United States Patent [19]

Cagle

[11] **3,732,989**

[45] **May 15, 1973**

[54] **LIFT CONTROL SYSTEM FOR PRESS UNLOADER OR THE LIKE**

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[22] Filed: **May 27, 1971**

[21] Appl. No.: **147,367**

[52] **U.S. Cl.**.....**214/1 BD,** 214/1 BB

[51] **Int. Cl.**.....**B66c 23/00**

[58] **Field of Search**.....214/1 B, 1 BS, 1 BV, 214/1 BD, 147 T, 1 BB

[56] **References Cited**

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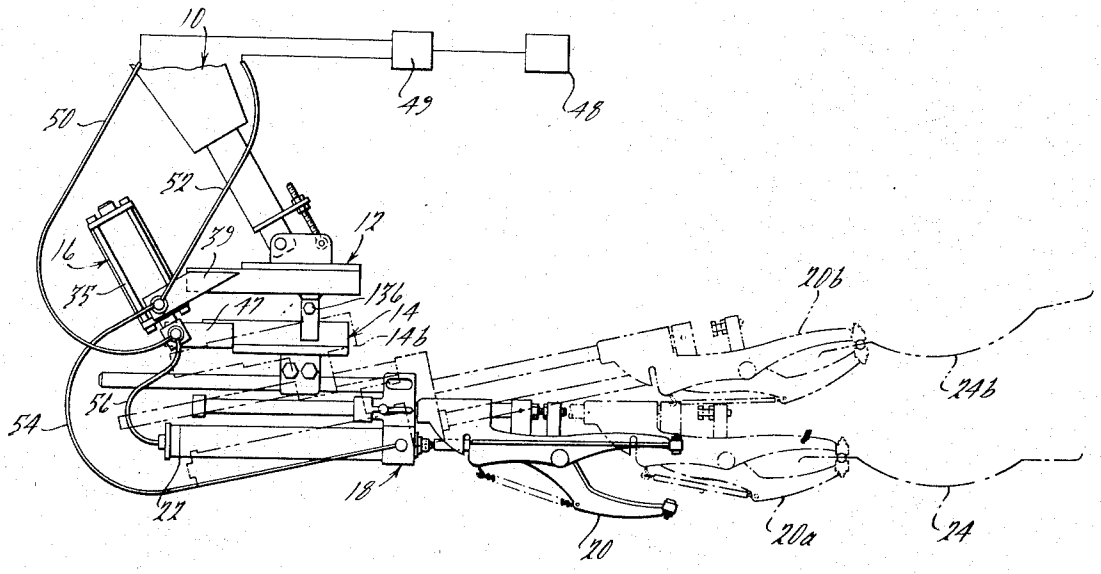
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[57] **ABSTRACT**

There is herein disclosed a lift control system for a press unloader having an extendable and retractable jaw means for gripping and removing a part from the die cavity of a press with pivotal frame means supporting the jaw means for pivotal movement to lift the part from the die cavity and interconnected air operated power cylinder means to sequentially extend the jaw means, grip the part, lift the part, and retract the jaw means.

7 Claims, 3 Drawing Figures



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SHEET 1 OF 2

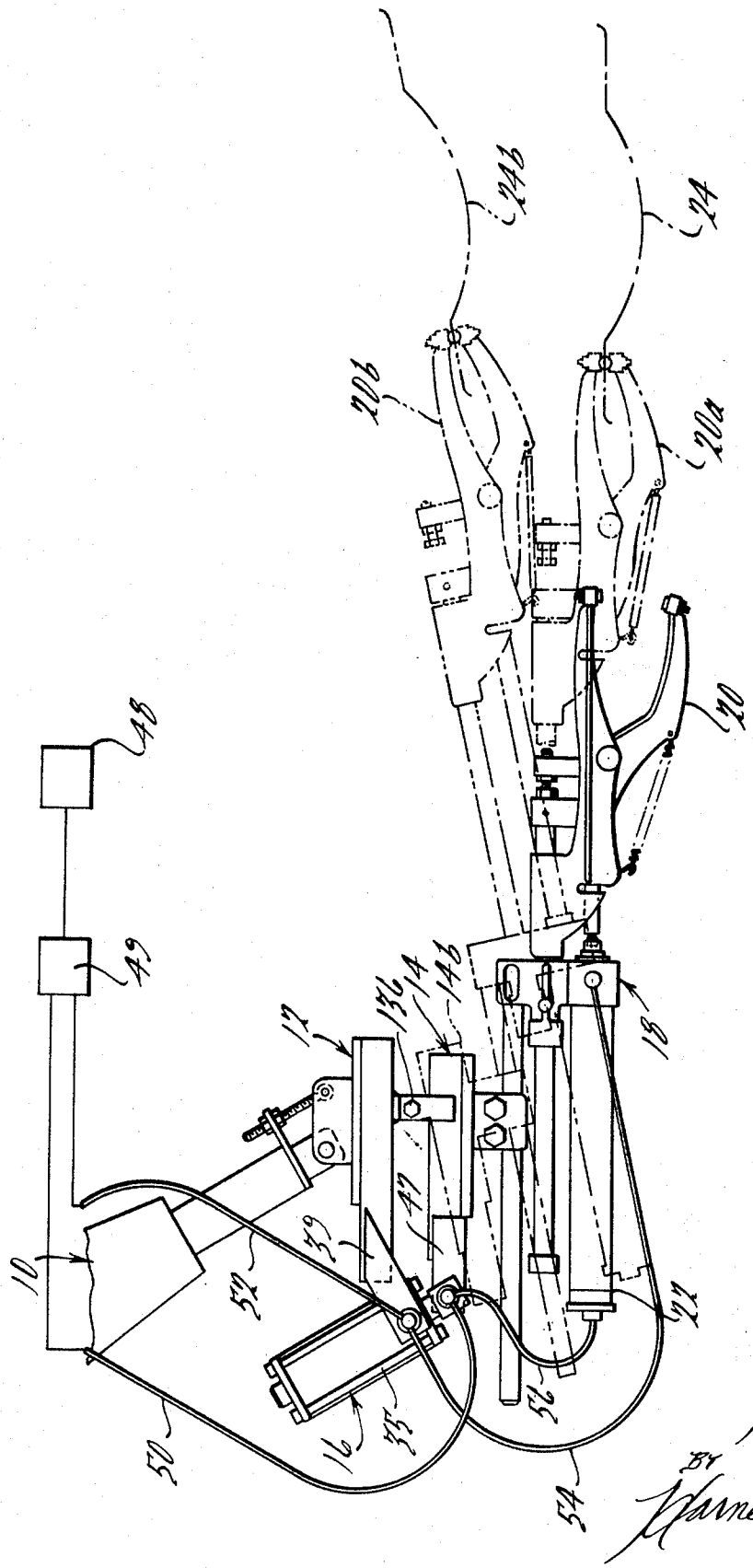


FIG. 1.

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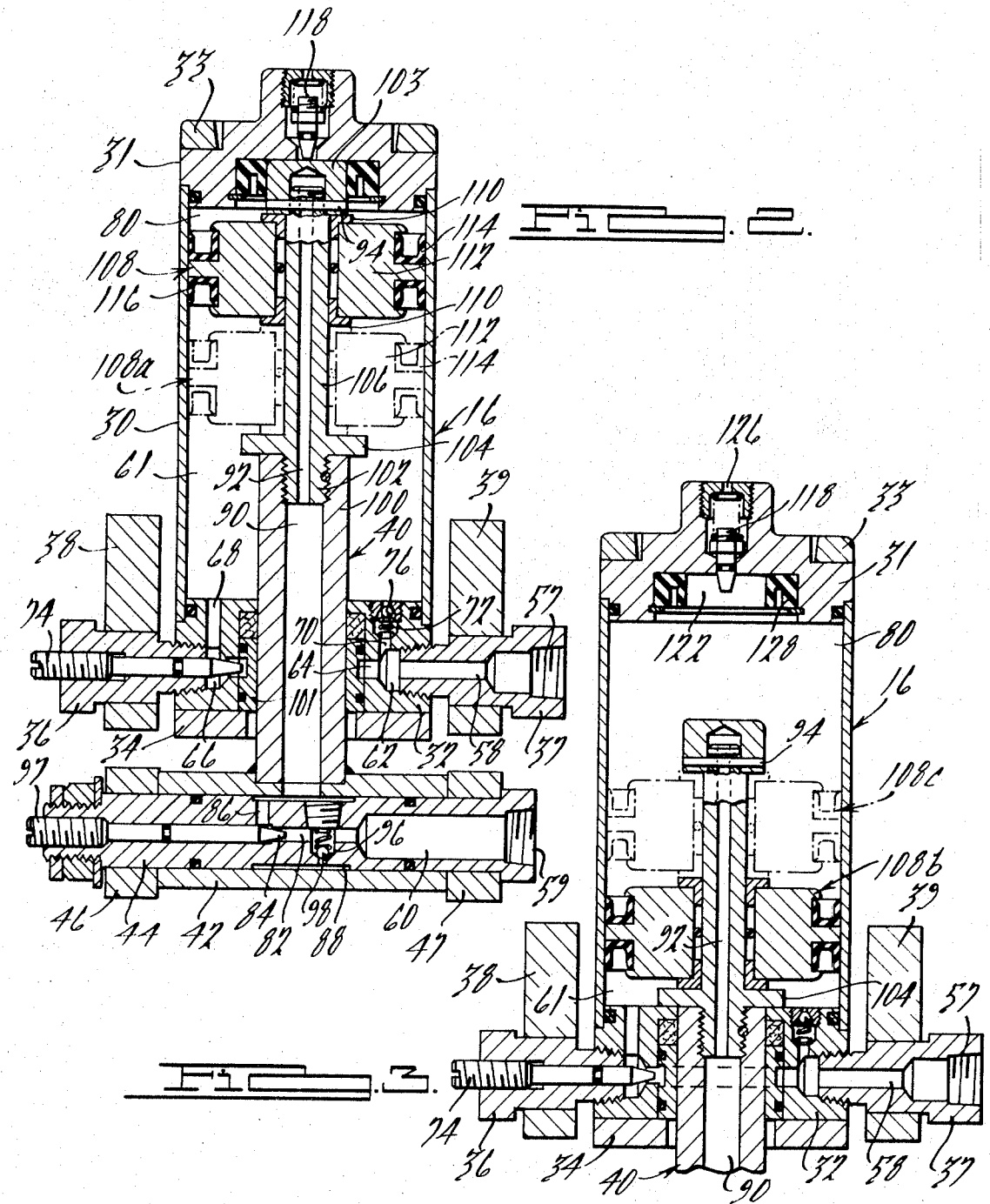


FIG. 2.

FIG. 3.

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LIFT CONTROL SYSTEM FOR PRESS UNLOADER OR THE LIKE

BACKGROUND AND SUMMARY OF THE INVENTION

While the concept and principles of the present invention may be applicable to various types of apparatus and environments, the invention disclosed herein relates generally to press unloading apparatus and, more particularly, to press unloading devices of the type disclosed in U.S. Pat. Nos. 2,609,776 and 3,206,040 and to control systems therefor of the type disclosed in U.S. Pat. Nos. 3,474,825; 3,436,186; and 3,394,650.

It is the primary object of the present invention to provide new and improved means for lifting a formed part out of a die cavity in a press prior to removal of the part from the press cavity. To this end, a new and improved air operated control system has been devised in which the number of parts required to achieve the desired results has been reduced, the parts of the system have been arranged in a new and improved manner facilitating assembly, operation, and repair, and new and improved parts have been devised for the system.

In the presently preferred embodiment of the inventive concepts and principles, a first air operated power cylinder means actuates jaw means carried by the press unloader device between an extended part gripping position in the press cavity and a retracted position while a second air operated power cylinder means moves the jaw means between the extended part gripping position and a lift position prior to return movement of the jaw means to the retracted position. The second cylinder means is connected to high pressure air inlet hoses and exhaust hoses in series with the first cylinder means and provided with integral control means effecting a time delay of operative connection to the jaw means whereby the desired sequential operation of the apparatus is obtained. It is contemplated that the inventive concepts are also applicable to fluid operated power cylinder apparatus generally whenever a time delay operation is required. Thus, in the broadest aspects of the invention, the power cylinder apparatus may be air operated or hydraulically operated and associated with any kind of machinery, particularly material handling equipment.

BRIEF DESCRIPTION OF THE DRAWING

The presently preferred embodiment is illustrated in the accompanying drawing wherein:

FIG. **1** is a side elevational view of a portion of a press unloading device incorporating the inventive concepts and principles;

FIG. **2** is an enlarged cross-sectional view of a portion of the apparatus of FIG. **1**; and

FIG. **3** is another enlarged cross-sectional view of a portion of the apparatus of FIG. **2** in a different operational position.

DETAILED DESCRIPTION

Referring now to FIG. **1**, the bottom portion of a conventional swinging arm type press unloader is shown to comprise a swingable support arm **10**, a fixed support frame means **12**, adjustably connected to and carried by the support arm, a movable support frame means **14** pivotally mounted on the fixed support frame, an air operated power cylinder means **16** pivotally mounted on the fixed support frame **12** and pivotally operably

connected to the movable support frame **14**, and a part gripping unit **18** carried by the movable support frame. The part gripping unit **18** comprises jaw means **20** movable between a retracted position, as shown by the solid lines of FIG. **1**, and an extended part gripping position, shown in phantom at **20***a* and **20***b*, by an air operated power cylinder means **22**. The jaw means is also movable between an open release position, as shown by the solid lines of FIG. **1** and a closed part gripping position as shown at **20***a* and **20***b*. The movable support frame **14** and unit **18** are pivotally movable between the extended part gripping position **20***a* and a lift position as shown at **20***b* to enable the part **24** to be lifted clear of the die cavity in the press.

Referring now to FIGS. **2** and **3**, the air operated power cylinder means **16** comprises a cylindrical member **30** having pivotal connecting means in the form of spaced opposite end plates **31, 32** and tie plates **33, 34** secured by suitable fastening means **35**. The cylinder is pivotally mounted on fixed support frame **12** by bearing members **36, 37** rotatably mounted in support arms **38, 39** fixed to plate **12** and threadably mounted in cylinder end plate **32** at the bottom of the power cylinder. The cylinder **16** is operatively connected to the movable frame means **14** by a movable piston rod **40** and pivotal connecting means in the form of a bearing sleeve **42** and a bearing shaft **44** pivotally mounted in arm portions **46, 47** fixed on the movable frame. A conventional high pressure air source **48** is connected to the power cylinder **16** through conventional control valve means **49** by air hose means **50, 52** and to the power cylinder **22** by air hose means **54, 56**. Air hose **52** is attached to the pivotally mounted bearing member **37** by a conventional threaded coupling (not shown) mounted in a threaded portion **57** of a central air passage **58** so as to be pivotally movable therewith and air hose **50** is similarly attached to the pivotally mounted bearing shaft **44** by a threaded portion **59** of a central air passage **60**. Air passage **58** is connected to one side **61** of the cylinder through air passage means comprising a chamber **62**, an annular inlet passage **64**, a valve chamber **66**, and an inlet passage **68**. Chamber **62** is also connected to the same side of the cylinder through an air outlet passage **70** and a valve chamber **72**. An adjustable needle valve **74** is threadably adjustably mounted in bearing member **36** and valve chamber **66** to regulate the rate of flow of inlet air through passage **68** and thus control the rate of movement of piston rod **40** as will be hereinafter described. A spring loaded ball type check valve **76** is mounted in valve chamber **72** to prevent passage of inlet air and permit passage of exhaust air. Air passage **60** is connected to the other side **80** of the power cylinder by air passage means comprising reduced diameter passage **82**, a valve chamber **84**, a transverse passage **86**, an annular chamber **88**, axially extending passage portions **90, 92** in the piston rod **40**, and a transverse outlet passage **94**. Passage **60** is also connected to the same side of the power cylinder through passage **82**, valve chamber **96**, annular chamber **88**, and passages **90, 92, 94**. An adjustable needle valve **97** is adjustably threadably mounted in bearing member **44** and valve chamber **84** to regulate the flow of high pressure air through inlet passage **86** and a spring loaded ball type check valve **98** is mounted in valve chamber **96** to prevent passage of inlet air while permitting passage of exhaust air.

The piston rod means **40** includes a tubular portion **100** slidably supported in suitably sealed bearing means **101** in end plate **32** and a reduced diameter member **102** having axially spaced abutment flanges **103, 104** providing piston connecting means located at opposite ends of a slide rod portion **106.** A piston means **108,** comprising a bearing sleeve **110,** a disc **112,** and sealing means **114, 116,** is slidably mounted on the slide rod for movement between the abutment flanges **103, 104** to provide timing means to prevent movement of the piston rod **40** until after the jaw means have been properly positioned.

A spring loaded relief valve **118** is mounted in end plate **31** and extends into a chamber **122** which receives piston rod flange **103** in an uppermost position, FIG. **3,** whereat valve **118** is positively opened to allow any air trapped in chamber portion **80** to escape through a port **126.** A seal **128** engages the flange **103** in the fully extended position to prevent any leakage of high pressure inlet air.

In operation, with the apparatus in the position shown by the solid lines of FIGS. **1** and **2,** at a predetermined time valve **49** is actuated to deliver high pressure air from source **48** to one side of power cylinders **16, 22** through air lines **50, 56** while exhausting air from the other side of the cylinders through air lines **54, 52.** The high pressure air in line **56** is immediately effective to actuate power cylinder **22** to extend and then close the jaw means **20** on the part **24** over a predetermined time interval of, for example, one or two seconds. During the jaw extension and clamping time period, some of the high pressure air in line **50** also flows through passages **60, 82,** past needle valve **97,** through passages **86, 88, 90, 92, 94** into chamber **80** wherein it acts against the adjoining surfaces and gradually moves the piston **108** from the solid line fully retracted position to an intermediate dotted line position **108a** whereat the piston engages the flange abutment **104** to begin to move the piston rod **40.** The air in chamber **80** also acts against the abutment flange **103** to keep the piston rod in the retracted position until the piston engages the other abutment flange and acts against the seal **128** to prevent escape of high pressure air through valve **118.** The rate of air flow is adjusted by needle valve **97** so as to move the piston **108** at a rate causing engagement of the piston with the piston rod abutment flange **104** after the jaw means has been extended and closed. Then when the piston moves the piston rod to the solid line fully extended position **108*b***, FIG. **3,** the bearing housing **42,** bearing shaft **44,** support arms **46, 47,** and the movable support frame **14** are moved downwardly about pivot means **136,** FIG. **1,** from the normal position parallel to the fixed plate **12** to an inclined position **14b** whereat the jaw means and part **24** are lifted clear of the die cavity.

Then the high pressure air source **48** is connected by valve **49** to air hoses **52, 54** while hoses **50, 56** are connected to exhaust. Again the high pressure air is immediately effective to reversely actuate power cylinder **22** to retract and then open the jaw means at a predetermined point to release the part after a predetermined time interval. During the jaw retraction and opening time period, some of the high pressure air also flows through chamber **62,** passage **64,** valve chamber **66,** and passage **68** to chamber **61** wherein it is effective to move the piston, without the piston rod, from the fully extended solid line position **108*b*** of FIG. **3** to the dotted line position **108*c*** whereat the piston engages the flange **103** and begins to move the piston rod **40.** The high pressure air in chamber **61** also acts against flange **104,** which is seated on end plate **32,** to hold the piston rod in the fully extended position until the piston engages the other flange **103.** The rate of air flow is adjusted by needle valve **74** so as to move the piston **108** at a rate causing engagement with the abutment flange **103** after the jaw means and the part gripped thereby have cleared the die cavity. The rate of travel of the piston may be varied to return the movable frame **14** to the parallel position at any desired time in relationship to the position of the jaw means being actuated to the fully retracted position by power cylinder **22.** It will be understood that when the piston **108** moves in one direction by application of high pressure air to one side or the other, the air on the opposite side is exhausted through the ball valves **76, 98** which are opened during exhaust due to pressure differential while being maintained closed during application of the high pressure air due to the springs and a pressure balance in the system.

It is contemplated that the inventive concepts and principles herein disclosed may be variously otherwise embodied and it is intended that the appended claims cover alternative embodiments except insofar as limited by the prior art.

I claim:

1. A control system for a press unloader having a movable arm carrying jaw means movable between a retracted position and an extended position for gripping a part in a die cavity and for carrying the part away from the die cavity, comprising air operated jaw operating power cylinder means for moving the jaw means between the extended position and the retracted position, frame means pivotally supporting said jaw operating power cylinder means and said jaw means, air operated frame operating power cylinder means for pivotally moving said frame means jaw operating power cylinder means and said jaw means between a part gripping position and a part lifting position whereby a gripped part is lifted from a die cavity in a press with which the press unloader is associated, timing means integral with said air operated frame operating power cylinder means to cause the pivotal movement after the jaw means has been extended and the part gripped, a pair of high pressure air hose means connected to said air operated jaw operating power cylinder means and said air operated frame operating power cylinder means to deliver high pressure air thereto and to exhaust air therefrom, said air operated jaw operating power cylinder means and said air operated frame operating power cylinder means being connected in series, first and second pivotal connecting means between said air operated frame operating power cylinder means and said frame means, one of said air hose means being connected to said power cylinder means through one of said pivotal connecting means, and the other of said air hose means being connected to said power cylinder means through the other of said pivotal connecting means.

2. A control system for a press unloader having a movable arm carrying jaw means movable between a retracted position and an extended position for gripping a part in a die cavity and for carrying the part away from the die cavity, comprising air operated jaw operating power cylinder means for moving the jaw means between the extended position and the retracted posi-

tion, frame means pivotally supporting said jaw operating power cylinder means and said jaw means, air operated frame operating power cylinder means for pivotally moving said frame means jaw operating power cylinder means and said jaw means between a part gripping position and a part lifting position whereby a gripped part is lifted from a die cavity in a press with which the press unloader is associated, timing means integral with said air operated frame operating power cylinder means to cause the pivotal movement after the jaw means has been extended and the part gripped, an air cylinder having spaced end walls, piston means in said air cylinder movable therein by air pressure during and after movement of said jaw means to the extended position, piston rod means operable by said piston and operably associated with said frame means to cause pivotal movement thereof, and connecting means operable after the movement of said jaw means to the extended position to connect said piston means and said piston rod means to said frame means to cause pivotal movement thereof, said piston means being slidably supported on and movable relative to said piston rod means during the first portion of the piston movement, said piston means being movable relative to said piston rod means during movement of said jaw means to the extended position, and said connecting means connecting said piston means to said piston rod means after the movement of said jaw means to the extended position during the last portion of the movement of said piston means.

3. The invention as defined in claim **2** and there being air flow rate adjustment means to control the rate of movement of said piston means by controlling the rate of flow of air to enable said jaw means to reach the extended position before said connecting means is effective to connect said piston means to said piston rod means.

4. The invention as defined in claim **3** and wherein said connecting means comprising spaced abutment flanges on said piston rod means engageable with said piston means after sliding movement of said piston means therebetween.

5. The invention as defined in claim **4** and wherein said spaced abutment flanges alternately engaging opposite ones of said spaced end walls of said air cylinder and being held thereagainst by high pressure air until said piston means engages one of said abutment flanges and moves said rod means.

6. A control system for a press unloader having a movable arm carrying jaw means movable between a retracted position and an extended position for gripping a part in a die cavity and for carrying the part away from the die cavity, comprising air operated jaw operating power cylinder means for moving the jaw means between the extended position and the retracted position, frame means pivotally supporting said jaw operating power cylinder means and said jaw means, air operated frame operating power cylinder means for pivotally moving said frame means jaw operating power cylinder means and said jaw means between a part gripping position and a part lifting position whereby a gripped part is lifted from a die cavity in a press with which the press unloader is associated, timing means integral with said air operated frame operating power cylinder means to cause the pivotal movement after the jaw means has been extended and the part gripped, a first frame means fixed to the movable arm, a second frame means pivoted to the first frame means and supporting said jaw means, said frame operating power cylinder means comprising an air cylinder, a movable piston, and a piston rod, a first pivotal connecting means pivotally mounting said frame operating power cylinder means between said air cylinder and said first frame means on said first frame means, a second pivotal connecting means between said piston rod and said second frame means whereby said frame operating power cylinder means is movable relative to said first frame means and said second frame means during pivotal displacement of said second frame means, air hose means connected to said frame operating power cylinder means to supply high pressure air thereto and exhaust air therefrom, a first air hose connection integral with said first pivotal connecting means, first air passage means extending from said first air hose connection through said first pivotal connecting means to one side of said piston, a second air hose connection integral with said second pivotal connecting means, and second air passage means extending from said second air hose through said second pivotal connecting means and said piston rod to the other side of said piston.

7. The invention as defined in claim **6** and further comprising adjustable valve means in each of said first and second passage means to variably control the rate of flow of high pressure air to said air cylinder.

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