July 31, 1945. T. G. McDOUGAL 2,380,659

PROCESSING MACHINE

Filed July 18, 1941 2 Sheets-Sheet 1

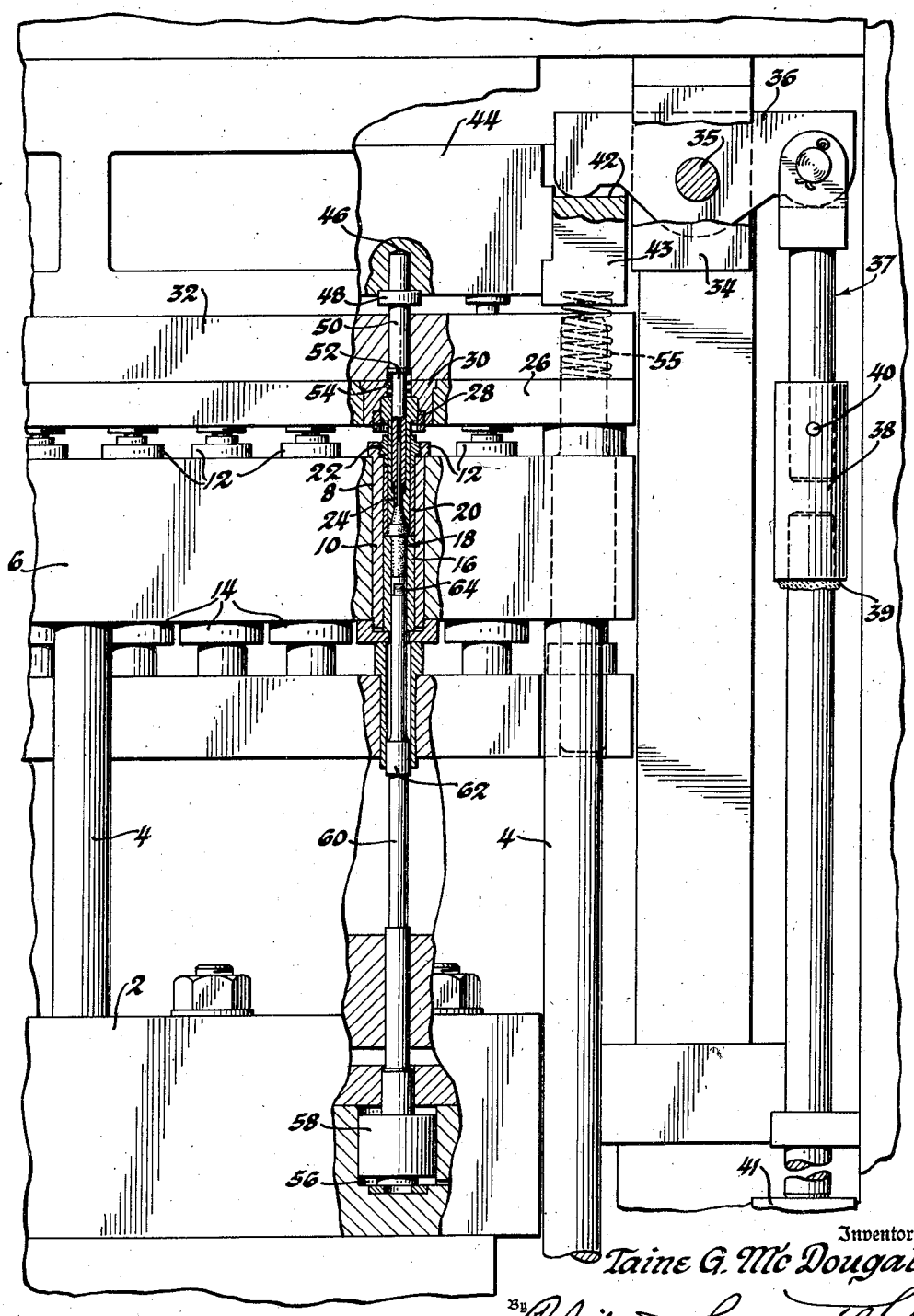


Fig. 1

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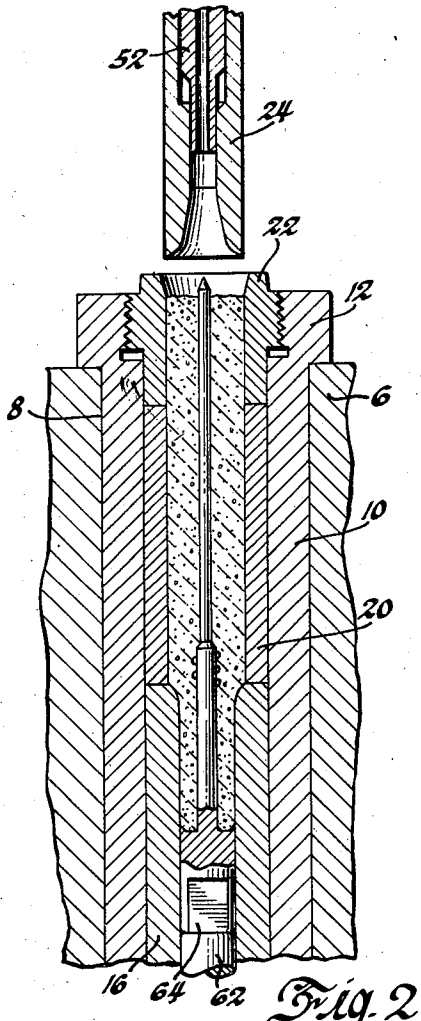


Fig. 2

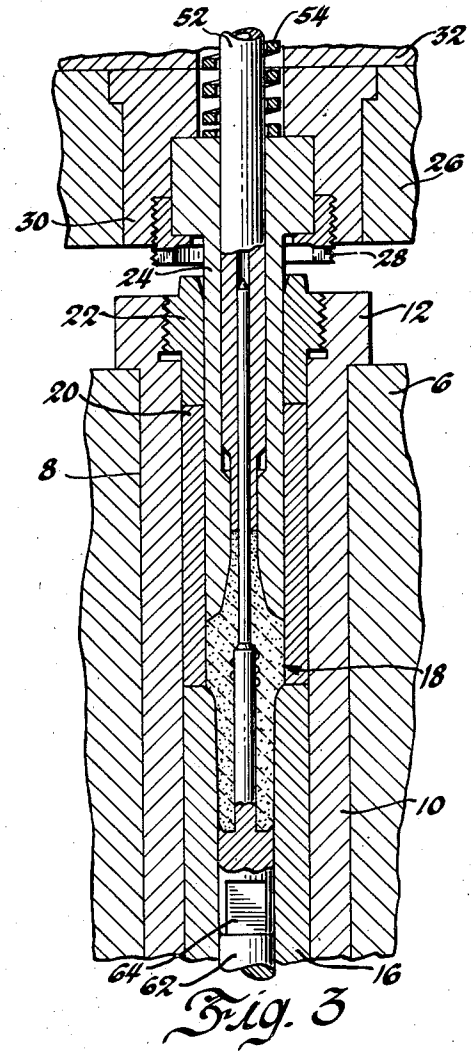


Fig. 3

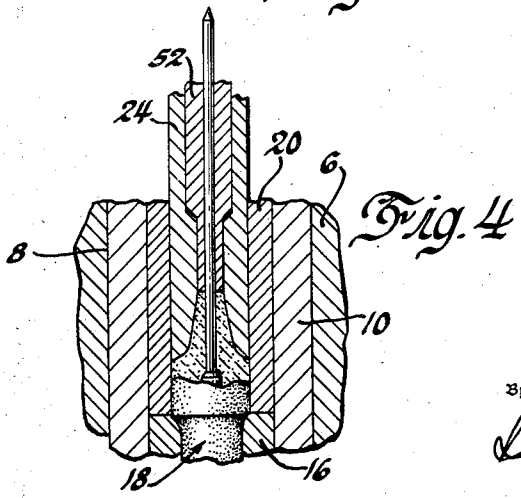


Fig. 4

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Patented July 31, 1945 2,380,659

UNITED STATES PATENT OFFICE

2,380,659

PROCESSING MACHINE

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Application July 18, 1941, Serial No. 402,973

8 Claims. (Cl. 18—16)

My invention relates to a machine for use in the manufacture of spark plugs, especially a machine used in the processing of spark plug insulators.

For maximum effectiveness and efficiency, a spark plug insulator must be formed of a very compact and dense material. For years it has been the objective of the spark plug industry to make a spark plug insulator having the proper density characteristics.

It is an object of my invention to provide a machine for use in the manufacture of spark plug insulators which compresses the insulating material supplied to the machine in powdered form into a compact, dense mass.

More specifically, it is an object of my invention to provide a machine in the manufacture of spark plug insulators in which a packer rod inside the die is moved against the molded powder during the last fraction of an inch of movement of the forming press, but after the die parts have come to rest. Uniformity in density among the insulators is made possible by the provision of compensating means to equalize the molding pressures among the various dies.

Figure 1 of the drawings is a front view of a machine embodying my invention, with parts broken away and in section.

Figure 2 is a detail view showing the upper die about to enter the cooperating lower die which has been filled with a predetermined quantity of powdered material.

Figure 3 indicates the relationship of the parts of the molding press after the upper die member has reached the limit of its travel but before the packer rod has been moved to compress the powdered material.

Figure 4 shows the relationship of the parts after the packer rod has been moved down to further condense and compress the powdered insulating material.

Referring to the drawings in detail and specifically to Figure 1, 2 indicates a stationary plate which may serve as the main support of my machine. Supported above plate 2 on rods 4 is a die block 6. Die block 6 may be fixed, if desired, but I prefer to mount supporting rods 4 on a cushioned platen (not shown) located below stationary plate 2. This platen will preferably be mounted on a piston fitting in a hydraulic cylinder. This cylinder may be used merely as means of giving block 6 a "floating" support, or it may also be used to raise die block 6 so as to lengthen the capacity of the female die above core pin 64, to permit the female die parts to hold a greater charge than is shown in Fig. 2. Die block 6 has a plurality of openings 8 in which sleeves 10 are secured by the heads 12 of these sleeves and nuts 14. Sleeves 10 carry the lower or female die members, made up in three parts. The lowermost or bottom one 16 of these parts is the forming die for the lower portion of the spark plug insulator indicated at 18. The middle or intermediate member 20 is substantially cylindrical in shape and is the molding die for the cylindrical intermediate portion of the insulator. The upper part 22 of the female die is in fact merely a retaining nut, which serves to hold the parts 16 and 20 in place but contributes nothing to the shape of the finished insulator.

Cooperating with the lower or female die member is the male die member 24. Die member 24 is secured to die plate 26 by a retaining nut 28 which cooperates with retaining bushing 30 in die plate 26. Die plate 26 is supported by backing plate 32. Plates 26 and 32 may be actuated by any suitable means such as a hydraulic ram (not shown).

A support 34 is mounted on the hydraulic ram so as to reciprocate with plates 26 and 32. Pivotally mounted at 35 on support 34 is a rocker arm 36. To one end of rocker arm 36 is connected a two-part push rod 37. The lower end of rod 37 is secured to a short cylinder or sleeve 38 as by a weld 39. The upper end of rod 37 is held in sleeve 38 by a shear pin 40. As the reciprocating parts near the limit of the stroke of the press, the lower end of rod 37 strikes a stationary stop 41. Continued downward movement of the reciprocating parts forces rod 37 upward, pivoting rocker arm 36 counterclockwise and causing it to bear upon a recessed surface 42 of pressure bar 43, which transmits the resulting downward thrust to pressure block or plate 44. Pressure block 44 is provided with a plurality of openings 46 into which are pressed plugs 48 of a special hardened wear resistant material. The downward pressure of plugs 48 is transmitted to pressure rods 50 which bear directly upon the heads of packer rods 52. A coil spring 54 below the head of each packer rod may be provided to return the parts to the position shown in Figure 1 either immediately before the downward thrust on packer rod 52 is applied or immediately after it is removed. Another set of springs, one of which is shown at 55, may be provided between pressure bar 43 and die plate 26 to assist springs 54 in returning packer rod 52 to its retracted position.

Located in the stationary plate 2 of my ma-

chine I have provided a cylinder 56 in which a piston 58 is slidably disposed. Piston 58 actuates rod 60 which operates an ejector 62. Ejector 62 is in effect the bottom or end wall of the female die. The material to be molded, whether a plastic or a dry powder, may rest immediately upon ejector 62, or I may first insert a core pin 64. After the molding operation has been completed and male die 24 has been withdrawn, pressure fluid may be admitted to the underside of piston 58 to loosen spark plug insulator 18 and core pin 64 in female die member 16. I prefer to use cylinders 56 in plate 2 as equalizers or compensators as well as ejector cylinders. By interconnecting these cylinders, I provide means whereby one or more of pistons 58 may be made to yield in case an excess of powder is supplied to the pocket above core pin 64 in the female die. Such a powder excess would ultimately create an excessive pressure in the corresponding cylinder 56, which would then be equalized through the connections (not shown) of this cylinder with the others.

A brief résumé of the operation of my machine follows:

With the male portions of the die withdrawn, core pins 64 are dropped into place in molds or die members 16. A predetermined quantity of powder to be formed is poured into the pocket or cavity remaining in the female die member above and around the core pin. At this stage of the operation the relationship of the machine parts is as shown in Figure 2. Plates 26 and 32 are then reciprocated so as to cause male die member 24 to enter the mold, compressing the powder to the form shown in Figure 3. In Figure 3 the parts of the machine are shown with plates 26 and 32 at the lower extremity of their travel. In Figure 3, however, packer rod 52 has not as yet been moved relatively to die member 24. At a point approximately $\frac{3}{8}$ of an inch before the end of the stroke of the machine is reached, the downward motion of plates 26 and 32 ceases, and push rod 37 contacts stop 41 pivoting rocker arm 36 counterclockwise to transmit pressure through bar 43, pressure block 44, plugs 48 and pressure rods 50 to packer rod 52. Rod 52 is thereby moved downward a fraction of an inch further, compressing the pulverized insulating material in the mold and increasing the density of the molded spark plug insulator, especially at its upper end. Differences in molding pressures among the cylinders which might be caused by differences in the charges, or the like, are not allowed to build up, because of compensating cylinders 56, as described above. The relationship of the machine parts at the end of the stroke of packer rod 52 is shown in Figure 4. Plates 26 and 32 are then reciprocated upward, withdrawing male die members 24. Ejector 62 is then actuated by piston 58 to loosen the formed insulator 18 which may thereupon be lifted out by lifting core pin 64.

Modifications and changes will become evident to those skilled in the art; for example, I may prefer to hold the male die stationary and reciprocate the female die.

I claim:

1. In a plastic molding press, a female die member having walls forming a cavity completely enclosed except at one end thereof and adapted to contain moldable material, a male die member, means to reciprocate one of said die members relatively to the other until the male die member has entered the female die through said one end and compressed moldable material therein, cushioned means for the die member not reciprocable for preventing excess pressure being created should an excess of moldable material be within the die cavity, a packer rod reciprocable within the male die member and relatively to both die members, and means cooperating with the reciprocating means for actuating the packer rod near the end of the working stroke of the reciprocating means.

2. In a plastic molding press, a female die member having walls forming a cavity completely enclosed except at one end thereof and adapted to contain moldable material, cushioned means for said member adapted to yield to prevent an excessive pressure being created in the die cavity should an excess of moldable material be supplied thereto, a male die member co-operable with said female die member, means to reciprocate the male die member into cooperating relationship with the female die member until the male die has compressed moldable material in said female die member, a packer rod reciprocable in the male die member, and means co-operable with the reciprocating means to actuate the packer rod near the end of the working stroke of the reciprocating means.

3. In a spark plug molding machine, a plurality of female dies, a plurality of male dies co-operable with the female dies, yieldable means for the female dies for preventing excessive pressure being created in the female dies should an excess of moldable material be supplied thereto, means to reciprocate the male dies into cooperating relationship with the female dies, a packer rod reciprocable in each male die, a reciprocable push rod, means including a rocker arm to transmit motion of the push rod to the packer rods, and stationary stop means engageable by said push rod near the end of the working stroke of the reciprocating means, whereby the packer rod in each male die is reciprocated relatively thereto.

4. In an insulator molding machine, a plurality of female dies, a plurality of male dies, means for reciprocating said dies into cooperating relationship, a packer rod reciprocable in each said male die, means to reciprocate said packer rods near the end of the working stroke of the first said reciprocating means, a movable end wall in each female die, means including a piston to support each end wall, a cylinder for each piston, and fluid connections among all the cylinders to equalize pressure differences.

5. In an insulator molding machine, a plurality of female dies, a plurality of male dies, means for reciprocating said dies into cooperating relationship, a packer rod reciprocable in each said male die, means to reciprocate said packer rods near the end of the working stroke of the first said reciprocating means, a movable end wall in each female die, a core pin in each female die supported on said end wall, means including a piston to support each end wall, a cylinder for each piston, and fluid connections among all the cylinders to equalize pressure differences.

6. In an insulator molding machine, a plurality of female dies, a plurality of male dies, means for reciprocating said dies into cooperating relationship, a packer rod reciprocable in each said male die, means to reciprocate said packer rods near the end of the working stroke of the first said reciprocating means, a movable end wall in each female die, a core supported on each said end wall and extending into the cavity of the female die, means including a piston to support each end wall, a cylinder for each piston, and fluid connec-

tions among all the cylinders to equalize pressure differences.

7. In an insulator molding machine, a female die member, a male die member, means to effect relative reciprocation of said die members, a packer rod reciprocable within the male die member and relatively to both die members, a push rod mounted on said reciprocating means, a stop engageable by said push rod near the end of the working stroke of the reciprocating means, and means including a rocker arm for transmitting the motion of the push rod to the packer rod.

8. In a processing machine, a plurality of female dies supported therein, a plurality of male dies, means for reciprocating the male dies into cooperating relationship with the female dies, a packer rod reciprocable in each male die, a push rod carried by said reciprocating means and reciprocable relatively thereto, means including a rocker arm for transmitting the movement of the push rod to the packer rods, and stop means engageable by said push rod after completion of the working stroke of the male dies and while said male dies are engaged with the female dies, whereby the packer rods are reciprocated in the male dies.

TAINE G. McDOUGAL.