United States Patent

Colston

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[54] **PNEUMATIC POWER ASSIST APPARATUS FOR SPOT FILM DEVICE**

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[52] **U.S. Cl.** **250/58,** 91/45, 91/413, 91/465

[51] **Int. Cl.**.....**G01n 21/34**

[58] **Field of Search**.....91/3, 45, 196, 413, 465; 250/54, 57, 58, 66

[56] **References Cited**

UNITED STATES PATENTS

2,224,725	12/1940	Felt	91/413 X
2,789,542	4/1957	Van Der Kay	91/4 J
2,890,346	6/1959	Kizaur et al.	250/66
3,383,506	5/1968	Bock et al.	250/66

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[57] **ABSTRACT**

A three axis pneumatic power assist system particularly adapted for moving a spot film device on an X-ray table. The system is adapted to control the motion of a spot film device accurately and safely with little effort from the operator and preferably includes a wrap-around handle which allows the operator to feel the force exerted by the spot film device on a patient and to operate various controls simultaneously.

15 Claims, 5 Drawing Figures

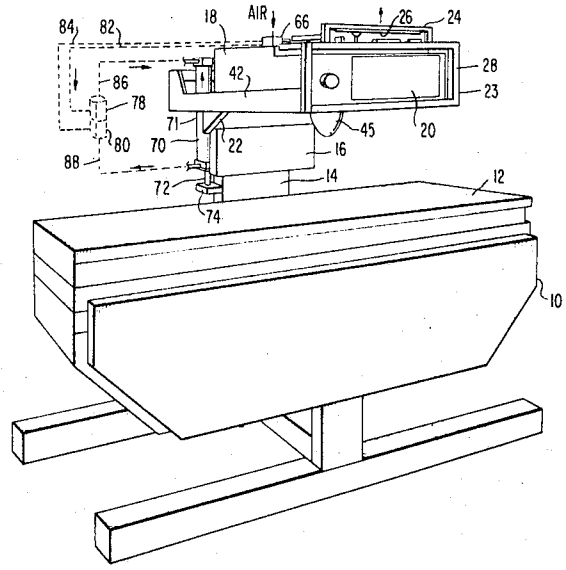

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FIG. 1

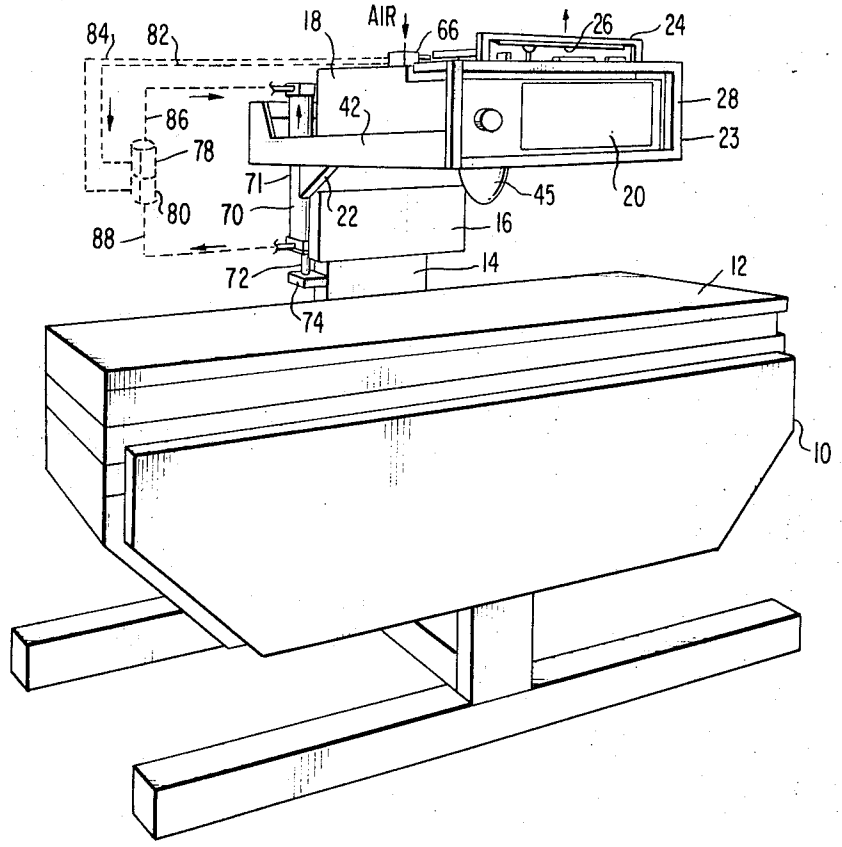

FIG. 3

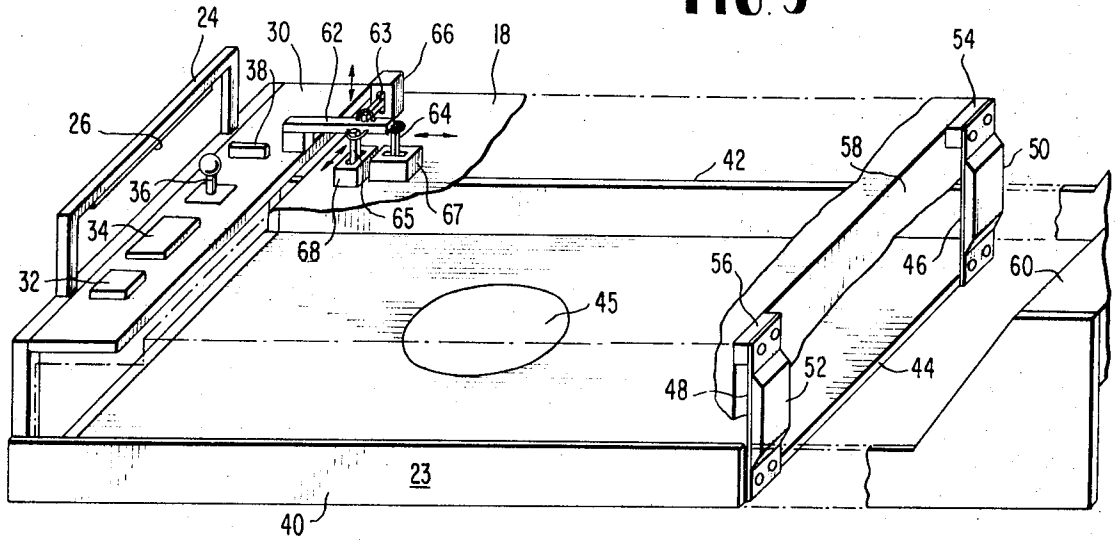

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FIG. 2

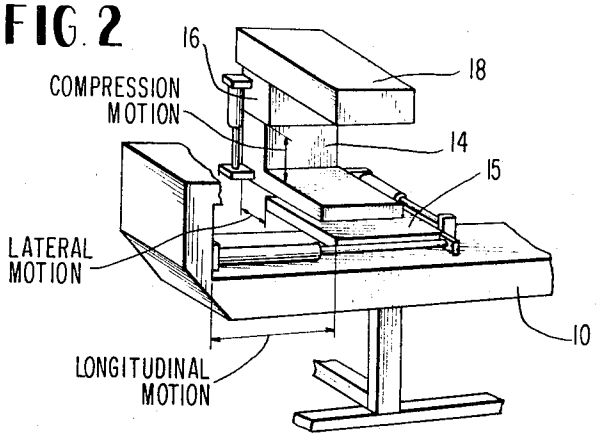

FIG. 4

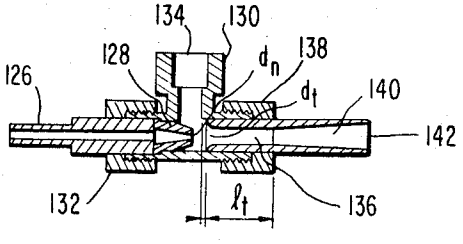

FIG. 5

PNEUMATIC POWER ASSIST APPARATUS FOR SPOT FILM DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to fluid pressure control mechanisms and more particularly to a pneumatic servo-mechanism particularly adapted to control the position of radiological apparatus.

2. Description of the Prior Art

Spot film devices are used in radiological apparatus both for fluoroscopy and radiography and generally include a spot film cassette housing which is mounted for movement upon a spot film tower. The spot film device must be able to be moved in three mutually perpendicular axes relative to the table top to obtain X-ray photographs and to make fluoroscopic observations. Currently in addition to the removable cassette, the housing may also include an X-ray image amplifier, a television camera, or other cameras mounted thereon and the tower may also move the X-ray tube, additional supporting carriages and counter balance weights. The total weight moved in the longitudinal axis of the table alone could be in the order of 1,000 pounds. As a result, the acceleration and frictional forces involved in moving this apparatus has become too high for easy operation of the equipment by radiologists and X-ray technicians.

One type of fluid pressure operated serialographic apparatus is known in the prior art. Such apparatus is disclosed in U.S. Pat. No. 2,890,346 issued to A. J. Kizaur but is limited to moving the cassette within the housing by fluid pressure carriage shifting means for selectively controlling the exposure position of the film in the cassette in a plane parallel to the top of the X-ray table. It does not, however, disclose the concept of a pneumatic servo-mechanism for moving the entire spot film device including the housing in any one or more than three mutually perpendicular axes simultaneously in order to easily bring the spot film apparatus to a selected position over the patient lying upon an X-ray table in the process of making a radiological examination.

SUMMARY

Briefly, the subject invention comprises a fluid, preferably pneumatic, power assist for apparatus movable in three mutually orthogonal axes. A pneumatic valve actuated by a control handle, two jet pump impedance changers and a fixed piston cylinder actuator coupled to the apparatus are included for each of the three axes. When the control handle actuates the valve, a pneumatic signal is coupled to one of the two jet pump impedance changers which then cause air in the cylinder to be transferred from one side of the piston to the other causing the cylinder and apparatus attached thereto to move in a predetermined direction.

In the preferred embodiment of the subject invention, it is utilized in combination with a spot film device on an X-ray table wherein the handle comprises a "wrap-around" handle which pivots near the back of the spot film cassette housing to allow effective motion of the control handle in three axes of desired spot film device motion. Additionally, the handle is counterbalanced so as not to activate the valve by its own weight and includes a "cone" on the undersurface thereof which is adapted to come in contact with a patient lying on an X-ray table. The force of the operator's hand on the wrap-around handle is nearly equal to the force of the cone on the patient providing a "feel" of the equipment on the patient.

The pneumatic valve for each axis is comprised of a pair of poppet valves separately actuable by means of a flexible linkeage coupled to the control handle. Each jet pump impedance changer includes a jet type nozzle which is directed towards a throat section causing additional fluid to be drawn from a pneumatic source through the throat by aspiration due to the fluid momentum exchange. The combined nozzle fluid in aspirated fluid flowing through the throat forms a more uniform velocity distribution as it travels the length of the throat. From the throat the fluid flows through a jet pump diffuser which decreases flow velocity while increasing the static pressure. This fluid flow is fed into the cylinder causing pressure on one side of the piston to increase, forcing the piston towards the other end of the cylinder.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a spot film device on an X-ray table incorporating the embodiment of the subject invention;

FIG. 2 is a schematic diagram of the subject invention including the power assist apparatus for the three desired axes of motion;

FIG. 3 is a perspective view partially in section of the wrap-around handle surrounding a spot film cassette housing;

FIG. 4 is a cross-sectional view diagrammatically illustrating the pneumatic power assist and locking system for the vertical axis; and

FIG. 5 is a cross-sectional view illustrative of one embodiment of a jet pump impedance changer assembly utilizable in the system shown in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Directing attention now to the drawings and more particularly to FIGS. 1 and 2, reference numeral **10** generally designates radiological examination table apparatus having a table top panel **12** for supporting an object or patient, not shown. A spot film tower **14** extends from the bottom of the table **10** past the side of the table and then upward in a direction at right angles to the table top **12**. The tower **14** is adapted, inter alia, to carry a suitable source of penetrating rays, such as X-rays, which is located beneath the table top **12**. The tower **14**, moreover, is mounted on a carriage **15** which is also located under the table **10** as shown in FIG. **2**. The carriage **15** is supported by the table **10** and is adapted to move longitudinally back and forth along the side thereof with the tower being movable on the carriage laterally relative to the top **12**.

A support elevator **16** for a spot film cassette housing **18** is mounted on the tower **14** and is adapted to move up or down from the table top **12** in an axis perpendicularly to the axes of movement of the tower **14** and carriage **15**. The housing **18** further is mounted on apparatus such as a pair of telescoping guide rails, not shown, attached to elevator **16** to permit the housing **18** to be positioned laterally, without power however,

over the table top 12 for the purpose of parking the spot film cassette housing 18 out of the way during handling of the patient under examination.

A spot film device which includes the housing 18 is well known to those skilled in the art and generally additionally embodies a fluoroscopic screen and a means for moving an encased film or cassette into and out of the X-ray beam emanating from beneath the table top 12 for making instantaneous radiographs of what the operator sees on the fluoroscopic screen. The X-ray film cassette is adapted to be inserted into the spot film housing 18 through the opening 20 and may have additional equipment mounted thereon such as an image amplifier, a television camera, a motion picture and/or a roll film camera, not shown. These additional components add to the mass of the moving parts and make the effort of moving the spot film device 18 exceedingly difficult during a radiological examination.

As illustrated in FIG. 2, the present invention provides a pneumatic power assist assembly individually for the carriage 15, the tower 14, and the elevator 16 so that the three axes of motion of the housing 18 relative to the table top 12 are easily accomplished by an operator with only a small actuating force in any direction. The actuating means for the pneumatic power assist along each of the three axes is provided by a "wrap-around" handle which is illustrated in FIGS. 1 and 3. The handle assembly includes a handle grip 24 with a pneumatic lock release bar 26. The handle grip 24 is attached to the top of a generally rectangular front frame 28 which is open to provide access to the front part of the spot film device housing 18. A flat mounting plate 30 shown in FIG. 3 is secured to the upper portion of the frame 28 and projects inwardly behind the grip 24 for providing a platform for the mounting of one or more control switches and levers 32, 34, 36 and 38. The handle grip 24 is relatively long so that it may be manipulated with either hand of the operator. The location of the switches and levers 32 ... 38 which are adapted to control the apparatus including table orientation is positioned on the mounting plate 30 so that they may be actuated by the operator while his hand is resting on the grip 24. The mounting plate 30 is attached to the frame 28 so that the force exerted by the operator between the hand grip 24 and a particular control switch or lever does not activate the power assist. The release bar 26 under the hand grip 24 is situated so that it may be operated by either or both of the operator's thumbs with or without gloves.

The wrap-around handle additionally includes a pair of laterally extending side panels 40 and 42 as well as a bottom panel 44 having a "cone" 45 attached thereto. The cone 46 has for its purpose depressing certain parts of the human anatomy such as the abdomen when the assembly including the wrap-around handle and spot film device are moved into position and lowered into contact with a patient lying on the table top 12. The wrap-around handle 23 is pivotally attached to the top rear of the spot film housing 18 by means of two flexible pivot plates 46 and 48 shown in FIG. 2 and respectively include stiffener members 50 and 52 located intermediate the ends thereof. The ends of the flexible plates 46 and 48 attach to the back end of the bottom panel 44 and the members 54 and 56 located at the upper rear portion of the back wall 58 of the spot film housing 18. Since the weight of the forward portion of the wrap-around handle including the grip 24 and the mounting plate 30 would have a tendency to tip downwardly, a counter balance weight 60 is located behind the pivot plates 46 and 48, being secured to the rear end of the side panels 40 and 42. Thus the balanced weight of the wrap-around handle 23 is suspended from the members 54 and 56 and partially enclosing the spot film device 18 as shown in FIG. 3.

When an operator grabs the hand grip 24, any force imparted thereto will cause the entire handle assembly 23 to move in accordance with the action of the flexible plates 46 and 48. For example a pulling force would cause both flexible plates 46 and 48 to buckle forwardly; however, a force tending to move the assembly longitudinally would cause the plates to buckle in mutually opposite directions i.e., one forwardly and one rearwardly. Thus the flexible plate pivots 46 and 48 allow the hand grip 24 to move in accordance with three possible orthogonal linear motions with very little angular motion and no friction forces.

In order to transmit the motion of the hand grip 24 into a signal for actuating the power assist apparatus, a mechanical link 62 (FIG. 3) is secured to the mounting plate 30 and projects over the upper portion of the spot film housing 18 and is adapted to couple to the lever arms 63, 64 and 65 of three pneumatic valves generally designated by reference numerals 66, 67 and 68 which are respectively actuated for the three desired axes of motion intended for the spot film device. The lever arm 63 is adapted to operate the pneumatic valve 66 for moving the elevator 16 up and down, the lever arm 65 is adapted to control the valve 68 which operates when movement of the tower 14 is desired, and lever housing 18 is desired laterally across the table top 12.

Since the power assist assemblies for each of the three axes of motion is comprised of like components only the assembly for a single or vertical (compression motion) axis will be considered for purposes of illustration, it being noted that simple mechanical expedients within the scope of one skilled in the art e.g., reversal of mechanical connections, are merely necessary to couple the respective assemblies to the proper elements in the proper manner for obtaining the desired result.

FIG. 2 is schematically illustrative of the relative intercoupling of the carriage 15 and the table 10 for providing longitudinal motion as well as the intercoupling of the carriage 15 and spot film tower 14 for providing lateral motion.

Referring briefly to FIG. 1, there is illustrated a cylinder actuator 70 which is rigidly secured to the elevator 16 by means of its cylinder housing 71 which is adapted to move vertically with the elevator 16 while its piston assembly including the piston rod 72 is attached to a rigid projection 74 either connected to or an integral part of the tower 14. Motion of the handle grip 24 actuates the valve assembly shown generally by reference numeral 66, which is coupled to the lever arm 64 for example such as shown in FIG. 3. Depending upon the actuation of the valve 66, a fluid power signal will be translated to either of two jet pump impedance changers shown diagrammatically in FIGS. 3 and 4 by reference numerals 78 and 80 by means of fluid lines 82 and 84 respectively. Changes in fluid on both sides of the piston 114 in the fluid actuator

cylinder 71 is effected by the output of the jet pump impedance changers by means of the lines 86 and 88. For example, in the event the hand grip 24 is raised, the valve 66 will cause a fluid signal to be coupled by means of the line 82 to the jet impedance changer 78 whereupon fluid will be transferred to the upper part of the cylinder 71 by means of the line 86 while fluid is aspirated from the lower part of the cylinder 71 by means of the jet pump impedance changer 80 which is coupled in back-to-back relationship with the other jet pump impedance changer 78 such as shown in FIG. 4. This action causes movement of the cylinder 71 upward due to the fact that the piston contained therein is fixed due to the attachment of the piston rod 72 to the tower 14 by means of the projection 74.

Reference now to FIG. 4 discloses in detail a typical embodiment of the power assist apparatus thus described. The control valve 66 is shown comprised of a poppet valve assembly including two spring biased poppet valves 90 and 92 including compression springs 91 and 93 which are adapted to selectively translate axially in response to movement of the lever arm 63 in a plane at right angles thereto. This is provided by the flexible linkeages 94 and 96 respectively, coupled to the poppet valves 90 and 92. The valve assembly 76 includes a common input chamber 98 and two separate output chambers 100 and 102. A non-lubricated pneumatic power supply, not shown, couples air under a predetermined supply pressure to the input chamber 98 by means of the fluid line 104. A tilting of the lever arm 63 to the right as shown in FIG. 4 will cause poppet valve 90 to be depressed whereupon pressurized air enters into the output chamber 100 where it is then coupled to the line 82 as a fluid input signal to the jet pump impedance changer 78. If on the other hand the lever 63 is tilted in the opposite direction, supply air in the input chamber 98 will be coupled to the line 84 from output chamber 102 as a fluid input signal to the jet pump impedance changer 80. The jet pump impedance changers 78 and 80 shown in FIG. 4 are more or less schematic in representation while FIG. 5 discloses one possible physical embodiment thereof. The fluid input signal flow from, for example, line 82 forms a jet as it flows through a nozzle 106. The jet is directed towards a throat section 108 causing additional fluid to be drawn or aspirated from a fluid source such as the other jet pump impedance changer 80 by fluid momentum exchange. The combined fluid flow through the jet pump throat section 108 forms a more uniform velocity distribution as it travels the length of the throat. From the throat section 108, the pneumatic fluid flows through a diffuser section 110 which decreases flow velocity but increases static pressure at its exit port 112.

The exit port 112 is coupled into the cylinder 71 causing pressure on one side of the piston 114 to increase. Due to the fact that the piston rod 72 is fixed, the cylinder 71 attached to the carriage 15 will move in the same direction as the movement of the lever arm 64 as shown. The pneumatic fluid on the opposite side of the piston 114 is forced by means of the action of the nozzle 106 through the diffuser section 116 and throat portion 118 in the reverse direction to the diffuser section 120. Thus flow into the piston can be provided in either direction by the double acting configuration depicted in FIG. 4. The first jet pump impedance changer 78 also includes a second diffuser section 122; however second diffuser sections 122 and 120 associated with the jet pump impedance changers 78 and 80 respectively shown in FIG. 4, can be eliminated when a configuration such as shown in FIG. 5 is utilized. Also a venting port 124 is included in the configuration shown in FIG. 4 which is adapted to be coupled to a muffler and air filter, not shown, so that no appreciable amount of ambient fluid can flow into the actuator 70. This prevents ambient contamination from entering the actuator and the jet pumps. When desired additional means, not shown, can also be included with the apparatus thus described for enhancing stability of the system.

Referring now to FIG. 5, there is disclosed an assembly drawing in cross section of a jet pump impedance changer comprised of a nozzle adapter tube 126 which couples to a fluid line, such as lines 82 or 84 shown in FIG. 4. A nozzle 128 is fitted to the opposite end of the adapter 126 inside of a pipe fitting 130. The nozzle 128 and adapter 126 are held in place by the pressure applied through a lock nut 132. The fitting 130 also includes a port 134 which is adapted to couple to a like port of a second identical assembly for providing a double acting configuration such as shown in FIG. 4. Vent means would also be included in this coupling. The nozzle 128 feeds into a throat section piece 136 which is axially aligned therewith and separated from the mouth of the nozzle 128 by a predetermined distance. The throat piece 136 has a length l_t and is fitted into the fitting 130 and held in place by a second lock nut 138. At the end of the throat section piece 136 is a diffuser section 140 which terminates at the exit port 142.

The dimensions of the jet pump impedance changer such as shown in FIG. 5 are critical and depend upon the specific application. In the subject application wherein a power assist for a spot film device is desired, the throat diameter d_t is twice the nozzle output diameter d_n. The jet pump throat length l_t is in the order of $20d_n$ while the diffuser section conical angle is in the order of 12°. Typical values for the nozzle diameter d_n is 0.0625 inches while a typical throat diameter d_t is 0.125 inches. The length of the throat section l_t is in the order of 1.25 inches.

The jet pump impedance changer overcomes the disadvantage of slow speed of response caused by large fluid capacitances of fluid actuators combined with the large fluid resistances and inductances of valves and lines. The present arrangement of back-to-back jet pump impedance changers illustrated in FIG. 4 results in faster time response of the actuator without increased areas of valves and valve lines. Pneumatic cylinder actuation, moreover, with non-lubricated air, has the advantage of being more reliable, quieter, and cleaner than other types of fluid actuation.

Having thus described the pneumatic power assist including jet pump impedance apparatus for a single axis of desired motion for a spot film apparatus, it may also be desirable to include a pneumatic locking system for holding the spot film device in position once it has been moved thereto by means of the power assist apparatus. FIG. 4 also discloses such a means. For example, reference numeral 144 designates a locking actuator

cylinder housing which includes a spring biased piston **146** which is adapted to slide back and forth on the piston rod **72**. A generally truncated conical brake shoe **148** is attached to one side of the piston **146** and is forced into engagement with a conical recession **150** in the outer portion of the cylinder wall **152** of the cylinder actuator **70**. The compression spring **152** in the housing **144** normally urges the brake shoe **148** against the seat **150** thus preventing any movement of the cylinder **71**. A pneumatic air supply line **154** is coupled from a second supply line **156** which is adapted to feed pressurized air into a recessed chamber **158** located in the underside of the hand grip **24** (FIG. **3**). The release bar **26** which forms one wall of the chamber **158** is biased against the shoulder **160** in the handle **24** by means of one or more springs **162**. When the release bar **26** is grabbed and depressed by the operator, the line **156** is shut off and the supply air is then fed to the line **154**, which is sufficient to cause the piston **146** and the brake shoe **148** to retract, thereby releasing the cylinder **71** for movement. When the bar **26** is released, the pressure against the piston **146** is released and the force of the spring **152** will again urge the brake shoe **148** forward to engage the recessed portion **150**.

Although not shown, a pressure regulator is preferably incorporated in the air supply line which regulates the power supply pressure to any desired pressure of for example 30 psi or less. In addition to acting as a pressure limiter, the pressure regulator will act as a gain adjustment for the power assist. A 30 psi supply pressure results in a sensitive control with fast response. Lowering the supply pressure decreases the sensitivity in response which requires the operator to apply more force on the control handle. Some operators may want this increased "feel". Also a coalescing filter may be located upstream of the pressure regulator to remove any contamination particles including those of sub-micron size. This prevents contamination from building up in the power assist components to obtain long life and high reliability. Also clean unlubricated air results in negligible pollution. If the supply area upstream of the coalescing filter is extremely dirty, it is best to use a five micron filter with an automatic drain just upstream of the coalescing filter. For safe operation of an X-ray table with the apparatus disclosed in the present invention, the limiting maximum actuation force should be less than 50 pounds and the maximum actuation velocity should be limited to less than 15 inches per second for a supply pressure in the range of 30 psi or less. If for some reason a control system fails with the maximum operating force pressing against the patient, the operator can still conveniently force the spot film device away from the patient.

What has been shown and described, therefore, is a three axes power assist system particularly useful for moving a spot film device on an X-ray table. The apparatus for each axis includes a jet pump impedance changer which is a component for increasing the speed of response of the fluid powered control system. The wrap-around handle with a cone and control switches and levers mounted on it allows the operator to feel the force of the spot film device on the patient and to operate control switches and levers with a hand that is simultaneously operating the power assist. Finally a pneumatic locking system is also disclosed so that the spot film device will not drift if the control system becomes slightly unbalanced over a long period of time and merely requires an operator's thumb under the handle to depress a bar that applies a release pressure to three spring loaded brakes, one on each axis.

The terms and expressions which have been employed herein are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is to be recognized that various modifications are possible within the scope of the invention as claimed.

I claim as my invention:

1. A hand operated fluid powered positioning servosystem comprising in combination:

a first member and a second member movably mounted on said first member;

a fluid actuator comprising a cylinder and a piston selectively coupled between said first and second member, said cylinder having at least one port selectively located on one side of said piston for coupling actuating fluid thereto;

a control handle;

fluid valve means normally biased to a closed position coupled to said control handle and selectively operated thereby to an open position, said valve means including fluid input means coupled to a pressurized fluid source and at least one fluid output means, and being adapted to feed fluid from said input means to said at least one output means in response to movement of said control handle;

a jet pump fluid impedance changer including nozzle means adapted to receive a fluid input signal from said at least one output means of said valve means, a throat section axially aligned with said nozzle means and having a dimension thereacross substantially greater than the inside diameter of the output of said nozzle means, a diffuser section located adjacent said throat section and having an inner surface diverging away from said throat section and being axially aligned with said nozzle means, and fluid supply means located in close proximity to said nozzle means and being adapted to supply additional fluid to said throat section as a result of aspiration caused by the flow of said fluid input signal from said nozzle means whereby the combined fluid flow forms a uniform velocity distribution as it travels the length of the throat section and upon passing through the diffuser section decreases flow velocity but at the same time increases static pressure at the output of said diffuser section;

first fluid circuit means coupling said at least one fluid output means to said nozzle means for coupling a fluid input signal to said nozzle means when said valve means is in said open position; and

second fluid circuit means coupling the diffuser section of said jet pump fluid impedance changer to said at least one port of said cylinder feeding actuating fluid thereto and causing movement of said second member due to the increase of static pressure on said one side of said piston.

2. The invention as defined by claim **1** wherein said cylinder is secured to said second member and said piston is secured to said first member.

3. A hand operated fluid powered positioning servosystem comprising in combination:

a work station having a base member and a support member movably mounted thereon;

fluid motor means including a cylinder and a piston coupled between said movable member and said base member, said cylinder additionally having a first and a second port respectively located on each side of said piston for coupling an actuating fluid thereto;

a control handle adapted to move in a first and a second direction along the common axis;

valve means normally biased to a closed position coupled to said control handle and operated thereby to a first and second open position in response to movement of said control handle in said first and second direction, respectively, said valve means including common fluid input means coupled to a pressurized fluid source and separate first and second fluid output means for selectively feeding fluid from said input means during said first and second open position respectively;

first and second jet pump fluid impedance changers each comprising, a nozzle adapted to receive a fluid input signal from said valve means, a throat section axially aligned with said nozzle and having a dimension thereacross substantially greater than the inside diameter of said nozzle, a diffuser section located axially adjacent said throat section and being adapted to receive the output thereof and having a diverging surface away from said throat portion, and fluid supply means located in close proximity to said nozzle and being adapted to supply additional fluid to said throat section as a result of aspiration caused by the flow of a fluid input signal from said nozzle whereby the combined fluid flow forms a uniform velocity distribution as it travels the length of said throat section and upon passing through said diffuser section decreases flow velocity while increasing static pressure at the output thereof and providing said actuating fluid thereby;

first fluid circuit means coupling said first and second fluid output means of said valve means respectively to the nozzle of said first and second impedance changers;

second fluid circuit means commonly coupling said first and second jet pump fluid impedance changers to configure said fluid supply means; and

third fluid circuit means coupling the output of said diffuser section of said first and second fluid impedance changers respectively to said first and second port of said fluid actuator cylinder assembly.

4. The invention as defined by claim 3 wherein said work station comprises radiological apparatus, said base member of said work station comprises a radiological examination table and said support member comprises a carriage for a spot film tower.

5. The invention as defined by claim 3 wherein said work station comprises radiological apparatus, said base member of said work station comprises a carriage for a spot film tower and said support member comprises a spot film tower.

6. The invention as defined by claim 3 wherein said work station comprises radiological apparatus, said base member of said work station comprises a spot film tower for a spot film device and said movable support member comprises elevator means supporting said spot film device.

7. The invention as defined by claim 3 wherein said work station comprises radiological apparatus including an examination table and radiological examination means associated therewith.

8. The invention as defined by claim 7 and wherein said control handle additionally includes attachment means pivotally securing said handle to said examination means.

9. The invention as defined by claim 8 wherein said examination means comprises a spot film device including a cassette housing and wherein said control handle is pivotally attached to said housing.

10. The invention as defined by claim 9 wherein said control handle comprises a structure partially enclosing said cassette housing of said film spot device, said structure including a generally open front frame portion, a hand grip secured to the top of said front portion, a mounting plate for control switches mounted on said front portion adjacent said hand grip and projecting rearwardly thereof, a bottom portion secured at one end to said front portion, a pair of flexible pivot plates attached at one end to the other end of said bottom portion being in mutually spaced apart relationship by a predetermined distance and attached at their respective other ends to the rear of said housing.

11. The invention as defined by claim 10 wherein each of said pair of flexible pivot plates additionally includes stiffener means located intermediate the ends thereof.

12. The invention as defined by claim 10 wherein said control handle additionally includes a pair of side panels extending from the front frame portion to beyond the end of said bottom portion and additionally including counter balance means secured between said side panels a predetermined distance behind said flexible pivot plates.

13. The invention as defined by claim 10 wherein said valve means recited in claim 3 additionally includes a lever arm for actuating said valve means and additionally including actuator means mounted on said mounting plate coupled to said lever arm whereby movement of said control handle in response to an operator gripping and applying force to said hand grip translates the movement thereof in one of three mutually perpendicular axes to said lever arm.

14. The invention as defined by claim 3 wherein said valve means comprises a poppet valve assembly comprised of a first and second spring biased poppet valve, a valve housing including an input chamber and a first and second output chamber respectively forming said input means and said first and second output means thereby, and additionally including means locating said first poppet valve between said input chamber and said first output chamber and the second poppet valve between said input chamber and said second output chamber.

15. The invention as defined by claim 1 wherein said fluid actuator includes a piston rod attached to said piston and additionally including a fluid powered braking and locking system for preventing drift of said fluid actuator during a rest condition of operation, said

locking system comprising spring biased brake shoe means attached to said piston rod, being normally urged against said cylinder and additionally including means actuable by said control handle for coupling a fluid signal to said brake shoe which is adapted to operate against said spring bias to retract said brake shoe means from said cylinder.

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