United States Patent [19]

Smith et al.

[11] **3,741,697**

[45] **June 26, 1973**

[54] **REMOTE CONTROL SYSTEM FOR POWDER COMPACTING PRESSES**

[75] Inventors: **Joseph E. Smith**, Birmingham; **Georges D. DeTroyer**, Grosse Ile; **Raymond P. DeSantis**, Royal Oak, all of Mich.

[73] Assignee: **Wolverine-Pentronix, Inc.**, Lincoln Park, Mich.

[22] Filed: **Feb. 2, 1972**

[21] Appl. No.: **222,737**

[52] **U.S. Cl.**..... **425/78**, 425/168, 425/437, 425/444

[51] **Int. Cl.. B30b 11/02**, B30b 11/14, B30b 11/22, B30b 11/18

[58] **Field of Search**..... 425/78, 168, 437, 425/444

[56] **References Cited**

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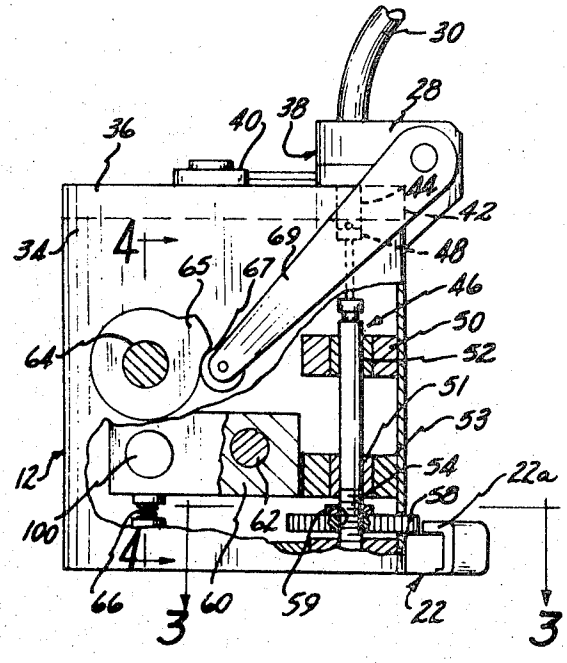
Primary Examiner—J. Howard Flint, Jr.

Attorney—Robert C. Hauke, Claude A. Patalidis et al.

[57] **ABSTRACT**

A multiple cavity press system for providing at a remote station both part collection and tool setup with provision for incremental, fine adjustment of ram fill and ram press stroke. For each press, the required incremental adjustment may be controlled from the remote station so that the appropriate size and weight corrections may be made immediately upon inspection of the collected parts. An operating means including a pneumatically actuated slide is used to provide for the incremental adjustment of ram travel in either direction.

12 Claims, 8 Drawing Figures



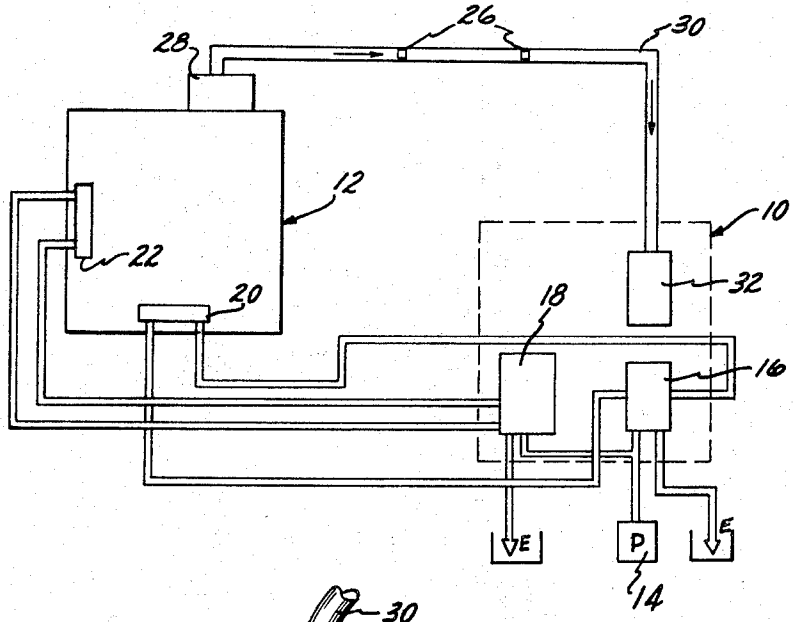


Fig-1

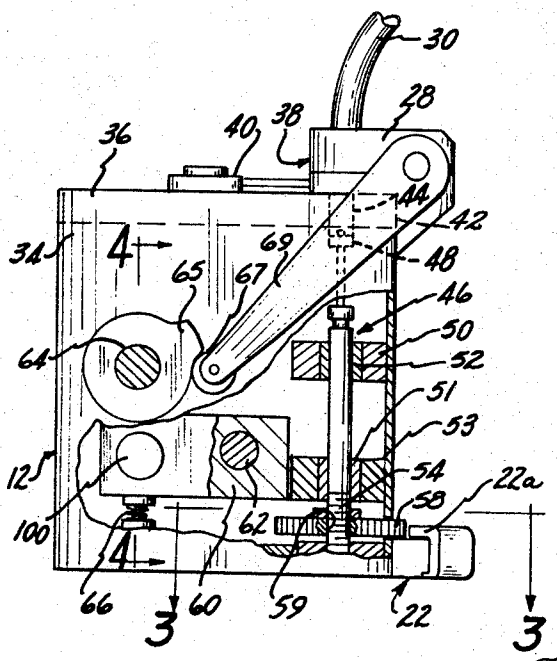


Fig-2

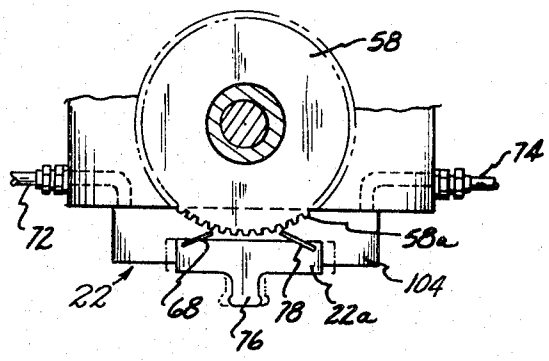


Fig-3

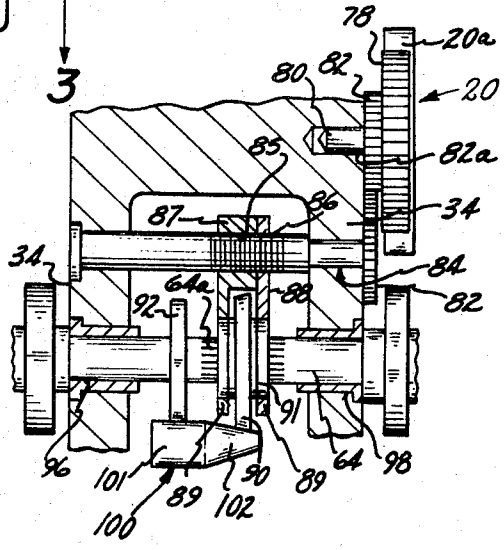


Fig-4

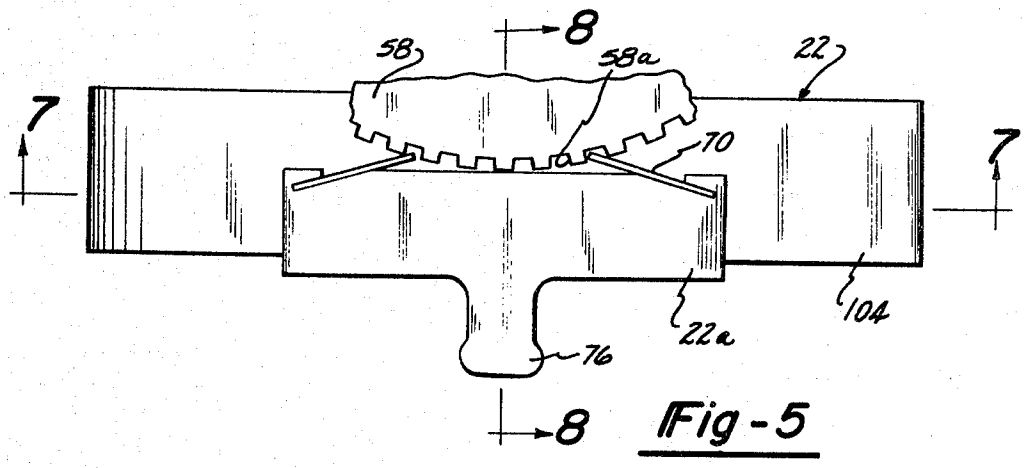


Fig-5

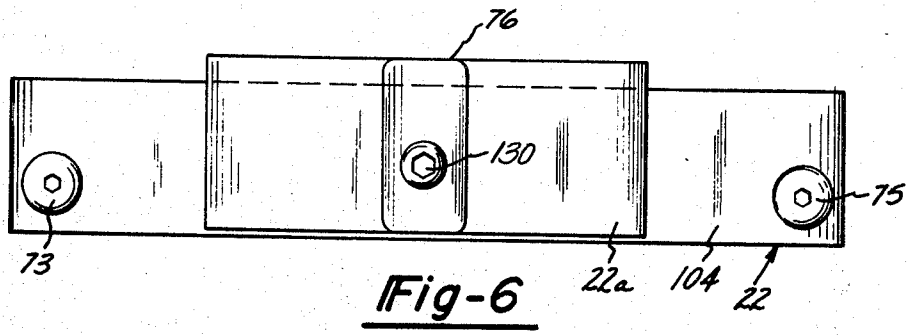


Fig-6

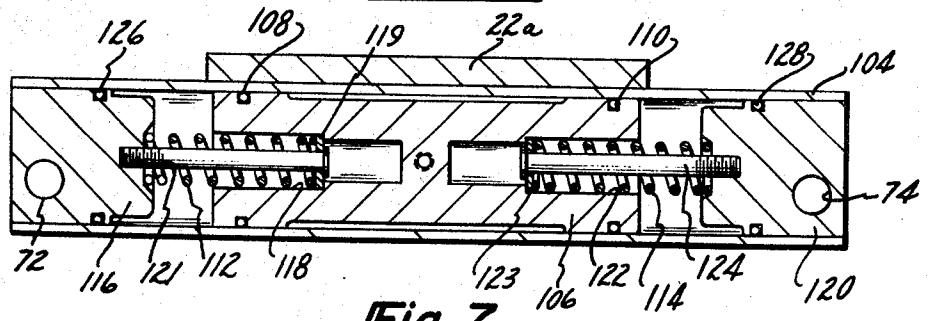


Fig-7

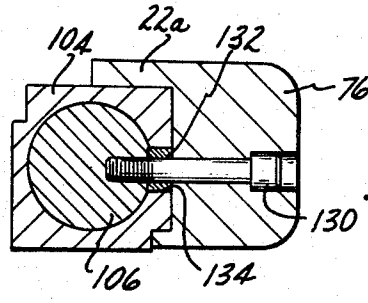


Fig-8

REMOTE CONTROL SYSTEM FOR POWDER COMPACTING PRESSES

CROSS REFERENCE TO RELATED APPLICATIONS

The present invention is in substance related to U.S. Pat. No. 3,561,054 issued on Feb. 9, 1971 on behalf of Joseph E. Smith for "Powder Compacting Press" and U.S. Application Ser. No. 173,452 filed Aug. 20, 1971 on behalf of Georges D. DeTroyer and Raymond P. DeSantis for "Collecting Mechanism for Parts Made by Powder Compacting Apparatus", both of which are of common ownership herewith.

BACKGROUND OF THE INVENTION

The invention disclosed in the present application relates to a new and improved automatic setup system for powder compacting presses. The invention relates to presses which are used to fabricate small parts, such as beads, pellets and the like made of powder metals, glass or other comparable powder substances, capable of forming a compacted article upon the application of ram pressure in a confined die cavity. The parts must be produced at very close tolerances. As one example, the parts produced are ferrite cores in which the thickness may be approximately 0.050 to 0.015 inch and the size accuracy must be held to approximately 0.0001 inch or even less. In the manufacture of such ferrite cores for use in memory devices, the density of the memory cores must likewise be held accurate, making it necessary that the fill, that is, the amount of powder in the die cavity or cavities of the compacting press, be regulated within very close limits. If the dimensional and density characteristics are not held within very close tolerances, the readout level from the cores in a memory core stack would not be sufficiently constant from core to core to serve the purpose of the arrangement. It will be realized that to achieve the dimensional accuracy thus referred to it is necessary that the press parts be capable of accurate adjustment within at least 50 millionths of an inch.

In the preferred form of the press such as is shown and described in detail in the aforementioned U.S. Pat. No. 3,561,054, the press ram is used to cyclically drive the associated punches upwardly into the die cavities to compact the powder. A positioner assembly is included, which assembly is rotatably movable through a limited arc over the die plate. The assembly carries a plate having an equal number of anvils which are alternately positionable over the die cavities. The positioner assembly further includes a powder housing for loading the cavities, and an air ejecting means for ejecting the finished parts and collecting them through tubes into a remote control station. Reference is made to the aforementioned patent and application for a detailed description of the positioner assembly, the collection system, and their mode of operation.

SUMMARY OF THE PRESENT INVENTION

The present invention relates to a system in which the collection and press adjustment means are located adjacent one to the other to facilitate at a remote location both inspection and corrective adjustment of the presses. This adjustment is provided through an incremental adjusting means which is so constructed as to permit holding highly accurate tolerances. The system, as it will be described in this application, has the additional advantage of permitting set-up of a number of press cavities for like sized parts at the same time. It will also be seen that when hazardous or poisonous materials are being incorporated into the press products there may be provided a continuous remote control of size and weight through the arrangement of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects and additional advantages of the invention will become apparent from the following detailed description with reference to the accompanying drawings wherein like numerals are used to identify like parts throughout the several views and wherein:

FIG. 1 is a combined schematic and block diagrammatic showing of the remote collection and adjustment control system;

FIG. 2 is a side elevational view of a compacting press with parts broken away to show the incorporation of the present invention in the press;

FIG. 3 is a top plan view along the section line 3—3 of FIG. 2 showing the slide and associated mechanism for incrementally adjusting one of the several press ram movement controls;

FIG. 4 is a vertical, cross-sectional, fragmentary view made longitudinally along section line 4—4 of FIG. 2;

FIG. 5 is a plan view to enlarged scale of one of the adjustment means;

FIG. 6 is a side elevational view of the adjustment means of FIG. 5;

FIG. 7 is a longitudinal sectional view along the section line 7—7 of FIG. 5 showing the internal valve construction details; and

FIG. 8 is a cross-sectional view of the slide and its handle taken along section line 8—8 of FIG. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 illustrates the manner in which parts are collected and adjustments are made from a remote control station **10**. The remote adjustments of size and weight are made to the press **12** through a pneumatic system. The system includes a source of pressurized fluid **14** which is connected to a pair of operating valves **16** and **18**, each of which is separately used to control the incremental adjustment of the press. More specifically, the valve **16** is used to incrementally adjust a pneumatic operator **20** for stepping in either direction a press adjust wheel **78**, which in turn adjusts the ram press stroke to control the thickness of the compacted part. In a similar manner, the valve **18** is used to control the movement of a pneumatic operator **22** which is used to incrementally adjust a fill adjustment wheel, which in turn controls the weight of the compacted part.

Also shown in FIG. 1 is the manner in which the finished parts **26** from each die cavity are collected separately through an aspirator pickup **28** and delivered through a tube **30** to suitable containers **32** provided at the remote control station **10**. It will be seen from the arrangement of the system that the press operator is thus enabled to inspect separately the compacted parts from a plurality of multiple die cavity presses, keeping the parts further segregated for each press die cavity. The operator can then make the necessary adjustments to height and weight for each individual press and its several die cavities from the remote station **10**.

FIG. 2 shows the major parts of the press 12 which include a die plate 42 having one or more die cavities 44. The ram mechanism includes a ram 46 having a plurality of punches 48, one of which is shown connected at the upper end of the ram. The ram 46 is further slidably movable in a vertical direction through an upper support bracket 50 having a bushing 52. The support 50 is fastened to the inner wall of the press frame 34. A second lower support bracket 53 with bushing 51 is also fixed to the press frame 34. A threaded portion 54 near the lower end of the ram 46 has a fill adjust wheel 58 with its threaded bore 59 threadably mounted thereon. According to the adjustment of the wheel 58, the lower movement of the ram is selectively adjustable to provide control over the fill operation. The main press operating parts include a lever or treadle 60 pivotably supported on a cross shaft 62. The ram 46 is driven upwardly under power during the press operation in the proper sequence according to the engagement of one of a plurality of cams mounted in the main camshaft 64 with a cam follower 100. The main operating shaft 64 is shown with one of the cams 65 shown in engagement with a cam follower 67 carried by a link 69 fro operating the positioner assembly 38 during the press operation. Reference is made to the previously mentioned patent and patent application for a complete description of the press parts and their mode of operation. A bearing compression spring 66 is included in abutment with the left hand lower end of the lever 60. The manner in which the press stroke adjustment is made will be further explained in connection with FIG. 4 hereinafter. Also shown in their operating position next to the adjusting wheel 58 is the pneumatic operator 22 and its associated slide 22a, which controls fill adjustment.

FIG. 3 illustrates the manner in which the slide 22*a* and the other slide 20*a* operate to incrementally adjust the associated toothed wheels. Illustrated in FIG. 3 is the fill adjustment wheel 58 having a plurality of teeth 58*a* formed about its periphery. The pressure inlet lines 72 and 74 are shown which provide operating pressure for the piston associated with the slide 22*a*. In one exemplary embodiment, there is provided an adjustment of 0.020 inch per revolution of the wheel 58 with 64 teeth 58*a*. It will be seen that the slide 22*a* has two leaf spring projections 68 and 70 which are engageable with the teeth 58*a* to rotate the adjusting wheel 58 either clockwise or counterclockwise in accordance with the direction with which the slide 22*a* is moved through the operation of the valve 18. A pressurized fluid flow is introduced selectively through the conduit 72 or 74 at either end of the operating cylinder so that the piston which operates the slide 22*a* is actuated in either direction. It will further be seen that the slide 22*a* has fixed to it a handle 76 to permit manual adjustment at the press 12 during the initial or subsequent setting of the press controls.

FIG. 4 shows the mechanism which operates to control the extent of movement of the ram 46 during press operation. To provide this control the toothed wheel 78 is rotatably mounted on the machine frame 34 on a stub shaft 80. A second gear 82 is pinned inside the wheel 78, mounted on the stub shaft 80 and has its gear teeth 82*a* engageable with the teeth of a second mating gear 83 mounted at the end of a shaft 84. The shaft 84 has a central threaded portion 86 in engagement with a threaded bore portion 85 extending through the upper end 87 of a yoke 88. The yoke 88 will be seen to control the lateral movement of a cam 90 which is mounted on a sleeve 91 between the lower end extensions 89 of the yoke 88. The cam 90 is slidably movable along the shaft 64 on a spline portion 64*a* thereof. A second cam 92 and the cam 90 are mounted on the camshaft 64, which shaft is rotatable to provide the several cycles of operation. The camshaft 64 is journalled between a pair of bushings 96 and 98 fitted into the side frame 34 of the press 12. Mounted in the press below the cams 92 and 90 is a cam follower 100 which has a uniform cylindrical left hand portion 101 engageable with the cam 90 to provide press operation. As is better shown in FIG. 2, the cam follower 100, upon being engaged by the cam 90, rotates the lever 60 about its pivot shaft 62 to provide the required upward movement of the ram 46 during the press operation. Because of the tapered end portion 102 of the cam follower 100 and according to the axial positioning of the yoke 88 on the shaft 84, which position in turn is controlled by the rotation of the press adjusting wheel 78, it is possible to angularly adjust the position of the lever 60 in minute increments. In this manner, the maximum extent of movement of the ram 46 and the punches 48 carried at its upper end and the distance which they will be driven into the die cavities 44 during the press cycle is fixed. The rotation of the wheel 78 is controlled by the remote actuated slide 20*a*, identical to the slide 22*a* shown in FIG. 3 and also provided with leaf spring projections identical to leaf spring projections 68 and 70, for rotating the toothed wheel 78 in either direction according to the change required. The internal details of the pneumatic operator used will be more clearly shown in FIGS. 7 and 8 hereinafter.

The stepping means, namely the slide 22*a*, is shown to a somewhat enlarged scale in FIG. 5 in order to illustrate the manner in which the leaf spring projections 68 and 70 angularly extend toward the toothed wheel 58 and its teeth 58*a* with which they are aligned for the control operations, either fill or press. Rearwardly of the slide 22*a* is the cylinder 104 of the pneumatic operator 22 which provides the remote actuation. The outwardly extending handle 76 for manual adjustment is shown. The incremental movement referred to with respect to the several adjusting wheels means that movement to a tooth-spaced degree which is provided by the slide. For example, in FIG. 5 the leftward movement of slide 22*a* will displace in a clockwise manner the wheel 58 so that the individual tooth 58*a* with which the end of projection 70 is initially in abutment will be moved angularly and the next succeeding tooth 58*a* will be placed in the same position as illustrated in the drawing.

FIG. 6 is a rear elevational view of the cylinder 104 showing the two cylinder bolt fasteners 73 and 75 which are used to mount the cylinder 104 and the associated slide 22*a* on the press side frame 34.

FIG. 7 shows a longitudinal section of the cylinder 104 which will be seen to contain a central piston 106. The piston 106 is peripherally provided at either end with a sealing O-ring 108 and 110. A pair of biasing springs 112 and 114 are mounted respectively at the left end between an end plug 116 and a central opening 118 in the piston 106 and at the right end between an end plug 120 and a central opening 122 in the piston 106. Spring 112 is further held in place by a cap 119 and a bolt 121. In a like manner, the spring 114 is held

in place by a cap **123** and a bolt **124.** The inlets **72** and **74** admit pressurized air to the chamber at either end of the cylinder to provide either a leftward or a rightward movement of the piston **106** with an accompanying movement of the slide **22***a*. In addition, a pair of sealing O-rings **126** and **128** are mounted, respectively, at the left and right hand end plugs **116** and **120** of the cylinder **104.**

In the sectional view of FIG. **8,** the manner is shown in which the slide **22***a* is fixed to and slidably mounted on the cylinder **104.** The slide **22***a* is mounted through a threaded fastener **130** to the piston **106.** A suitable seal **132** is used to permit the sliding movement of the slide **22***a* along with the piston **106** in a longitudinal slot **134.**

DESCRIPTION OF OPERATION

The general operation of the collection and inspection system is shown in FIG. **1** in which the finished parts are collected and removed to a remote control station **10.** The remote station **10** provides a collection point for parts being made in a plurality of cavities **12.** A plurality of remote stations provide a collection point for a plurality of presses, each of which separately contains a number of die cavities ranging for example from six to 12 or more in number. Periodic size and weight checks are made on the finished parts so that if a problem arises with respect to the die cavities in one of the presses, a corrective adjustment can be made from the remote station. The remote adjustment may be provided by the press operator at the remote station **10** through the manipulation of operating valves **16** and **18** to provide activation of the respective slides **20***a* and **22***a* which individually relate to the control of the press adjustment and fill adjustment. The type of construction used for the incremental adjustment means lends itself to exceedingly close dimensional tolerances of the order of 50 millionths of an inch for one tooth space advancement. As is shown in FIGS. **3** and **5,** each slide remotely operated through pneumatic pressure also has fixed to it a handle **76** which permits manual adjustment at the press during initial setup.

With reference to FIGS. **2** and **4,** each of the presses **12** is cyclically operated through a main camshaft **64,** which carries a plurality of cams used to initiate the several operations during a complete cycle of press operation. The fill adjustment wheel **58** adjusts the lowermost position of the ram **46** with respect to its positioning in the die cavity **44** during fill so that control is exercised over the weight of the finished part being produced. The press adjustment wheel **78** as shown in FIG. **4** provides adjustment of the upward stroke of the ram **46** and thus provides an incremental adjustment of the thickness of the part.

The stepping means used to provide the several adjustments above referred to are pneumatically actuated operators, such as the cylinder **104** illustrated in FIGS. **7** and **8.** The piston **106** is biased by springs **118** and **122** to a central, neutral position in the cylinder **104** and, responsive to the actuation of the associated valve control such as control valve **16** shown in FIG. **1,** the slide associated with the piston **106** is moved leftwardly or rightwardly. This provides engagement with the respective toothed wheels of the projection **68** or **70** in such manner that the wheel is rotated clockwise or counterclockwise for a fine incremental adjustment, one tooth at a time.

It will thus be seen that the present system provides a substantially improved arrangement for a multiple cavity press operation in which inspection, together with size and weight control of the finished part, may be continuously maintained. In addition, the particular mechanism employed for the operational adjustment of the press ram through its stroke provides ready adjustment to very close tolerances.

What is claimed is:

1. A system for operating a plurality of ram operated, powder compacting presses in a remote press installation comprising:

a remote control station having a collecting means for separately accumulating finished parts from said presses for inspection;

a separate means for adjusting the extent of movement of the ram associated with each of said presses through its successive fill and press operations; and

an operating means operably connected to said adjusting means for incrementally adjusting the ram movement for at least one of the aforesaid operations, said operating means located in said remote control station to facilitate finished part inspection and corrective ram setup at said station.

2. The combination as set forth in claim **1** wherein said collecting means includes a conduit and a removing means operatively connected to a die cavity of each of said presses, respectively.

3. The combination as set forth in claim **2** wherein said removing means comprises an aspirator and said finished parts are moved to said remote control station by pressurized air flow.

4. The combination as set forth in claim **1** wherein said separate ram adjusting means comprises a toothed wheel operably connected to each of said rams, and said operating means comprises a stepping means engageable with said wheel and movable in either direction for providing said incremental adjustment.

5. The combination as set forth in claim **4** wherein said stepping means comprises a pneumatically operated slide having a pair of projections engageable with the teeth of said wheel, and wherein a valve operating means is operably connected to said slide for controlling its direction of movement.

6. The combination as set forth in claim **1** wherein each of said press rams is operated through its respective press operations by a cam drive means, and wherein said means for adjusting comprises a yoke and a gear means for controlling the operation of said drive cam means.

7. Apparatus for providing a remotely controlled adjustment for a powder compacting press having a ram and a punch mounted on said ram and movable relative to a cavity of a die plate for successive fill and press operations comprising:

a means operatively connected to said ram for incrementally adjusting ram movement for at least one of the aforesaid operations, said adjusting means comprising a rotatable adjusting means having a plurality of teeth about its periphery;

a stepping means for said rotatable means comprising a differentially movable slide engageable with said teeth; and

a means for selectively actuating said slide in either direction.

8. The combination as set forth in claim 7 wherein a cylinder having a piston is operatively connected to said slide for moving it, and a valve means is operably connected to provide pressure to said piston including a pair of control valves, said valve means connected between a pressure source and both ends of said cylinder.

9. The combination as set forth in claim 7 wherein said adjusting means is operable to control the lowermost position of said ram during cavity fill operation thereby to adjust the weight of parts produced by said press.

10. The combination as set forth in claim 7 wherein a cam driven lever is operably connected to said ram for driving it through its press stroke, and said adjusting means is operable to preset the uppermost limit of movement of said ram.

11. The combination as set forth in claim 10 wherein a variable extending cam driving said lever is selectively movable by said adjusting means to control its operation.

12. The combination as set forth in claim 8 wherein said piston is spring biased to normally inactive central position in said cylinder, and said operating valve is manually movable to connect said pressure source to one end of said cylinder.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,741,697 Dated June 26, 1973

Inventor(s) Joseph E. Smith et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

IN THE SPECIFICATION

Column 1, line 27, change "approximately" to - - within - -

line 47, change "rotatably" to - - arcuately - -

line 61, after "collection" insert - - of finished parts - -

after "and" insert - - the - -

Column 2, line 21, after "a" insert - - fragmentary - -

line 32, cancel "the" and "valve"

line 50, cancel numeral "78"

line 58, after numeral "28" insert - - supported by a station positioner 38 mounted on the end of a radially movable arm 40, (FIG. 2) - -

Column 3, line 2, after "include" insert - - a frame 34 on the top of which is mounted a table 36 supporting - -

lines 5-6, cancel "further"

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

Column 3, line 9, after "lower" insert - - ram - -

after "with" insert - - a - -

line 12, after numeral "58" insert

- - provided - -

change "its" to - - a - -

line 24, change "fro" to - - for - -

line 28, cancel "bearing"

line 35, change "controls" to - - control - -

line 36, between "the" and "manner"

insert - - structure and the - -

after reference numeral "22a"

insert a comma (,) followed by - - for example, - -

line 37, after "and" insert - - similarly - -

after reference numeral "20a"

insert a comma (,)

line 38, change "the" to - - its - -

cancel "toothed wheels. Illustrated

in FIG. 3 is"

line 39, cancel "the"

line 40, cancel "The pressure inlet lines"

line 41, cancel

line 42, cancel "for the piston associated

with the slide 22a."

line 49, change "with" to - - in - -

Column 3, line 50, after reference numeral "18" insert - - (FIG. 1) - -

cancel "A pressurized fluid flow is in - -

line 51, cancel

line 52, cancel

line 53, cancel

line 54, cancel "tion."

line 56, cancel numeral "12"

line 58, cancel "operates to"

lines 58-59, change "control" to - - controls - -

line 62, cancel "second"

line 63, after numeral "80" insert a comma (,)

cancel "its"

Column 4, line 5, change "shaft" to - - camshaft - -

line 10, cancel "in the press"

line 11, change "a" to - - the - -

line 26, change "fixed" to - - determined - -

line 27, between "the" and "wheel" insert - - adjusting - -

lines 27-28 change "remote" to - - remotely - -

line 29, after "FIG. 3" insert a comma (,)

Column 4, line 35, after "namely' insert - - the example of - -

line 38, after reference numeral "70" insert - - of the slide - -

line 40, change "control" to - - adjustment -

cancel the comma (,)

cancel "either fill or press"

line 43, after reference numeral "76" insert - - of the slide is - -

lines 43-44, cancel "is shown"

line 47, cancel "in FIG. 5 the" and insert thereinstead - - a - -

line 48, cancel "will displace" and insert thereinstead - - rotates - -

change "manner" to - - direction - -

line 50, after "of" insert - - the leaf spring"

line 58, change "of" to - - through - -

line 59, cancel "will be seen to"

change "contain" to - - contains - -

line 63, after reference numeral "116" insert - - for the cylinder - -

Column 4, line 63, change "opening" to - - blind bore - -

line 65, change "opening" to - - blind bore - -

line 66, after the period (.) insert - - The - -

change "Spring" to - - spring - -

line 67, change "bolt" to - - stud - -

Column 5, line 1, change "bolt" to - - stud - -

line 10, cancel "fixed to and"

line 11, change "mounted" to - - connected - -

line 12, before "threaded" insert - - radially disposed - -

line 19, after "FIG. 1" insert a comma (,) and change "in which" to - - whereby - -

line 22, change "cavities" to - - presses - -

line 32, after "of" insert - - the - -

line 61, after "as" insert - - the - -

after numeral "16" insert - - or 18 - -

line 64, change "wheels" to - - wheel - -

after numeral "70" insert - - of the slide - -

IN THE CLAIMS

Column 6, line 10, after "operated"

cancel the comma (,)

Column 7, line 4, cancel "including"

line 5, cancel "a pair of control valves"

after "means" insert - - being - -

Signed and sealed this 25th day of December 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents