

BICYLINDER ACTUATOR FOR A PLASTICS INJECTION MOLDING
MACHINE

BACKGROUND OF THE INVENTION

This invention relates to an injection actuator for a plastics injection
5 molding machine, and more particularly to an injection actuator having an
auxiliary actuator for optional operations.

It is known that, usually, two parallel injection actuators 1 of single
cylinder, as shown in Fig 1, are used in a plastics injection molding
machine. A pair of hydraulic actuators 1 are correspondingly mounted on
10 two sides of a screw conveyor 7. Said screw conveyor 7 is a well-known
device in the field of plastics injection moulding technique and has a frame
71 with a rotary shaft 72 extending outwardly rearwardly and a barrell 73
extending outwardly frontwardly therefrom. Each of the hydraulic
actuator 1 includes a cylinder 10 which is closed at two ends 14, 15
15 thereof and in which is mounted linearly a movable piston rod 11 in a
fluid-tight relationship with the closed end 14. At an end inside the
cylinder 10 of the piston rod 11 is situated a linear piston 12 which is
associated with appropriate piston packings 121. The piston rod 11
protrudes from the closed end 14 and extends parallel to the rotary shaft
20 72 of the screw conveyor 7. The two piston rods 11 and the rotary shaft
72 terminate at a bearing set 4, as shown in Fig 2, and secured thereto.

Referring to Fig 2, the two hydraulic actuators 1 associated with the

screw conveyor 7, the bearing set 4 and an electricity-powered hydraulic motor 3 are mounted on a slidable platform 51. In operation, the hydraulic motor 3 is turned on to drive the rotary shaft 72 together with a screw (not shown) of the screw conveyor 7 to rotate so as to feed material, then the platform 51 is slid frontwardly into a preset position by means of a hydraulic actuator 5 so that all of the hydraulic actuators 1, screw conveyor 7, bearing set 4 and the hydraulic motor 3, etc. are shifted into their injection positions. the hydraulic fluid or oil is admitted into the cylinders 10 that forces the pistons 12 and the piston rods 11 of the two actuators 1 to move frontwardly.

Said frontward movement of the two synchronous hydraulic actuators will drive the screw conveyor 7 to inject through the bearing set 4 so that the injection activity of its plastics injection moulding machine is accomplished. The platform 51 is then slid backward into its original position for a second working cycle.

In practice, different products made through a plastics injection molding process may need different injection pressures. As the hydraulic actuators of a conventional molding machine are fixed in their dimensions. Said various injection pressures can be achieved only by adjusting output power of the hydraulic pump. It means a hydraulic pump of wide range in output power rendering high cost in manufacture is necessary to a conventional moulding machine.

OBJECTS OF THE INVENTION

An object of this invention is to diminish the disadvantages of a known hydraulic actuator, used in a plastics injection molding machine and to allow for optional operations both in ranges of injection pressure and speed.

SUMMARY OF THE INVENTION

The present invention provides a bicylinder actuator for a plastics injection molding machine comprising:

10 a first cylinder having two closed ends including a leading closed end and a lagging closed end for receiving a hydraulic fluid, a first piston slidably mounted within the first cylinder and bounding a leading chamber and a lagging chamber in the first cylinder, first port means for admitting and returning the hydraulic fluid respectively communicated with the leading chamber and the lagging chamber and an axial piston rod slidably mounted through the lagging closed end in a fluid-tight relationship with an end outside the first cylinder thereof for connecting to a bearing set of a plastics injection molding machine and its other end inside the first cylinder attached to the first piston; and

20 a second cylinder coaxially attached to the leading closed end of the first cylinder, a second piston slidably mounted within the second cylinder and having its periphery sealingly engaged with an inner surface of the

second cylinder to form a variable chamber in the second cylinder for receiving a hydraulic fluid, a second port means for admitting or returning the hydraulic fluid communicated with the chamber in the second cylinder and an axial connecting rod slidably mounted through the leading closed
5 end in a fluid-tight relationship and interconnecting the first piston of the first cylinder and the second piston of the second cylinder.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig 1 is a partial cross-sectional view of a pair of known hydraulic
10 actuators secured to a known screw conveyor;

Fig 2 is a front elevational view of a plastic injection molding machine having a hydraulic actuator according to the present invention;

Fig 3 is a partial cross-sectional view of a pair of hydraulic actuators according to the present invention secured to a known screw
15 conveyor;

Fig 4 is a cross-sectional and diagrammatic view of a hydraulic actuator of the present invention in super high pressure injection operation;

Fig 5 is a cross-sectional and diagrammatic view of a hydraulic
20 actuator of the present invention in high speed injection operation; and

Fig 6 is a cross-sectional and diagrammatic view of a hydraulic actuator of the present invention in super low speed injection operation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in Fig 3, a pair of parallel bicylinder injection actuators for a plastics injection molding machine are correspondingly and laterally secured to two side of a frame 71 of a conventional screw conveyor 7 which is all the same as the screw conveyor shown in Fig 1. Each of the hydraulic actuator is a bicylinder hydraulic actuator combining a primary actuator 1 and an auxiliary actuator 2 axially attached to the primary actuator 1.

The primary actuator 1 has a primary cylinder 10 which is closed at two ends thereof by means of a leading end packing gland 15 and a lagging end packing gland 14. A movable piston rod 11 is linearly mounted in fluid-tight relationship with the lagging end packing gland 14 in the primary cylinder 10. At an end inside the primary cylinder 10 of the piston rod 11 is situated a linear piston 12 which is associated with appropriate piston packings 121. The piston rod 11 protrudes from the closed end 14 and extends parallel to the rotary shaft 72 of the screw conveyor 7. The two piston rods 11 and rotary shaft 72 terminate at a bearing set 4, as shown in Fig.2, and secured thereto.

At the closed ends, the leading end packing gland 15 and the lagging end packing gland 14, of the primary cylinder 10 are respectively provided with two ports 141, 152 leading to a lagging end chamber 101 and a leading end chamber 102 divided by the piston 12 in the inner

chamber thereof.

The auxiliary actuator 2 also has an auxiliary cylinder 20 which is axially attached to the primary cylinder 10 by means of the leading end packing gland 15. The auxiliary cylinder 20 is preferably smaller in dimension than the primary cylinder 10, and preferably the auxiliary cylinder 20 is smaller in cross-sectional dimension yet the same or even longer in length in comparison with the primary cylinder 10 as shown in Figs. 3 to 6. The auxiliary cylinder 21 has an auxiliary piston 22 therein which is associated with an appropriate piston packing 221.

The auxiliary piston 22 and the primary piston 12 are interconnected by an axial connecting rod 16 which passes slidably through and is kept in a fluid-tight relationship with the leading end packing gland 15 and terminated with nuts 251 to secure the auxiliary piston 22 thereto. The leading end packing gland 15 is further provided with a port 151 leading to the inner chamber 201 of the auxiliary cylinder 20 of which the leading end is fitted with a circular cap 25 having an axial hole 250 therein which allows the nuts 251 to pass in reciprocation therethrough.

The provision of the auxiliary hydraulic actuator 2 allows optional operations both in the ranges of injection pressure and injection speed of a plastics ejection moulding machine hereof. In super high pressure ejection operation, as shown in Fig 4, the hydraulic fluid or oil is pumped

by the hydraulic pump and is admitted into the chambers 101, 201 through the ports 141, 151, and the hydraulic fluid or oil in the leading chamber 102 is returned through the port 152. Due to the entering hydraulic fluid or oil in the chambers 101, 201, the two pistons 12, 22 are synchronously moved frontwardly to inject molten plastic material into a mould therewith. Vice versa, the hydraulic fluid or oil is admitted into the leading chamber 102 of the primary cylinder 10 through the port 152 to return the two pistons 12, 22 and the hydraulic fluid or oil in the chambers 101, 201 are returned through the ports 141, 152. A super high pressure injection is rendered by the movements of the auxiliary piston 22 as well as the primary piston 12.

In high speed injection operation, as shown in Fig.5, the primary actuator 1 is idle and the hydraulic fluid or oil is admitted only into the chamber 201 of the auxiliary cylinder 20. Due to the small size of the auxiliary cylinder 20, the injection speed actuated by the piston 22 is fast. The pistons 12, 22 can be returned by admitting the hydraulic fluid or oil into the leading end chamber 102 of the primary cylinder 10. Similarly, a low speed ejection can be performed by admitting the hydraulic fluid or oil only into the lagging end chamber 101 of the primary cylinder 10 through the port 141.

In super low speed injection operation, as shown in Fig.6, the hydraulic fluid or oil is admitted simultaneously into the chambers 101,

201. Due to an enlarged capacity of the bicylinder actuator hereof to the hydraulic fluid or oil, a super low speed injection is performed.

CLAIMS

1. A bicylinder actuator for a plastics injection molding machine comprising:

5 a first cylinder having two closed ends including a leading closed end and a lagging closed end for receiving a hydraulic fluid, a first piston slidably mounted within the first cylinder and bounding a leading chamber and a lagging chamber in the first cylinder, first port means for admitting and returning the hydraulic fluid respectively communicated with the leading chamber and the lagging chamber and an axial piston rod slidably
10 mounted through the lagging closed end in a fluid-tight relationship with an end outside the first cylinder thereof for connecting to a bearing set of a plastics injection molding machine and its other end inside the first cylinder attached to the first piston; and

a second cylinder coaxially attached to the leading closed end of the
15 first cylinder, a second piston slidably mounted within the second cylinder and having its periphery sealingly engaged with an inner surface of the second cylinder to form a variable chamber in the second cylinder for receiving a hydraulic fluid, a second port means for admitting or returning the hydraulic fluid communicated with the chamber in the second cylinder
20 and an axial connecting rod slidably mounted through the leading closed end in a fluid-tight relationship and interconnecting the first piston of the first cylinder and the second piston of the second cylinder.



2. A bicylinder actuator for a plastics injection molding machine as claimed in Claim 1, wherein one end opposed to the end attached to the first cylinder of the second cylinder is fitted with a circular cap member
- 5 having an axial hole.
3. A bicylinder actuator according to Claim 1 or 2, wherein the second cylinder is smaller in dimension than the first cylinder.
- 10 4. A plastics injection molding machine comprising a bicylinder actuator as described in any preceding claim.
5. A bicylinder actuator for a plastics injection molding machine substantially as herein described with reference to Figs 3 to 6.
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