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SELF-MANIFOLDING CYLINDERS

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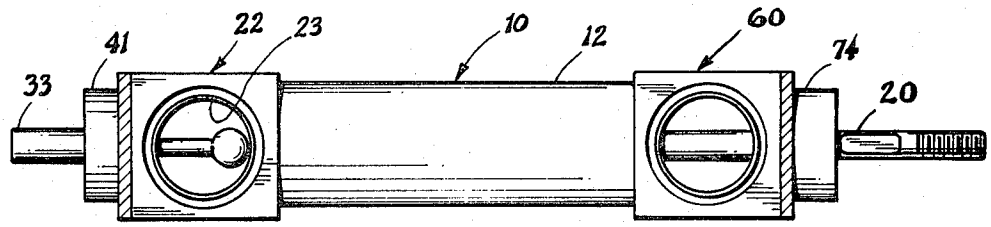


FIG. 1

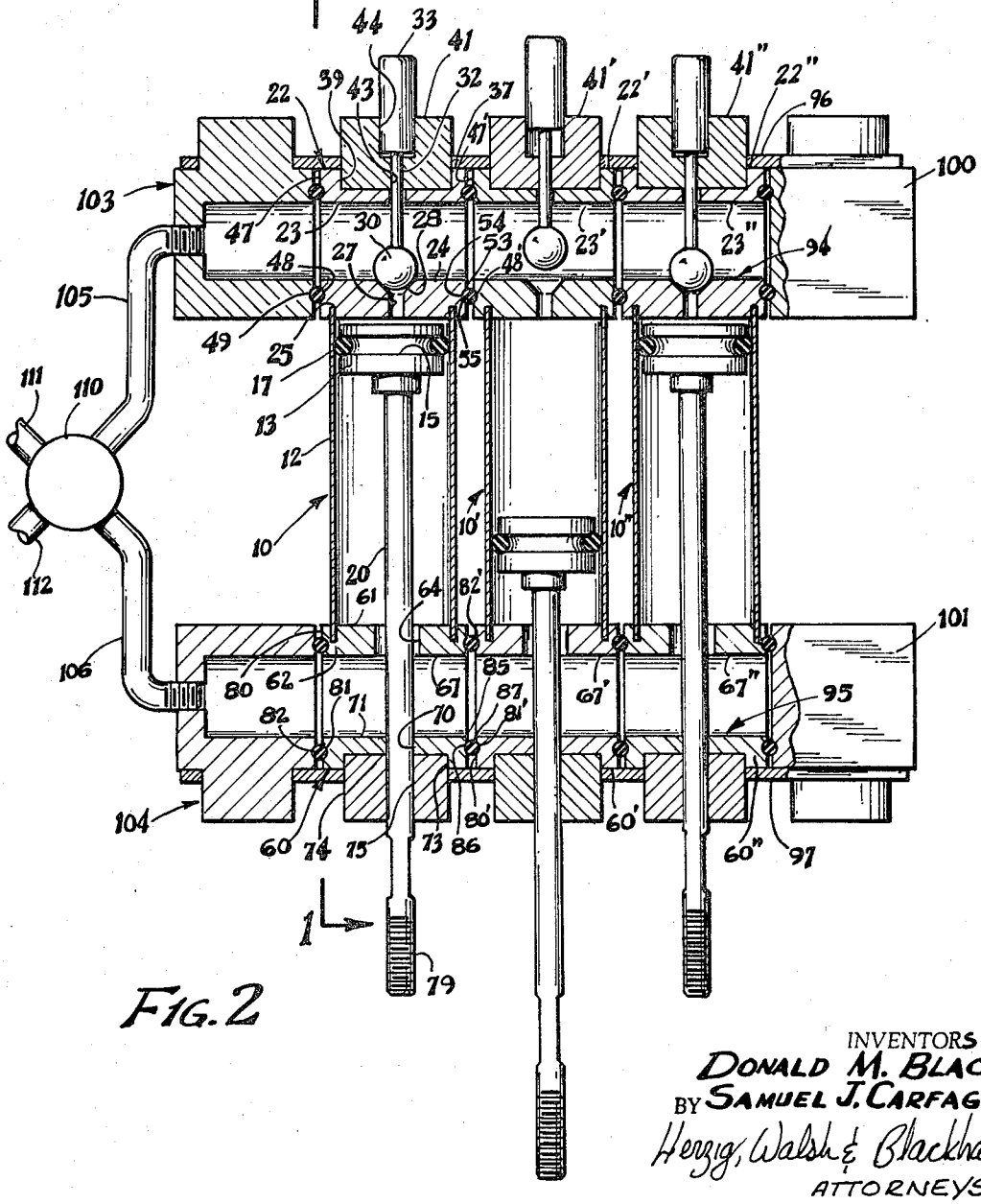


FIG. 2

INVENTORS
DONALD M. BLACK
BY SAMUEL J. CARFAGNO
Herzig, Walsh & Blackham
ATTORNEYS

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SELF-MANIFOLDING CYLINDERS

Donald M. Black and Samuel J. Carfagno, Chatsworth, Calif., assignors to Flexible Packaging Equipment, Inc., Chatsworth, Calif., a corporation of California

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ABSTRACT OF THE DISCLOSURE

The invention relates to fluid actuating cylinders. By the structure of the invention, groups of cylinders are assembled in parallel with manifolds provided directly across the ends of the cylinders, that it, the cylinders being joined directly to the manifolds. In one manifold there are provided valves controlling communication between the manifold and individual cylinders. The piston rods of the cylinders extend through the other manifold. In a preferred form of the invention, the manifolds are formed by way of modular units at the ends of the cylinders which are juxtaposed against each other in sealing relationship to provide a continuous manifold across the ends of the cylinders.

This invention relates to improvements in fluid cylinders having fluid-driven pistons in them. They may be cylinders constituting pneumatically or hydraulically driven actuators. In the exemplary form of the invention as described herein, it is described as being applied to pneumatically-driven double-acting cylinders. The pistons of the cylinders have actuating stems which are reciprocated, and may be utilized to perform any desired operating function. In the specific exemplary form of the invention, the cylinders or actuators may be utilized to operate punches for punching holes in polyethylene material which will serve as aerating holes in bags formed of the polyethylene.

The invention as described herein is intended to solve particular problems and to serve particular purposes in the art. Air or fluid operated actuators (i.e.) air cylinders are widely used for performing various functions wherever a type of actuator having a linear stroke is appropriate. For certain types of service or duty, it is necessary to have a plurality of actuators assembled together, each actuator individually performing a desired function. The air cylinders or actuators may be operated from a common source of air under pressure, for example, and they may be connected to a common discharge line. Furthermore, it is usually desirable to provide valve means for individually controlling the respective air cylinders.

In the past, the setting up of an installation of the type described has required a substantial amount of equipment for purposes of making connections between air cylinders; making connections to the source of operating pressure; and providing valves in these connections for control of the air cylinders. It is a primary object of this invention to greatly simplify and make more economical the setting up of an installation of this type, particularly by eliminating the need for a substantial part of the equipment that would otherwise be required, and the time involved in setting up the apparatus.

In the preferred exemplary form of the invention, air cylinders are provided having end parts having transverse channels therethrough, the cylinders being constructed so that the end parts can be directly manifolded and sealed together so as to provide a continuous manifold at each end of the assembly of manifolded cylinders. Preferably, each cylinder has an end part or unit having the transverse channel in it, and a built-in valve cooperating with a port controlling the admission of operating air to the cylinder.

The manifolds at opposite ends of the assembly can be alternately connected to a source of pressure for operating the pistons in the cylinders in first one direction and then the other, the side of each piston which is not exposed to pressure being connected to a discharge line. The piston rod or stem of each unit is connected to its individual tool for performing a desired operation.

From the foregoing, it may be observed that in order to provide air cylinders or actuators for multiple individual operations, the result can be very effectively realized merely by manifolding the cylinders together in the manner described (i.e.) that is, merely by juxtaposing the air cylinders together in sealing relationship with each other to provide a manifold at each end of the assembly.

A further specific object of the invention is to contribute to the result desired as described, by providing a valve built into the end part of each air cylinder and controlling a port providing admission of operating fluid to that cylinder. In the exemplary form of the invention, this valve is shown as a manual shut-off valve, although it might be a throttling valve or an automatically-operated valve.

A further object of the invention is to provide an air cylinder of the type described having end parts, the end parts having transverse channels which are normal to the bore of the cylinder; the said end parts having flat exterior surfaces adapted to be brought into sealing juxtaposition with similar flat surfaces on other air cylinders whereby to provide continuous manifolds at opposite ends of an assembly of the said cylinders.

Further objects and additional advantages of the invention will become apparent from the following detailed description and annexed drawings, wherein:

FIGURE 1 is a view of one of the air cylinders of the invention; and

FIGURE 2 is a cross-sectional view of a group of the air cylinders showing them manifolded together.

Referring now to the figures of the drawing, numeral **10** designates one of the air cylinders. It comprises a tubular body **12** made of any suitable material. In the body is a piston **13** having an annular groove **15** in it, in which is a sealing O-ring **17**. The piston **13** is connected to a piston rod or stem **20** which will be referred to again presently.

At one end of the cylinder is a part or member in the form of a rectangular block **22** having in it a cylindrical passageway or channel **23** which is normal to the bore in the cylinder **10**. One face of the end member **22** has an annular groove or slot **25** in it and the end of the cylinder **12** is seated in this groove. The side **24** of the member **22** has a channel or orifice **27** through it, one end of which is tapered, as shown at **28**, to provide a sea for a ball valve **30**. The valve **30** is operable by a stem **32** having a handle **33** on its end. The channel or orifice **27** communicates with the interior of the cylinder **10** on one side of the piston **13**. One side **37** of the member **22** has a cylindrical recess **39** in it and seated in this recess is a cylindrical member **41** having a central bore **43** through which the stem **32** passes. The bore **43** connects with a counterbore **44** in which the handle **33** is received.

The end face **47** of the member **22** has an annular groove **48** in it in which is received a sealing O-ring **49**. The end face **53** of the part **22** has an annular groove **54** in it in which is received a sealing O-ring **55**.

At the opposite end of the cylinder **12** is a part or member **60** which is similar to the part **22**. Formed in its inner face **61** is an annular groove or slot **62** in which is received the other end of the cylinder **12**. This side of the part **60** has an aperture **64** through which the stem **20** of the piston passes. This part **60** has a transverse bore or channel **67** similar to the transverse bore or channel **23** in the part **22**. The stem **20** passes through an opening **70** in the other side or face **71** of the part **60**. This side of the part

60 has a circular recess 73 in it in which is received a cylindrical member 74. This member has a central bore 75 and the stem 20 passes outwardly through this bore. The stem 20 is threaded at its end, as shown at 79, for attachment thereto of any type of tool to be reciprocated, such as a punch. The punch may be of a type suitable to punch holes in polyethylene material to provide aerating holes in bags made from the polyethylene material. Of course, any other type of service might be performed also. In the end face 80 of the part 60 there is an annular groove 81 and provided in this groove is a sealing O-ring 82. In the end face 85 of the part 62 there is provided an annular groove 86 in which is provided a sealing O-ring 87.

Numerals 10′ and 10″ designate two additional air cylinders which are identical in construction to the air cylinder 10. Inasmuch as the cylinders are identical in construction, they need not be described in detail.

The cylinders as described are self-manifolding. FIGURE 2 shows the manner in which the cylinders are manifolded together. As may be seen, the face or side 53 of part 22 of cylinder 10 is juxtaposed against the face or side 47′ of the part or member 22′ of cylinder 10′. When these faces are thus brought together, the annular grooves 54 and 48′ are opposite each other with an O-ring 55 in the grooves and sealing these faces together.

Similarly, the face 85 of part 60 at the other end of cylinder 10 is brought into facing juxtaposition with the face 80′ of the part 60′ at the other end of cylinder 10′. The annular grooves 86 and 81′ are now opposite each other with an O-ring 87 in these grooves providing sealing relationship between these parts of the two cylinders.

Cylinder 10″ is similarly manifolded to the cylinder 10′.

All of the air cylinders may be operated together or individual cylinders may be operated. It will be observed that the transverse channels 23, 23′ and 23″ form a continuous manifold 94 at one end of the assembly. The transverse channels 67, 67′ and 67″ form a continuous manifold 95 at the other end of the assembly. Thus, it will be seen that any number of air cylinders may be manifolded together in the manner described to provide a desired number of individual actuators at a single location. The cylinders may be held or clamped together in any suitable manner. A preferred manner is by the use of plates having spaced apertures sized to fit over the circular members 41, 41′ and 41″, a similar plate being used at the opposite ends of the cylinders. The plates are designated at 96 and 97. When the desired number of actuators has been manifolded together in this manner, the manifolds 94 and 95 are closed at one end. This may be done simply by securing an additional member like member 22″ to it, in the same manner, the additional member not having the transverse channel or bore through it. Such members are designated at 100 and 101, sealed to members 22″ and 60″ by O-rings as shown. Manifolds 94 and 95 are closed at the left end by members 103 and 104, similar to members 22 and 60, to which threaded connection is made with lines 105 and 106. Members 103 and 104 are closed at one end as shown, having threaded openings for lines 105 and 106. All of the members 100, 101, 103 and 104 have the extending cylindrical parts to be received in apertures in plates 96 and 97 for holding the components together in sealed relationship.

Numeral 110 designates a four-way valve connected to inlet pipe 111 and outlet pipe 112. The pipe 111 may be connected to a source of suitable operating pressure and the pipe 112 may be connected with a discharge line. The four-way valve 110 may be operated cyclically and this operation may be automatic. For example, it may be operated at the rate of 150 cycles per minute to admit air under pressure to first one of the manifolds 94 and 95 and then the other through lines 105 and 106.

When one manifold is connected to the pressure source, the other is connected to the discharge line. Thus, with each of the valves 30 open, each of the air cylinders in the assembly would perform a reciprocating actuating stroke at the rate of 150 strokes per minute. In the event it should be desired to inactivate any particular cylinder, this would be accomplished simply by closing its individual valve 30 preventing air from entering that particular cylinder. In FIGURE 2, pressure in the manifold 94, of course, drives the pistons downwardly, and pressure in the manifold 95 drives the pistons upwardly.

From the foregoing, those skilled in the art will understand the nature of the construction, operation and purpose of the invention and will appreciate that it achieves and realizes all of the objects and advantages set forth in the foregoing, as well as having many additional advantages that are apparent from the detailed description. As may be seen, the invention ideally adapts itself to the situation wherein it is desired to accomplish a plurality or a large number of individual actuations at a given site. It avoids the problem and necessity of individually mounting a large number of cylinders at a given location. This comes about because of the fact that the air cylinders described herein are assembled together into a unitary compact package. It is unnecessary to provide tubing or piping for connecting or manifolding the cylinders together because they are self-manifolding; that is, when juxtaposed together, the cylinders provide their own manifolds at opposite ends. There are no piping connections between cylinders. To then provide for operation, it is only necessary to make connections to the manifolds at the opposite ends of the cylinders, which is done in a very simple way as described.

Furthermore, it is not necessary to provide separate lengths of piping and valves for control of individual cylinders. This comes about because each cylinder has its own built-in valve unit at one end. Thus it may be seen that the invention makes substantial contributions from the standpoint of economies in construction and fabrication, as well as in assembly and maintenance as well as savings in time in these areas.

While the invention has been described herein in exemplary form, as applied to an air cylinder or actuator, it should be understood, of course, that the invention is equally applicable to cylinders operated by other fluids, such as hydraulically-operated cylinders. The invention may be adapted in cylinders which are single-acting as well as double-acting.

The foregoing disclosure is representative of a preferred form of the invention and is to be interpreted in an illustrative rather than a limiting sense, the invention to be accorded the full scope of the claims appended hereto.

What is claimed is:

1. In apparatus of the character described, in combination, a cylinder having a movable piston therein, a fitting at an end of the cylinder having a channel therethrough, a second similar cylinder having a similar end fitting, said end fittings having faces configurated adapting them to be brought into juxtaposed sealing relationship in a manner whereby the channels through the fittings form a continuous manifold adapted to have communication with the cylinders.

2. A construction as in claim 1 wherein said faces of the end fittings are flat and embody means to provide sealing engagement between the said faces.

3. A construction as in claim 1 wherein each of said fittings has a port providing communication with the interior of the cylinder, and valve means carried by the fitting controlling said port.

4. A construction as in claim 1 wherein said first cylinder has a similar fitting at the opposite end having a channel therethrough, said second cylinder having a similar fitting at its opposite end, the said fittings at the opposite ends being configurated so as to adapt them to be brought into juxtaposition in sealing relationship whereby the channels therein form a continuous manifold, at the opposite end of the assembly.

5. A construction as in claim 1 wherein the pistons in said cylinders have stems extending through the fittings at the second ends of the cylinders.

6. A construction as in claim 1 including means for connecting and disconnecting the manifolds formed at opposite ends of the assemblies of cylinders to a source of fluid pressure.

7. A construction as in claim 1 including means for closing the ends of the said manifold and alternately admitting pressure thereto.

8. A construction as in claim 1 for holding the cylinders in juxtaposed relationship.

9. A construction as in claim 8 wherein said means comprises at least one plate having spaced apertures fitting over similarly spaced protuberances on the said fittings.

10. In an apparatus of the character described in combination, a plurality of parallel cylinders having pistons therein, means at one end of the cylinders forming a manifold extending transversely to the axes of the cylinders and all cylinders being joined directly to the said manifold, means at the opposite ends of the cylinders forming a second manifold extending transversely to the

axes of the cylinders and all of the cylinders having communication with the second manifold, a plurality of individual valves, each individual valve being positioned to control the path of communication between one of said cylinders and said first manifold, and the said valves being within the first manifold.

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EDGAR W. GEOGHEGAN, *Primary Examiner.*

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60—52; 92—128, 255; 137—608