June 18, 1935. D. D. HUYETT 2,005,260

PRESS MECHANISM

Filed Dec. 30, 1932 2 Sheets-Sheet 1

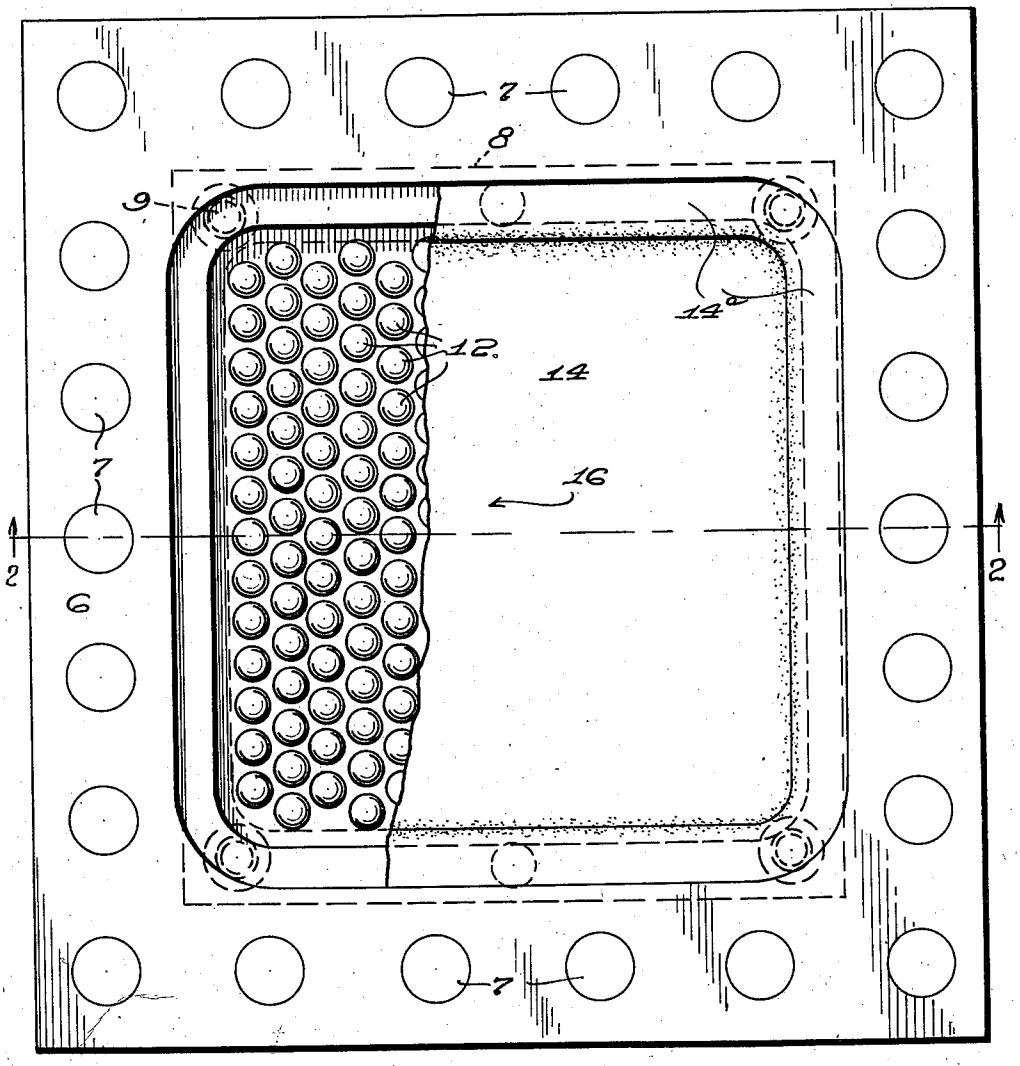

Fig. 1.

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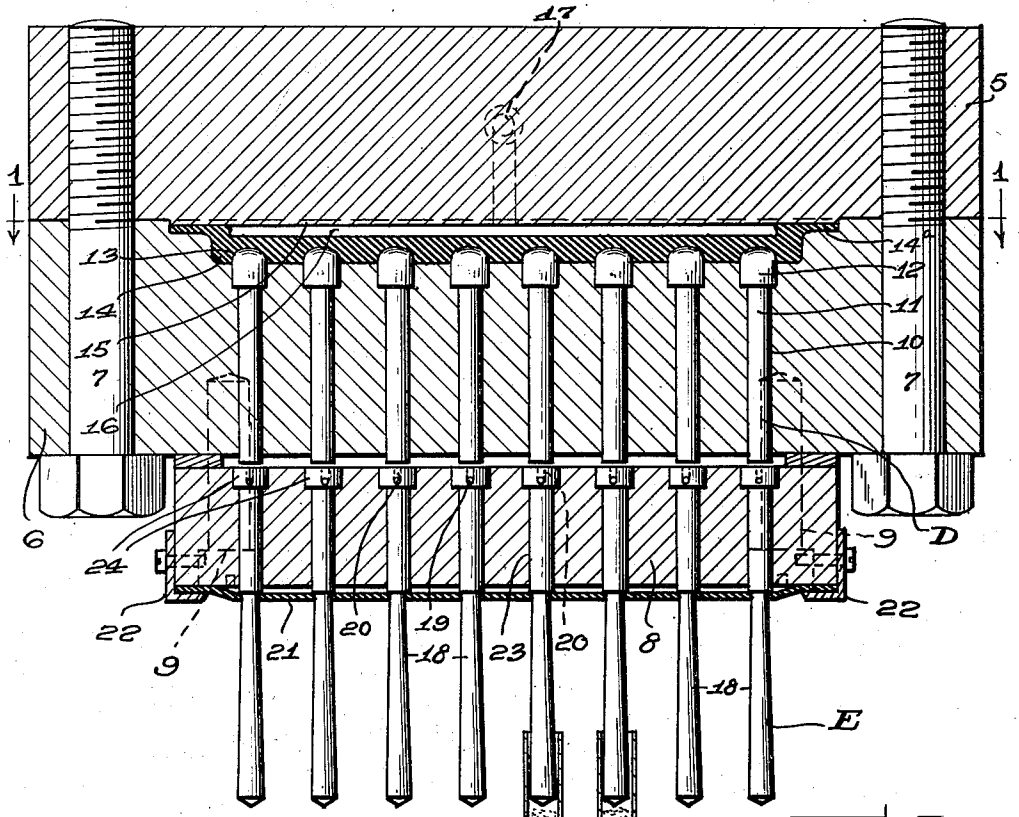

Fig. 2.

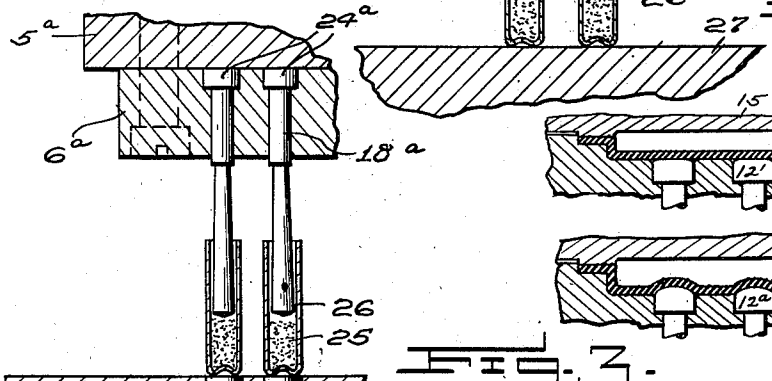

Fig. 3.

Fig. 4.

Fig. 5.

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PRESS MECHANISM

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14 Claims. (Cl. 86—20)

This invention relates to press mechanism and more particularly to what may be termed a multiple point uniform pressure press adapted to deliver uniform pressure upon material at a multiplicity of points.

The press of the present invention is of particular utility in pressing explosive charges into detonator or blasting cap shells, but as this description proceeds it will be seen that the invention is not limited with respect to the particular use for which the device is employed but that it is capable of use in a wide variety of pressing and pelleting operations.

Uniformity is particularly desirable in the manufacture of many pelleted articles and especially in the manufacture of explosive charges. It is customary in the manufacture of detonators to deposit the explosive charge used into a large number of detonator shells in a single operation and then remove the rack containing the charged shells to a press where pressure is applied simultaneously to all of the charges by means of numerous metal press points or plungers one of which enters the open end of each shell.

It is very difficult to deposit uniform weight charges into detonator shells within the limits of commercial practice because of variations in the density of the explosive and variation in its flowing properties. Consequently, the under-weight charges are under pressed while over weight charges are over pressed. Over pressing may render the charges "dead pressed" or cause bulging of the detonator shells. Upon the other hand under pressed charges are conducive to even greater evils for where the the explosive charge it not firmly pressed into a common mass it tends to loosen and fall out of the open end of the shell. The presence of loose explosive in the metal containers in which the shells are packed constitute an exceedingly great hazard. Further, the attempt to use detonators from which the explosive is wholly or partly missing brings about miss fires.

It is, therefore, a primary object of the present invention to bring about uniformity of pressure upon the substance being pressed while at the same time maintaining conditions of maximum safety for the press operators.

Further objects and advantages of the invention will be set forth in the detailed description which follows:

In the accompanying drawings

Figure 1 is a sectional plan view upon line 1—1 of Fig. 2.

Figure 2 is a vertical sectional view upon line 2—2 of Fig. 1.

Figure 3 is a vertical sectional view illustrating a modified form of the invention, in which the cushioning and pressure applying means is carried by the bed plate of the press instead of being carried by the gate or head of the press as in Figures 1 and 2, and

Figures 4 and 5 illustrate further modified forms of the diaphragms hereinafter described.

Like numerals designate corresponding parts in all the figures of the drawings.

In the form of the invention illustrated in Figures 1 and 2, 5 designates the vertically reciprocatory gate or head of the press. A steel plate 6 is fastened to the gate by bolts 7, and a block 8 is secured to plate 6 by screws 9. The plate 6 is provided with a multiplicity of openings 10 shaped to receive the plungers comprising shanks 11 and enlarged heads 12. The tops of these heads are properly rounded and highly polished and are all acted upon by a single rubber diaphragm 14 common to all points. This diaphragm is made of "non-coldflow" rubber which has the characteristic of recovering its original thickness after being subjected to pressure. It will not flow or take a permanent set under repeated strain as readily as some grades of rubber. These "non-coldflow" properties are secured by definite methods of compounding and curing and by proper moulding. Under actual test a diaphragm of this character with 1500 pounds per square inch hydraulic pressure imposed has been subjected to 1,728,000 strokes of the plungers without failure of the rubber. This is equivalent to 2160 days, operation of the detonator press.

As will be observed from an inspection of Figure 2, the diaphragm 14 may be held at its edges 14a directly between gate 5 and plate 6, or an intermediate steel cover plate 15 may be employed, if desired.

The main portion of the diaphragm is spaced from plate 15 and plate 6 to constitute a pressure chamber 16 in which a fluid pressure of any desired degree is maintained through a port indicated at 17 and receiving fluid under pressure from any desired source. A multiplicity of press points 18 are held slidably in block 8 and are prevented from turning by pins 19 and slots 20. A perforated sheet rubber guard 21 is held in place by angular clips 22; the guard 21 fitting snugly around the press points and serving to prevent explosive dust from working into the

clearance space between the press points and the openings 23 in block 8 in which said press points are mounted.

The heads 12 limit the downward movement of the plungers and the heads 24 of the press points limit both the downward and upward movement of the press points, the latter coming to a solid stop against block 8 in their downward movement and against plate 6 in their upward movement. The upward movement is limited so as to prevent injury to the diaphragm in case the press is operated with insufficient water pressure in chamber 16, or with other improper adjustments. A slight clearance exists between the bottom of the plungers and the top of the press points. Thus, as the gate descends and the press points start to apply pressure they have a free lift until the clearance is taken up, after which they exert a pressure on the explosive charges 25 in the detonator shells 26 supported upon press bed 27 up to the desired maximum for compressing the same to the proper density. Continued downward movement of the gate will result in the lifting of the plungers against the action of diaphragm 14 and against the action of the constant hydraulic pressure in the chamber 16.

Uniform density in all detonators whether they contain high, low, or normal charges is assured by adjusting the bottom-stroke position of the press points so that they will travel about one-half of their total lift when pressing a normal charge. Thus, with a low charge the press points will retract less than half their total lift and with a high charge more than half their total lift, but in all cases the ultimate pressure delivered upon the charge is determined by the hydraulic pressure existing in chamber 16.

In practice, it is not necessary to provide for a very wide variation in the volume or density of the loose explosive charged into the detonators and therefore a long compensating stroke of the press point is not necessary. A total lift of about $\frac{1}{16}$'' has been found to take care of variations met with in the present methods of charging. However, in designing this press, a ⅛'' lift has been provided and found to be well within the working limits of the rubber diaphragm.

The clearance provided between the plungers D and press points E serves two purposes—it permits the press point to move slightly and feel its way into the mouth of the detonator shell, and it also prevents the transfer of strain to block 8 which might be set up by any slight deflection of plate 6 imposed by the pressure in chamber 16.

With the construction shown in Fig. 2 it will be seen that plate 8 with its complete set of press points can readily be replaced with another, by removal of four bolts 9, and without disturbing any of the hydraulic pressure elements. This mounting of a complete set of press points in plate 8 renders it possible to use groups of press points of different sizes according to the nature of the work to be done without the necessity of disturbing the diaphragm and its associated plungers 11. However, I wish it to be understood that a structure in which the press points are directly connected to the plungers is within the scope of the invention. That is to say, it is clear that if the upper ends of the press points were caused to bear directly against the diaphragm many of the advantages of the present invention would be achieved. Consequently, the appended claims are intended to cover not only the specific arrangement shown in the drawings, but any equivalent arrangement accomplishing the same general result. The term "press points" is to be broadly construed to mean any pressure exerting elements for simultaneously exerting their individual pressures upon a plurality of elements whether such elements be detonator charges, pellets, or otherwise.

A very close regulation of the finally delivered pressure may be had with the construction herein shown and described because the necessity of packing the individual plungers against high pressures is avoided and they are left free to follow the movements of the diaphragm without excessive frictional interference. Further, any leakage of water or other fluid along the plungers which might find its way to, and ruin the explosive charge, is effectively prevented.

In the modified form of the invention illustrated in Fig. 3, the plungers 11*a* are shown engaged with a diaphragm 14*b* which, in this instance, is carried by the bed plate 27*a* of the press. The press gate 5*a* carries a steel plate 6*a* and this plate in turn has the press points 18*a* rigidly secured thereto by having the heads 24*a* of said press points bound between the gate 5*a* and the plate 6*a*. Under this construction, the plungers 11*a* are caused to yield downwardly against the action of the diaphragm and the pressure in a pressure chamber 16*a* after the charges in the detonator shells 26*a* have been compressed to the predetermined degree fixed by the pressure in pressure chamber 16*a*.

The modified form of diaphragm indicated at 14*a*' in Fig. 4 comprises a web of relatively thin (preferably about $\frac{1}{16}$ inch) flat rubber of the non-coldflow character. In this case, the heads 12' of the plungers are almost flat on top but are rounded at the corners while the corners of the sockets within which said heads are seated are also slightly rounded as at 12*x*.

In the modification illustrated in Fig. 5 the relatively thin web of non-coldflow rubber 14'' rests upon the heads 12*a* of the plungers said heads being rounded across substantially their whole diameters and the upper corners of the sockets in which said heads are seated being sharp or square.

In the modification illustrated in Fig. 4, the action is much more sensitive than in the forms illustrated in Figs 1 and 2 but there is some tendency for the diaphragm to wear out because of the chewing action adjacent the upper corner of the heads of the plungers.

The modification illlustrated in Fig. 5 is much less subject to the wearing action aforesaid and gives much longer wear than the form illustrated in Fig. 4 while giving the desired sensitive action.

In determining the best form of diaphragm to be employed, I have to choose between long life upon the one hand and a desired sensitivity upon the other. The form of diaphragm illustrated in Fig. 2 has a decidedly longer life than either of the diaphragms illustrated in Figs. 4 and 5 but is much less sensitive. In this form of diaphragm about 50 pounds per pin is required to deform the rubber when lifting ⅛'' as against a requirement of only 10 pounds with the diaphragm illustrated in Figs. 4 and 5. In other words, with the hydraulic pressure set for the pin to start lifting at any given pressure "A" the total pressure exerted by each pin as it lifts is approximately as follows with different types of diaphragm.

Pressure exerted by pin as movement of pin starts—"A"

	1/32" lift	1/16" lift	1/8" lift
Fig. 5	A+2.5#	A+5#	A+10#
Fig. 4	A+2.5#	A+5#	A+10#
Fig. 2	A+12½#	A+25#	A+50#

A ten pound variation in total pressure on a charge would be negligible for any known explosive material but 50# variation is considered too great for substances like nitromannite although permissible for fulminate-chlorate.

Under most severe test conditions, the diaphragm of Figures 2 and 3 has shown almost unlimited life, the form illustrated in Figure 4 has indicated that it is good for a press operation of about one year, while the form illustrated in Figure 5 lasts for considerably more than a year. Replacing diaphragms more than once per year or even at more frequent intervals is entirely practicable from an operating standpoint. The degree of sensitivity desired is dependent somewhat upon the nature of the material being pressed. For pressing fulminate or tetryl I would use the diaphragm illustrated in Figs. 2 and 3 but for material requiring comparatively light pressures, such as nitromannite, I employ the much thinner diaphragm of Figures 4 and 5.

The provision of the rubber web 21 for preventing the accidental passage of explosive dust upwardly into the sockets within which the press points are mounted to move is a feature which makes for additional safety to the press operators since it guards against the possibility of explosions arising from the setting off of such explosive dust by either friction or shock in the operation of the press.

The particular character of actuating means for the press gate is immaterial. The press may be either hand or power operated. Presses of this character are very common in the arts not only in the making of explosives but in the making of pellets, tablets and molding blocks of the various kinds. The characteristic feature of presses to which the invention relates is that they commonly employ a multiplicity of press points and it is in the provision of simple and efficient means for equalizing the pressure delivered upon all of the press points that this invention particularly resides, irrespective of the particular character of the material being pressed.

It is to be understood that the invention is not limited to the precise construction set forth, but that it includes within its purview whatever changes fairly come within either the terms or the spirit of the appended claims.

Having described my invention, what I claim is:

1. A device of the character described comprising a press gate, a plate secured thereto, a diaphragm held between the plate and gate and shaped to constitute a pressure chamber therebehind, a plurality of plungers having heads engaged with said diaphragm, and a plurality of press points aligned with said plungers as and for the purposes set forth.

2. A device of the character described comprising in combination a gate, a plate secured thereto, a diaphragm located between the gate and plate, a pressure chamber outwardly of the diaphragm, a plurality of plungers having rounded heads seated in pockets of the diaphragm, and a plurality of press points aligned with said plungers.

3. A structure as recited in claim 2 wherein said diaphragm is composed of "non-coldflow" rubber.

4. A structure as recited in claim 2 in combination with a member in which the press points are mounted to move, and a diaphragm of flexible material through which said press points pass and which diaphragm snugly engages said press points.

5. A device of the character described comprising a gate, a plurality of press points fixed rigidly to said gate, a press bed, a diaphragm supported by the press bed having a pressure chamber there-behind, and plungers engaging said diaphragm and aligned with the press points.

6. A device of the character described comprising a gate, a plurality of press points fixed rigidly to said gate, a press bed, a diaphragm supported by the press bed having a pressure chamber there-behind, and plungers engaging said diaphragm and aligned with the press points, said plungers being provided with means for limiting their outward movement toward the press points under the action of said diaphragm.

7. A machine for applying a uniform pressure simultaneously to the contents of a group of containers comprising in combination, a reciprocatory structure having a pressure chamber formed therein, one side of which pressure chamber consists of a diaphragm, a plurality of press points or punches associated with and carried bodily by said reciprocatory member, means for supporting a group of containers in alignment with the press points, said press points being adapted to enter and press the contents of the containers, a source of positive pressure supply, means for admitting pressure fluid to the said chamber from said source of pressure supply during the reciprocation of said structure, and means for transmitting the pressure of the diaphragm as determined by the pressure fluid, simultaneously to all of the press points.

8. A structure as recited in claim 7 wherein said diaphragm is composed of a non-cold flow rubber.

9. A device of the character described comprising a reciprocatory press gate, a pressure chamber formed therein, one side of which pressure chamber is constituted by a rubber diaphragm, a plurality of plungers having heads engaged with said diaphragm, and a plurality of press points alined with said plungers and against which said plungers thrust, said press points and plungers moving bodily with the said press gate.

10. A structure as recited in claim 9 wherein the rubber of the diaphragm is of the non-cold flow type.

11. In a machine for applying uniform pressure simultaneously to the contents of a group of containers, the combination with a reciprocatory press gate, a plate secured to the press gate, a diaphragm held between the plate and gate to form a pressure chamber therebehind, means for supporting a group of containers in the line of travel of the reciprocatory press gate, a plurality of press points traveling with the press gate and having ends shaped and dimensioned to enter and press the contents of said containers, means for transmitting the thrust of the said press points simultaneously to the dia-

phragm, and means for admitting pressure fluid to the pressure chamber from a source of pressure supply during the travel of the press gate.

12. In combination, a bodily movable head, comprising a pressure chamber, a flexible, imperforate sheet comprising one side of said chamber, a group of press points bodily movable with said head, means for transmitting pressure from said sheet to said press points, and means for admitting pressure to said pressure chamber from a source of fluid pressure supply during the movement of said head.

13. Means for imparting uniform pressure to a multiplicity of points comprising a reciprocatory head including a pressure chamber, a rubber diaphragm closing and forming one side of said chamber, a group of pressure transmitting members bodily movable with said head, and parts of which bear upon said diaphragm, and means for supplying pressure fluid from a positive source of fluid pressure supply, to said chamber during the reciprocation of said head.

14. A structure as recited in claim 13 wherein the rubber of the diaphragm is of the non-cold flow type.

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