Sept. 11, 1962 V. A. RAYBURN 3,052,919

ARTICLE-FORMING APPARATUS

Filed May 9, 1960 3 Sheets-Sheet 1

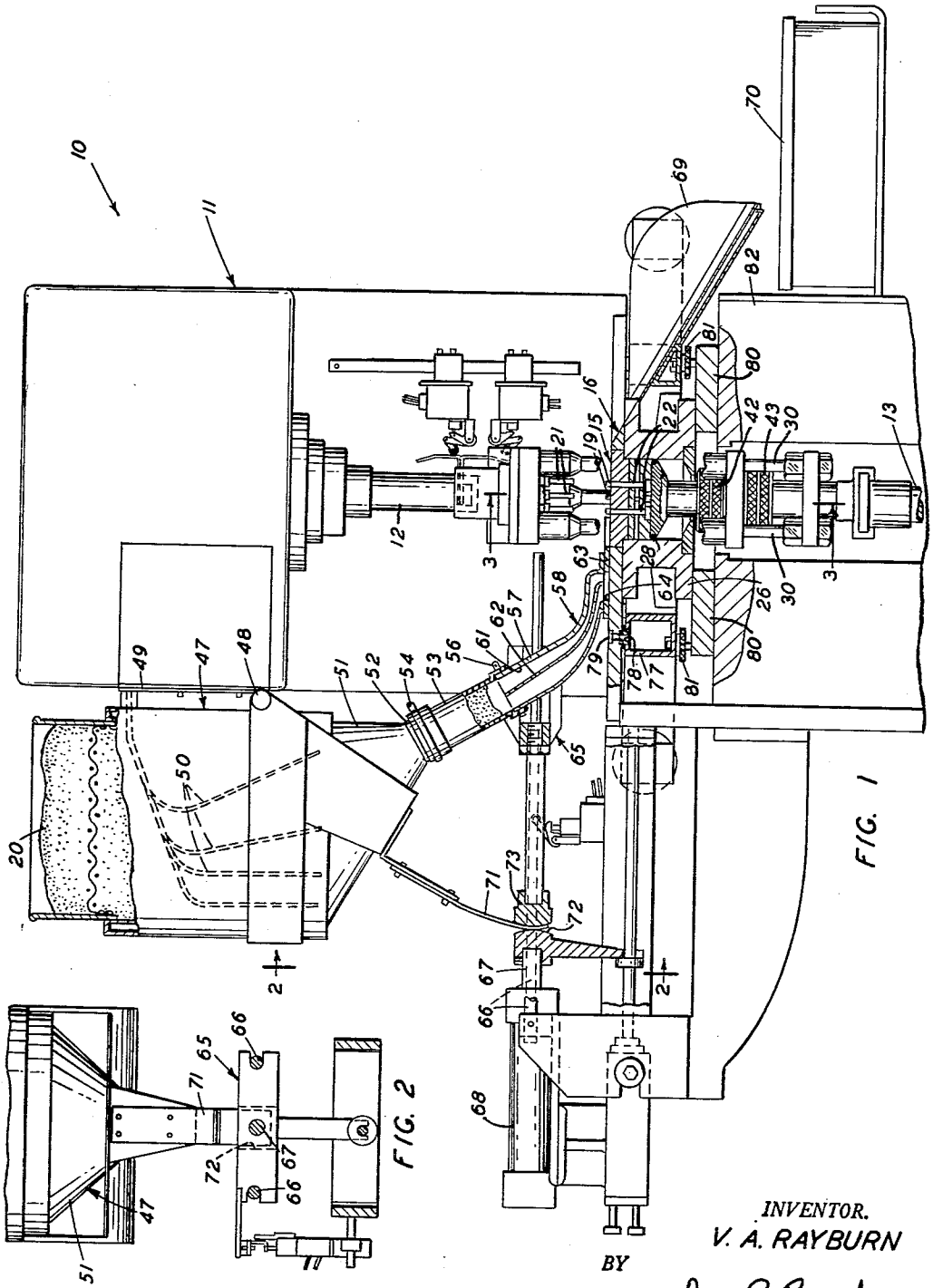


FIG. 1

FIG. 2

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Sept. 11, 1962 V. A. RAYBURN 3,052,919

ARTICLE-FORMING APPARATUS

Filed May 9, 1960 3 Sheets-Sheet 2

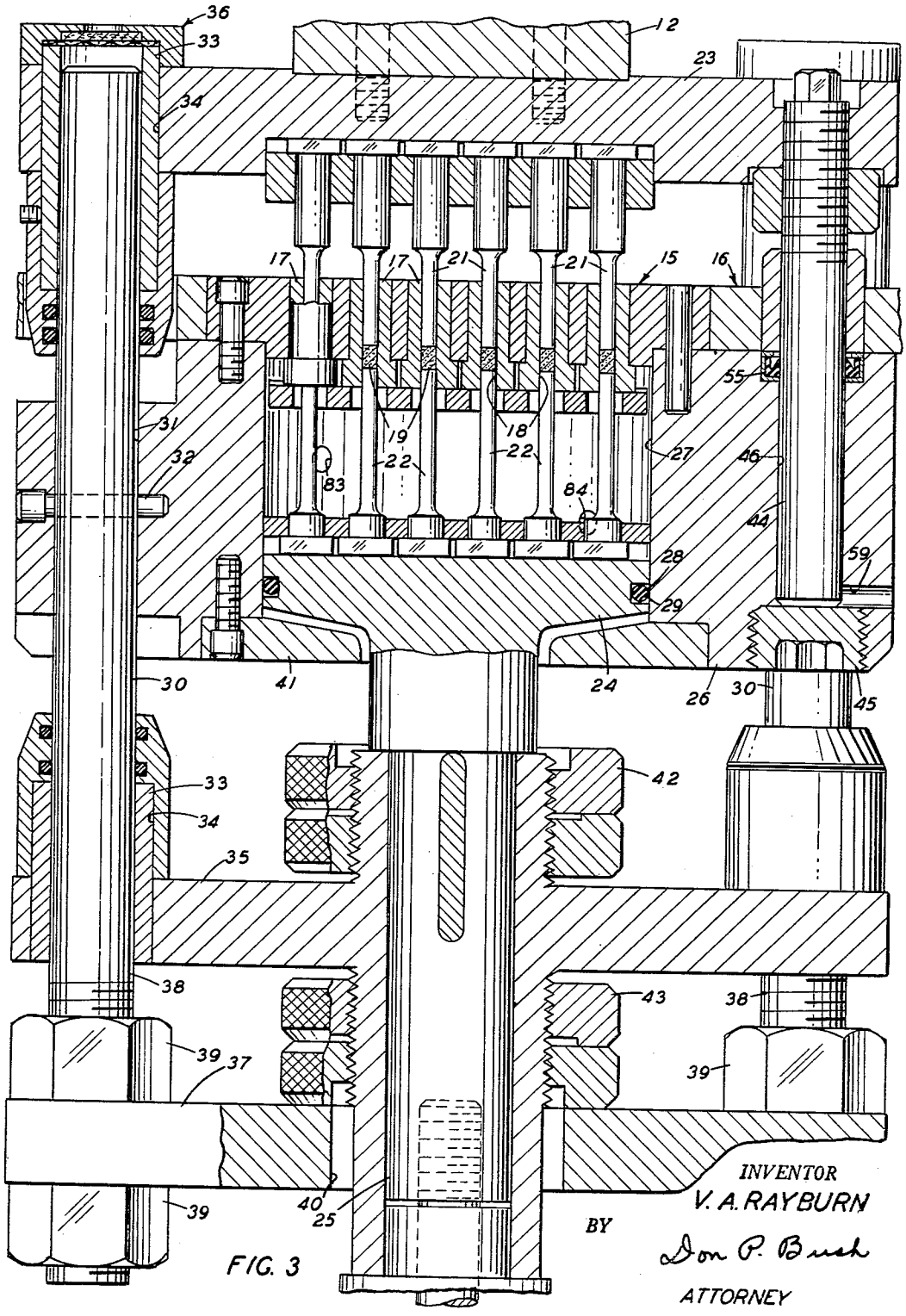


FIG. 3

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Filed May 9, 1960 3 Sheets-Sheet 3

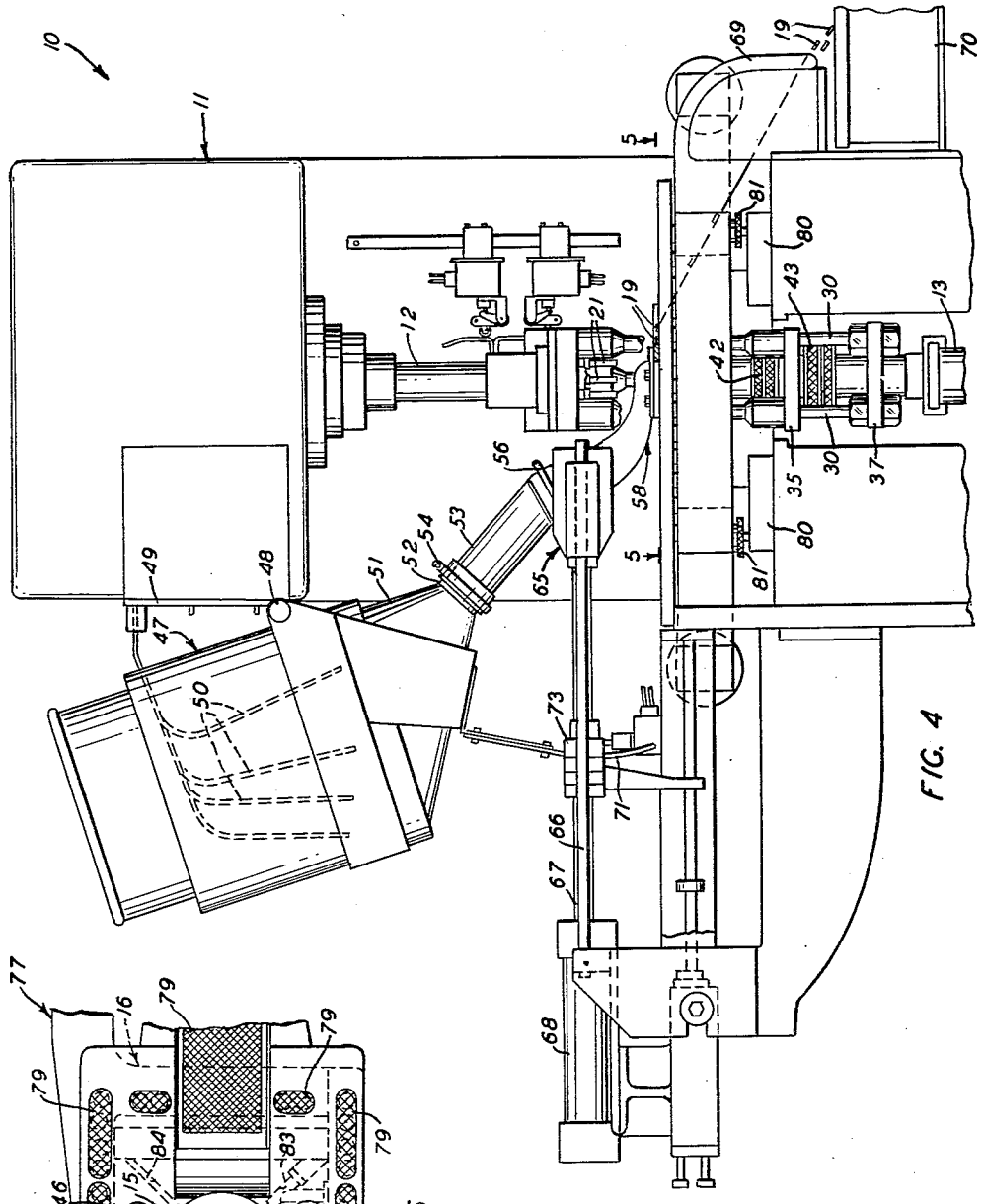


FIG. 4

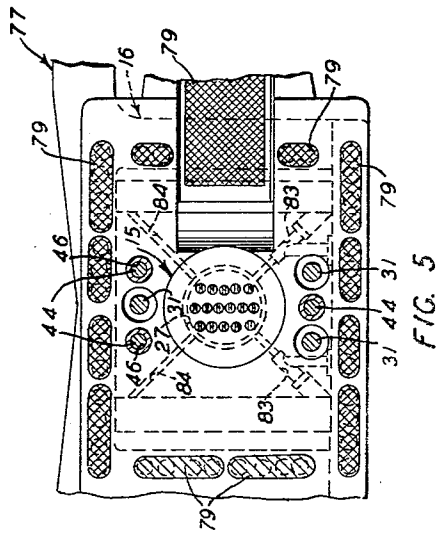


FIG. 5

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3,052,919

ARTICLE-FORMING APPARATUS

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7 Claims. (Cl. 18—16)

The present invention relates to an article-forming apparatus, and more particularly, although not exclusively, to a hydraulically operated tablet press having a multicavity molding die plate in which carbon inserts for lightning protectors are formed from a powered mix of carbon and a suitable binder by cooperating upper and lower forming members.

In the manufacture of carbon inserts for lightning protectors for communications equipment, a powered mix of carbon, coke and a suitable binder are formed into small rectangular or cylindrical tablets by a tablet press. Because of the particular use to which the carbon inserts are placed, it is highly desirable that all of the carbon inserts be of uniform size and possess uniform, predetermined physical and electrical properties. It has been found difficult in the past to insure that identical amounts of powdered carbon and binding agent are supplied to forming die cavities of the tablet press at a uniform rate, so that all of the carbon inserts formed by the tablet press are of the same size and have the same density and other physical and electrical properties.

In the past, when utilizing a tablet press to form tablets out of powdered ingredients, it has been common practice to utilize the retraction of forming members reciprocating in bores in a forming die to lower the powdered ingredients into the cavities in the forming die. However, this type of tablet press possesses a disadvantage in that, when the forming members have come to the end of their retraction stroke, any suction produced by the forming members ceases, so that the charge of powdered ingredients to the cavities is not uniform because air entrapped in the powdered mix in the cavities is not drawn out or exhausted. Therefore, the powdered ingredients are not fed into the cavities at a uniform rate, and all of the air in the powdered mix remains in the cavities. Further, most tablet presses used for processing finely divided powdered ingredients, which have a relatively low density, create a dust nuisance and are relatively untidy.

It is an object of the present invention to provide new and improved article-forming apparatus.

A further object of the present invention is to provide new and improved tablet presses.

Another object of the present invention is to provide new and improved tablet presses which will produce tablets from powdered ingredients which possess uniform density and other physical properties.

Another object of the present invention is to provide new and improved tablet presses for making tablets from finely divided powdered ingredients in which improved suction means are provided to introduce uniform charges of the powdered ingredients to each of a plurality of mold cavities at a uniform rate, and simultaneously withdraw air from the powdered ingredients which are fed into the cavities.

A still further object of the present invention is to provide a tablet press for forming tablets from relatively finely divided, low density, powdered ingredients in a relatively inexpensive, efficient and tidy manner.

An article-forming apparatus, embodying certain principles of the present invention, may include a molding die having a mold cavity in which a tablet is formed from a powdered mix, means for supplying the powdered mix to an open entrance at one end of the mold cavity, and means slidable in the mold cavity to compact the powdered mix into tablet form. A member is positioned adjacent to the die and has a passageway which is relatively large in cross section as compared to the cross section of the cavity and communicates with the mold cavity at the end of the cavity opposite the end to which the powdered mix is supplied. A piston or plunger is mounted closely and slidably in the passageway and is moved in the passageway away from the mold cavity to form a partial vacuum in the passageway to draw the powdered mix into the cavity.

Other objects and advantages of the present invention will be more readily understood from the following detailed description of a specific embodiment thereof, when read in conjunction with the appended drawings, in which:

FIG. 1 is a fragmentary, side elevation of a tablet press embodying certain principles of the present invention, with portions broken away for purposes of clarity;

FIG. 2 is a fragmentary, sectional view of the apparatus of FIG. 1, taken along line 2—2 thereof;

FIG. 3 is an enlarged, fragmentary, sectional view of the apparatus of FIG. 1, taken along line 3—3 thereof;

FIG. 4 is a fragmentary, side elevation of the apparatus of FIG. 1, in a different operating position, with portions broken away for purposes of clarity, and

FIG. 5 is a fragmentary, sectional view of the apparatus of FIG. 4, taken along line 5—5 thereof.

Referring now to the drawings, there is shown a tablet press, designated generally by the numeral 10, which includes a conventional hydraulic press frame, designated generally by the numeral 11. The press has a hydraulically actuated load ram 12, a hydraulically actuated knock-out ram 13, and a die holder, designated generally by the numeral 15, and a surface plate, designated generally by the numeral 16, intermediate of the rams 12 and 13.

Referring now specifically to FIG. 3, the die holder 15 is provided with a plurality of molding dies or die inserts 17—17 forming die cavities 18—18 in which carbon inserts 19—19 are formed from powdered mix 20 (FIG. 1) by cooperating upper and lower forming members 21—21 and 22—22, respectively. The powdered mix 20 includes finely divided carbon and coke particles and a suitable binder, such as coal-tar pitch, sugar, molasses or any other suitable organic material which will burn to carbon when the molded inserts 19—19 are subsequently fired.

The upper and lower forming members 21—21 and 22—22, respectively, could be of any general configuration but are generally rectangular in cross section with rounded corners and fit slidably within die inserts 17—17 forming the die cavities 18—18 of complementary cross sections. The upper forming members 21—21 are carried by an upper platen 23 secured to the load ram 12 for vertical reciprocating movement therewith. Similarly, the lower forming members 22—22 are secured to a lower platen 24 which, in turn, is connected operably to the knock-out ram 13 by an elongated rod 25 for vertical reciprocation therewith. The upper and lower forming members 21—21 and 22—22, respectively, and the die inserts 17—17 can be removed readily from the upper platen 23, the lower platen 24 and the die holder 15, respectively, when it is desirable to make different shaped articles.

The die holder 15 and surface plate 16 are secured to and supported by a generally rectangular die block 26. The die holder 15 is secured to the die block 26 sufficiently tight to form an airtight seal therebetween. The die block 26 has a cylindrical bore 27 formed centrally therein, which forms a chamber or passageway of a relatively large cross section as compared to the cross section of the die cavities 18—18. The lower platen 24 is cylindrical in shape and fits closely and slidably within

the bore 27 of the die block 26 to form a piston or plunger. An O-ring sealing element 28, made of rubber or other suitable elastomeric material, encircles the lower platen 24 in a circumferentially extending annular recess 29 in the periphery thereof and provides an airtight seal between the movable lower platen 24 and the wall of the bore 27.

When the lower platen 24 and the O-ring 28 are moved downwardly by the knock-out ram 13, a partial vacuum is drawn within the bore 27, which bore communicates with the die cavities 18—18 through clearances between the lower forming members 22—22 and the walls of the respective cavities 18—18. The partial vacuum in the bore 27 draws the powdered mix 20 into the die cavities 18—18 at a uniform rate and withdraws air from the powered mix in the cavities so that the density of the powdered mix in the cavities will be uniform throughout, prior to the compaction thereof by the upper and lower forming members 21—21 and 22—22, respectively, and the die inserts 17—17 forming the walls of the cavities 18—18. The partial vacuum also withdraws any fine particles of the powdered mix 20 from between the lower forming members 22—22 and the die inserts 17—17 which may work down from the die cavities 18—18.

Aligning pins 30—30 are attached fixedly in bores 31—31 in the die block 26 by pins 32—32, only one of which is illustrated in the drawings, and serve to simultaneously align both the upper platen 23 and the lower platen 24, with respect to the die block 26. The aligning pins 30—30 are positioned in sealed bushings 33—33 in bores 34—34 in the upper platen 23 and in a plate 35 keyed to the rod 25. A vent cap, designated generally by the numeral 36, provided with an oil-soaked felt seal is secured to an end of the bushing 33 projecting from the upper platen 23 above each of the aligning pins 30—30 to permit clean air to flow into and out of the space in the bushing 33, as the volumes thereof are changed by the movement of the upper platen 23 with respect to the ends of the pins 30—30. The aligning pins 30—30 support a stop plate 37 which is adjustably secured to the lower ends of the pins 30—30 by means of threads 38—38 and lock nuts 39—39. The plate 37 is provided with an opening 40 through which the rod 25 of the lower platen 24 moves freely.

In order to control the limit of movement of the lower forming members 22—22 more precisely, the plate 35, which is keyed to the rod 25, has externally threaded projections to receive annular, threaded, adjustable two-member, stop collars 42 and 43. The upward movement of the lower platen 24 and members 22—22 is limited by the stop collar 42 striking a hardened steel, annular member 41 which loosely encircles the rod 25 and is secured to the die block 26, whereas the downward movement of the lower platen 24 is limited by the stop collar 43 striking the plate 37. In order to control the size of the carbon inserts 19—19, the downward travel of the upper forming members 21—21 must be controlled with respect to the position of the lower forming members 22—22. Therefore, downward travel of the upper platen 23 is limited by adjustable, stop pins 44—44 striking hardened steel stop anvils 45—45, only one of which is shown in the drawing.

Upper threaded ends of the stop pins 44—44 are secured adjustably in the upper platen 23 and the lower portions of the pins 44—44 are received slidably within bores 46—46, formed in the die block 26 which are sealed at the upper ends thereof by seals 55—55. At the lower end of each of the bores 46—46 is a laterally extending vent hole 59 which permits free movement of air into and out of the bore 46 during the travel of the associated stop pin 44. The vent holes 59—59 provide escape passages for any particles of the powdered mix 20 which may get into the bores 46—46, which would otherwise effect the limit of movement of the stop pins 44—44, and also prevent "cushioning" or dashpot action of air within the bores 46—46.

Referring now to FIGS. 1 and 4, a feed hopper, designated generally by the numeral 47, which contains a supply of the powdered mix 20, is mounted pivotally on the press frame 11. The hopper 47 pivots about a pin 48 supported by a bracket 49 secured fixedly to the press frame 11. The bracket 49 also supports fixedly a plurality of curved breaker tines 50—50 which function to break up bridges and lumps and prevent arching in the powdered mix 20 in the feed hopper 47. The hopper 47 is substantially semicircular in cross section and has a funnel-shaped bottom 51 with a cylindrically shaped outlet 52. A length of flexible hose 53, made of high elongation rubber (400%), is attached at one end thereof to the cylindrically shaped outlet 52 by a hose clamp 54. The other end of the flexible hose 53 is attached, by a hose clamp 56, to a curved neck 57 of a feeder boot, designated generally by the numeral 58. The feeder boot 58 directs the powdered mix 20 to the cavities 18—18 in the die holder 15.

The curved neck 57 of the feeder boot 58 is provided with a passageway 61 which is divided by a flow-equalizing vane 62. The neck 57 is secured to a flat sole plate 63, made of vulcanized bone fiber and having a rectangular opening 64 which communicates with the passageway 61 in the neck 57. The feeder boot 58 is supported by a shuttle, designated generally by the numeral 65, for horizontal sliding movement on parallel, horizontal, guide rods 66—66 for movement back and forth across the face of the die holder 15.

In operation, the feeder boot 58 is reciprocated by a piston rod 67 of a shuttle air cylinder 68 with the sole plate 63 designed to travel over the top surface of the plate 16 and the die holder 15 in close proximity therewith. When the sole plate 63 is moved to the position illustrated in FIG. 4, the sole plate 63 pushes the carbon inserts 19—19, which have been ejected from the cavities 18—18 by the lower forming members 22—22, down a chute 69 and into a handling tray 70. When the feeder boot 58 is moved to the position illustrated in FIG. 4, the feed hopper 47 is pivoted by the shuttle 65 so that the outlet 52 remains substantially in line with the curved neck 57 to prevent bending or collapsing of the hose 53 and shutting off of the supply of powdered mix 20 from the feed hopper 47. Simultaneously, a slight amount of tension is placed in the hose 53 to facilitate maintaining the hose straight.

When the feeder boot 58 moves to the position to discharge the carbon inserts 19—19, the rectangular opening 64 in the sole plate 63 of the boot 58 is positioned directly over the cavities 18—18 in the die holder 15. The feeder boot 58 is vibrated by the air cylinder 68 and the lower platen 24 is moved downwardly at the same time so that the powdered mix 20 is withdrawn from the boot into the cavities 18—18, through the cooperation of the partial vacuum formed in the bore 27 by the lower platen 24, to fill the cavities 18—18. The powdered mix 20 is leveled flush with the surface of the die holder 15 by the sole plate 63 of the boot 58 when the boot is returned to the position illustrated in FIG. 1.

A spring steel member 71 is attached fixedly at one end thereof to the bottom of the pivotable hopper 47. The other end of the spring steel member 71 is held slidably in a slot 72 in a block 73, which, in turn, is secured to the piston rod 67 of the shuttle air cylinder 68. Thus, it may be seen that, as the piston rod 67 is reciprocated to move the feeder boot 58 to and fro across the die holder 15, the spring steel member 71 oscillates the hopper 47 to jostle the powdered mix 20 therein and facilitate the feeding thereof to the feeder boot 58. During this oscillation, the tines 50—50 function to break up bridges and lumps in the powdered mix 20 in the hopper 47 to facilitate the feeding of the mix to the boot 58.

A substantially rectangularly shaped exhaust manifold,

designated generally by the numeral 77, surrounds the die block 26 and the die holder 15 and is in engagement with the lower surface of the surface plate 16. The surface plate 16 and the chute 69 are provided with a plurality of screen-covered apertures 79—79 (FIG. 5). A plurality of rubber-sealed sleeves 78—78 are secured to the lower surface of the surface plate 16 and chute 69 and depend downwardly therefrom into a plurality of complementary apertures in the upper surface of the manifold, which is supported by screw jacks 81—81 resting on supporting platens 80—80. The platens 80—80 are, in turn, supported by a pedestal 82. The manifold 77 is designed to carry away, by air suction, any particles of the mix 20 which happen to spill on the surfaces of the surface plate 16 and the die holder 15 and slide down the chute 69. An exhaust system (not shown) is connected to the manifold 77.

The exhaust manifold 77 is connected to passageways 83—83 in the wall of the die block 26 and are caused to communicate with the bore 27 above the lower platen 24 at a predetermined lower portion of the downward travel of the lower platen 24 to facilitate removal of particles of the powdered mix 20 which may escape into the bore 27 (FIGS. 3 and 5). Bores 84—84 are also formed in the wall of the die block 26 to expose the bore 27 thereof to the surrounding atmosphere at a predetermined time after the exhaust manifold 77 is connected to the bore 27 above the lower platen 24. This permits a free sweep of air from the surrounding atmosphere through the bore 27 to facilitate removal of particles of the mix 20, which are drawn into the bore 27 past the lower forming members 22—22, from the bore 27 by the exhaust manifold 77.

The relative positions of the passageways 83—83 and bores 84—84 have been chosen so that air from the surrounding atmosphere will not be permitted to flow into the bore 27 prior to the time suction is applied thereto by the exhaust manifold 77. Otherwise, the insurgent flow of air from the surrounding atmosphere might puff the powdered mix 20 contained within the die cavities 18—18 at that time.

Operation

In operation, after the die cavities 18—18 in the die inserts 17—17 have been charged with powdered mix 20 from the feeder boot 58, through the cooperation of conventional electrical control circuits and conventional fluid circuits, the feeder boot is withdrawn from above the cavities and the load ram 12 descends to move the upper platen 23 downwardly. When the upper platen 23 is moved downwardly, the upper forming members 21—21 thereon enter their respective cavities 18—18 a predetermined distance, as controlled by the cooperation of stop pins 44—44 and anvils 45—45, to compress the mix 20 against the lower forming members 22—22 and the walls of the cavities 18—18, thereby producing compressed carbon inserts 19—19 of predetermined dimensions which are subsequently fired in an oven (not shown). Immediately after the compression step, the load ram 12 is retracted and the knock-out ram 13 raises the lower forming members 22—22 to eject the compressed carbon inserts 19—19 from the cavities 18—18 in which the carbon inserts were formed.

The upward movement of the knock-out ram 13 ceases when the ends of the lower forming members 22—22 are flush with the top surface of the die holder 15. Immediately thereafter, the air cylinder 68 operates to move the feeder boot 58 to the right, as viewed in FIGS. 1 and 4. As the feeder boot 58 moves to the right, the front edge of the sole plate 63 sweeps the carbon inserts 19—19 down the discharge chute 69 and into the handling tray 70.

Before the feeder boot 58 is returned to its retracted position by the air cylinder 68, the feeder boot 58 is vibrated by the shuttle 65 and the knock-out ram 13 is retracted to move the lower platen 24 and attached forming members 22—22 downwardly. As the lower platen 24 moves downwardly, the piston formed by the lower platen 24 draws a partial vacuum within the bore 27 of the die block 26 which facilitates the filling of the cavities 18—18 by the powdered mix 20 from the vibrating feeder boot 58, the opening 64 of which, at this time, is positioned directly over the cavities 18—18. With the cavities 18—18 filled, the feeder boot 58 is returned to the left, as viewed in FIGS. 1 and 4, to its retracted position and the sequence of operation, described above, is repeated.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of the invention. Other arrangements may be devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. An article-forming apparatus, which comprises a molding die having a mold cavity in which tablets are formed from a powdered mix, means for supplying the powdered mix to an open entrance at one end of the mold cavity, first and second oppositely disposed means slidable in the mold cavity to compact the powdered mix into tablet form, a clearance being provided between the second compacting means and a wall of the mold cavity to permit entrapped air to pass therebetween, a member secured to the die and having a passageway which is relatively large in cross section as compared to the cross section of the cavity and communicates with the mold cavity at the other end thereof, a plunger connected to said second compacting means and mounted closely and slidably in the passageway, means for moving the plunger in the passageway away from the mold cavity to form a partial vacuum in the passageway to draw the powdered mix into the cavity and to withdraw entrapped air from the powdered mix entering the cavity, an exhaust system communicating with the passageway prior to a limit of travel of the plunger away from the cavity to exhaust particles of the powdered mix therefrom, and a passage in the member to connect the passageway to atmosphere adjacent to the limit of travel of the plunger away from the cavity to permit free flow of air into the passageway.

2. An article-forming apparatus, which comprises a molding die having a mold cavity extending vertically therethrough in which tablets are formed from a powdered mix, means for supplying the powdered mix to an entrance to the mold cavity at the upper end thereof, an upper forming member slidable into and out of the cavity of the molding die, means for reciprocating the upper forming member, a member positioned adjacent to the die and having an enlarged passage communicating with the cavity in the die, a lower platen slidable in the passage and having a complementary shape thereto, a lower forming member secured to the lower platen and slidable in the cavity toward and away from the upper forming member to cooperate therewith and the walls of the cavity to compact the powdered mix into tablet form, a clearance being provided between the lower forming member and the walls of the cavity to permit entrapped air to pass therebetween, sealing means encircling the lower platen to provide a substantially air-tight seal between the lower platen and the walls of the passageway, and means for moving the platen and lower forming member downwardly in the passage to form a partial vacuum in the passage to draw the powdered mix into the cavity and remove entrapped air from the powdered mix and particles of the powdered mix from between the lower forming member and the walls of the cavity and for subsequently moving the lower forming member upwardly to eject the tablet from the cavity.

3. An article-forming apparatus, which comprises a molding die plate having a plurality of mold cavities extending vertically therethrough in which tablets are formed from a powdered mix, means for supplying the powdered mix to an entrance to the mold cavities at the upper end thereof, a plurality of upper forming mem-

bers slidable into and out of the cavities of the molding die, means for reciprocating the upper forming members, a member positioned adjacent to the die and having an enlarged passage communicating with the cavity in the die, a lower platen slidable in the passage and having a complementary shape thereto, a plurality of lower forming members secured to the lower platen and slidable in the cavities toward and away from the upper forming members to cooperate therewith and the walls of the cavities to compact the powdered mix into tablet form, a clearance being provided between the lower forming members and the walls of the cavities to permit entrapped air to pass therebetween, sealing means encircling the lower platen to provide a substantially airtight seal between the lower platen and the walls of the passageway, and means for moving the platen and lower forming members downwardly in the passage to form a partial vacuum in the passage to draw the powdered mix into cavities and remove entrapped air from the powdered mix and particles of the powdered mix from between the lower forming members and the walls of the cavities and for subsequently moving the lower forming members upwardly to eject the tablets from the cavity.

4. A tablet press, which comprises an apertured surface plate, a die holder positioned in an aperture in the table, a plurality of dies positioned in the die holder and having a plurality of mold cavities extending vertically therethrough in which tablets are formed from a powdered mix, means for supplying the powdered mix to the entrance of the mold cavities at the upper end thereof, a plurality of upper forming members slidable into and out of the cavities of the dies, means for reciprocating the upper forming members, a die block positioned adjacent to the die holder and having an enlarged cylindrical passage communicating with the cavity in the dies, a lower cylindrical platen slidable in the passage and having a complementary shape thereto, a plurality of lower forming members secured to the lower platen and slidable in the cavities toward and away from the upper forming members to cooperate therewith and the walls of the cavities to compact the powdered mix into tablet form, a clearance being provided between the lower forming members and the walls of the cavities to permit entrapped air to pass therebetween, an O-ring made of elastomeric material encircling the lower platen to provide a substantially airtight seal between the lower platen and the portion of the die block forming the walls of the passage, means for moving the platen and lower forming member downwardly in the passage to form a partial vacuum in the passage to draw the powdered mix into the cavities and remove entrapped air from the powdered mix and any particles of the powdered mix which may work down between the lower forming members and the walls of the cavities and for subsequently moving the lower forming members upwardly to eject the tablets from the cavity, an exhaust manifold surrounding the die holder and the die block and having openings communicating with apertures in the surface plate around the die holder and a passage in the wall of the die block adjacent to the lower portion of travel of the lower platen to remove the particles of powdered mix from the passage removed from between the lower forming members and the walls of the cavities, and an aperture in the wall of the die holder below the level of the passage communicating with the exhaust manifold to permit free flow of air into the cylindrical passage from surrounding atmosphere.

5. A tablet press, which comprises a molding die having a mold cavity in which tablets are formed from a powdered mix, a pivotable feed hopper for the powdered mix, a plurality of stationary tines extending into the feed hopper to break up lumps and prevent bridging of the powdered mix therein, said hopper having a funnel-shaped bottom with a cylindrical outlet, a resilient hose made of high-elongation elastomeric material secured at one end to the cylindrical outlet, a feeder boot having a curved neck for feeding the powdered mix to an entrance at one end of the mold cavity secured to the other end of the resilient hose, a shuttle for reciprocating and vibrating the feeder boot, a slotted member secured to said shuttle for reciprocation and vibration therewith, an elongated spring secured to the feed hopper and slidable in the slot in the member for causing the hopper to be pivoted and vibrated as the shuttle is reciprocated and vibrated, means for reciprocating and vibrating the shuttle, the slotted member and the feeder boot so that the feed hopper is vibrated and is pivoted with respect to the tines and the hose is maintained straight as the feeder boot moves with respect to the molding die to prevent bending and collapsing of the hose and thus prevent shutting off of the supply of powdered mix from the hopper to the feeder boot, first and second oppositely disposed means slidable in the mold cavity to compact the powdered mix into tablet form, a clearance being provided between the second compacting means and a wall of the mold cavity to permit entrapped air to pass therebetween, a member secured to the die and having a passageway which is relatively large in cross section as compared to the cross section of the cavity and communicates with the mold cavity at the other end thereof, a plunger connected to said second compacting means and mounted closely and slidably in the passageway, and means for moving the plunger in the passageway away from the mold cavity to form a partial vacuum in the passageway to draw the powdered mix from the feeder boot and into the cavity and to withdraw entrapped air from the powdered mix entering the cavity.

6. A tablet press, which comprises an apertured surface plate, a molding die holder positioned in an aperture in the surface plate and having a plurality of die inserts having die cavities extending vertically therethrough in which tablets are formed from a powdered mix, means for supplying the powdered mix to the entrance of the mold cavities at the upper end thereof, an apertured upper platen, a plurality of upper forming members depending from the upper platen and slidable into and out of the die cavities, means for reciprocating the upper platen and upper forming members, a die block secured to the die holder and having an enlarged cylindrical chamber communicating with the cavities in the die inserts, a lower cylindrical platen slidable in the chamber and having a complementary shape thereto, a plurality of lower forming members secured to the lower platen and slidable in the cavities toward and away from the upper forming members to cooperate therewith and the inserts to compact the powdered mix into tablet form, a clearance being provided between the forming members and the walls of the cavities to permit entrapped air to pass therebetween, an O-ring encircling the lower platen to provide a substantially airtight seal between the lower platen and the portion of the die block forming the walls of the chamber, means for moving the platen and lower forming member downwardly in the chamber to form a partial vacuum in the chamber to draw the powdered mix into the cavities and remove entrapped air from the powdered mix and particles of the powdered mix from between the lower forming members and the walls of the cavities and for subsequently moving the lower forming members upwardly to eject the tablets from the cavities, means for limiting the lower limit of travel of the upper platen including stop anvils in the die block and stop rods which strike the anvils secured adjustably to the upper platen and slidable in bores in the die block, vent holes in the die block extending laterally of the bores in which the stop rods slide and communicating therewith to permit air to move into and out of the bores, aligning rods secured to the die block and positioned in the apertures in the upper platen for guiding the upper and lower platens, and oil-soaked felt filters positioned over the apertures in the upper platen in which the aligning rods slide adjacent to the upper sur-

face of the upper platen to permit passage of air into and out of the apertures in the upper platen as the upper platen slides with respect to the rods.

7. An article-forming apparatus, which comprises a molding die having a mold cavity in which tablets are formed from a powdered mix, means for supplying the powdered mix to an open entrance at one end of the mold cavity, a first compacting means positionable for obstructing the entrance end of the mold cavity, a member positioned adjacent to the die and having a passageway which is relatively large in cross section as compared to the cross section of the cavity and communicates with the mold cavity at the other end thereof, a plunger mounted closely and slidably in the passageway, a second compacting means slidable in the mold cavity connected to said plunger and movable therewith, clearance being provided between the second compacting means and a wall of the mold cavity in which a portion of the second compacting means is mounted slidably, the clearance being sufficient to permit entrapped air to flow therethrough from the mold cavity to the passageway, means for moving the second compacting means away from the entrance of the mold cavity to draw the powdered mix into the cavity and for simultaneously moving the plunger secured to the second compacting means in the passageway away from the mold cavity to form a partial vacuum in the passageway for withdrawing entrapped air from the powdered mix in the mold cavity through the clearance provided between the second compacting means and the wall of the cavity, and means for causing relative movement between the first compacting means and the second compacting means to compact the powdered mix into tablet form.

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