram defining an annular chamber for containing hydraulic fluid, a passageway extending from the inner end portion of the bore in the work ram to said annular chamber between said two annular sealing means and providing communication between the bore in the work ram and said annular chamber between the work ram and the pressure pot, a hydraulic fluid contained in said bore, said passageway and said annular chamber, said piston rod during a working stroke forcing hydraulic fluid in the bore of the work ram through the passageway into said annular chamber thereby moving the work ram in the direction of the machine and effecting operation of the movable part of the machine, said second and third annular sealing means in conjunction with the inner cylindrical surface of the pressure pot and the outer cylindrical surface of the work ram defining an annular chamber for receiving air, means adjacent the third annular sealing means for introducing air into said last mentioned annular chamber to retract the work ram, the piston and piston rod and force hydraulic fluid into the bore of the work ram.

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