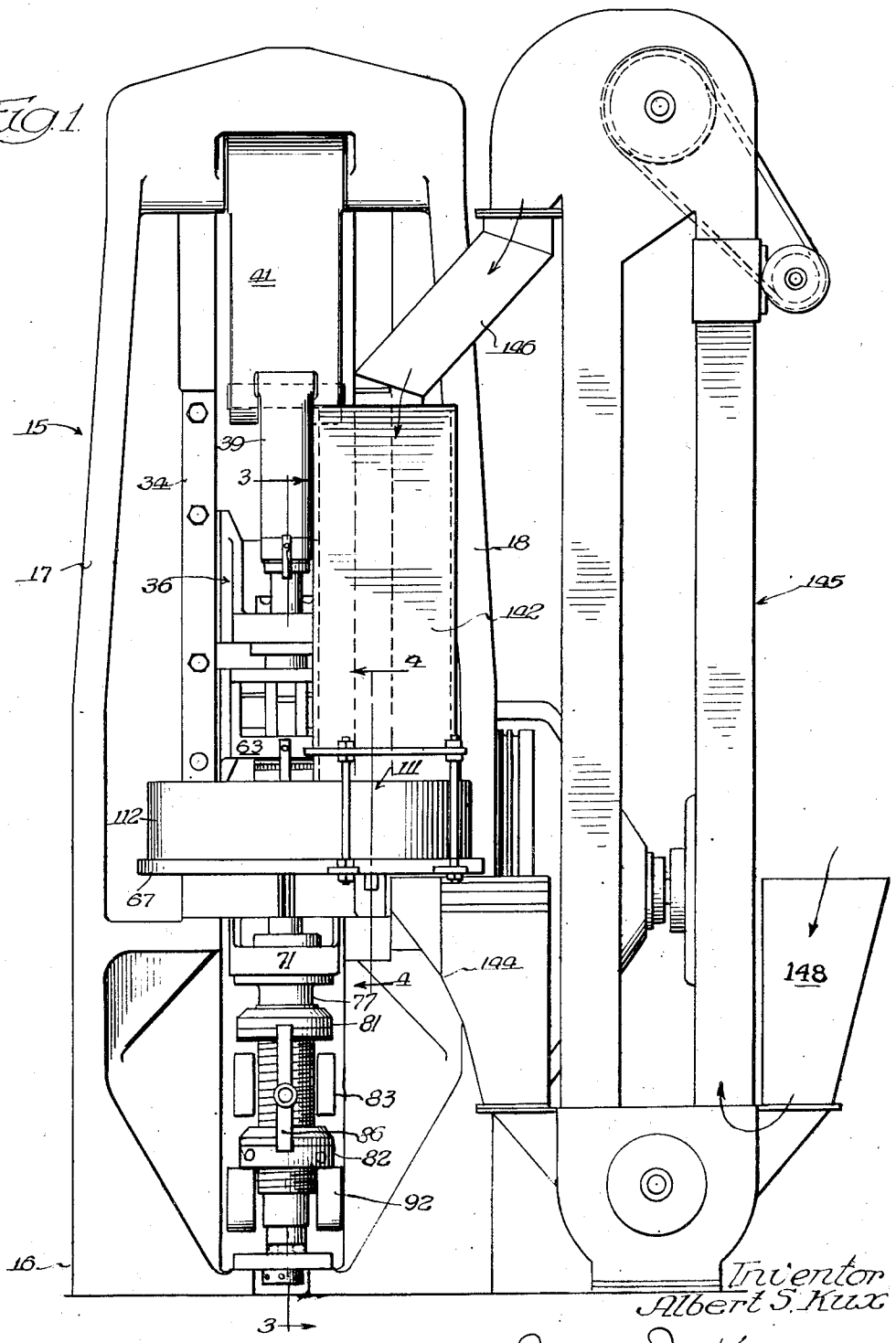
June 12, 1951 A. S. KUX 2,556,475

COMPRESSING MACHINE

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Fig. 1.



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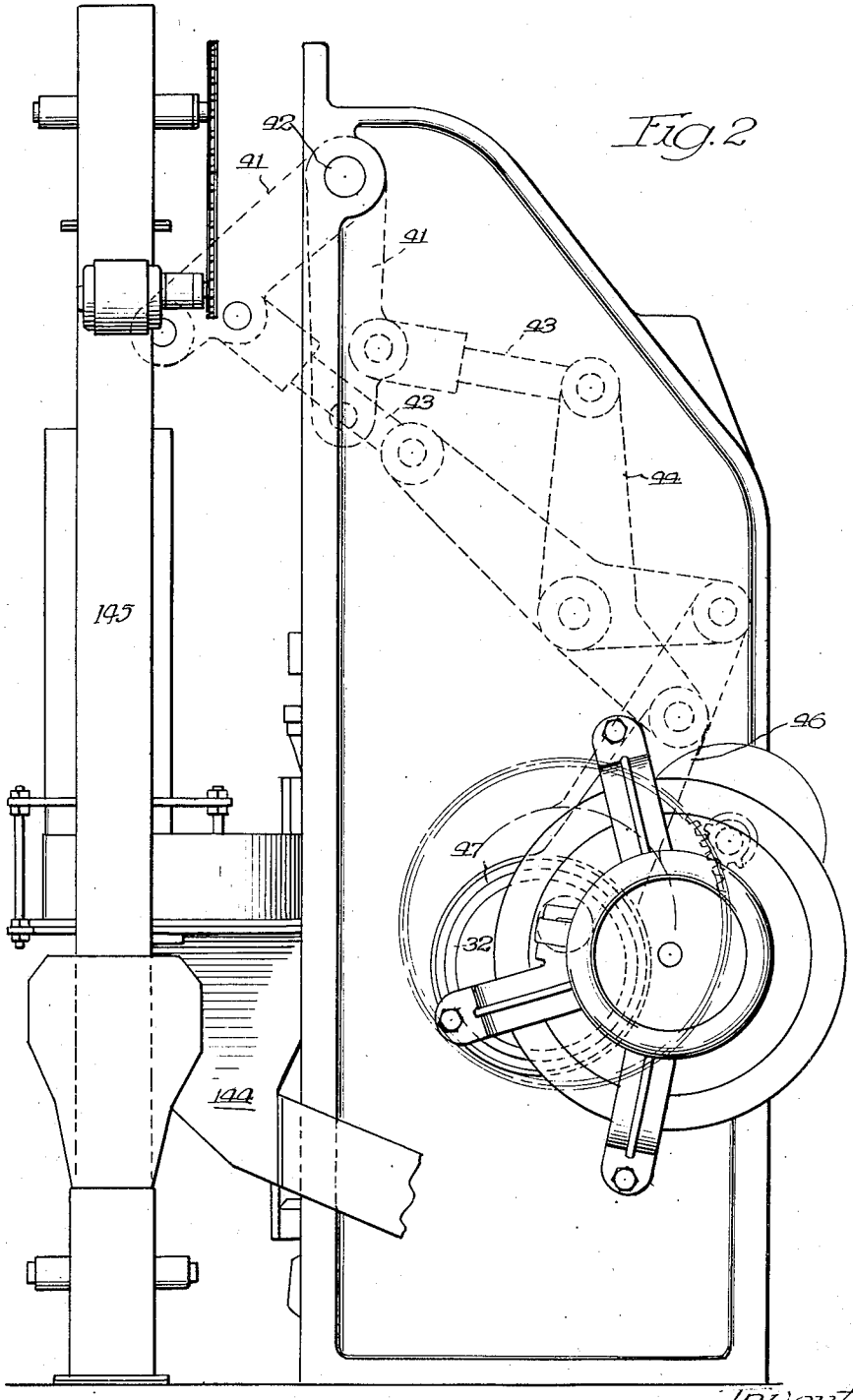


Fig. 2

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COMPRESSING MACHINE

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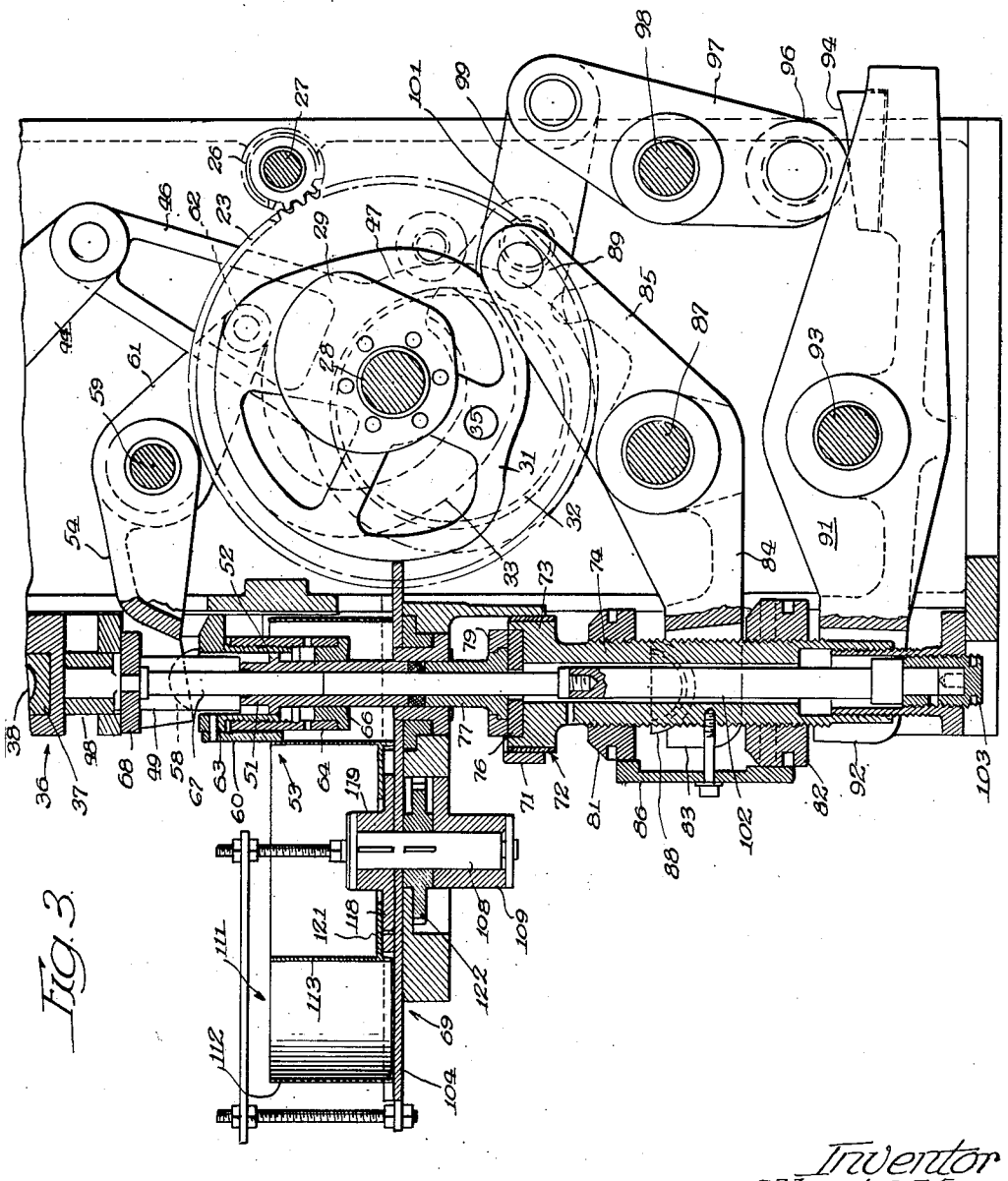


FIG. 3

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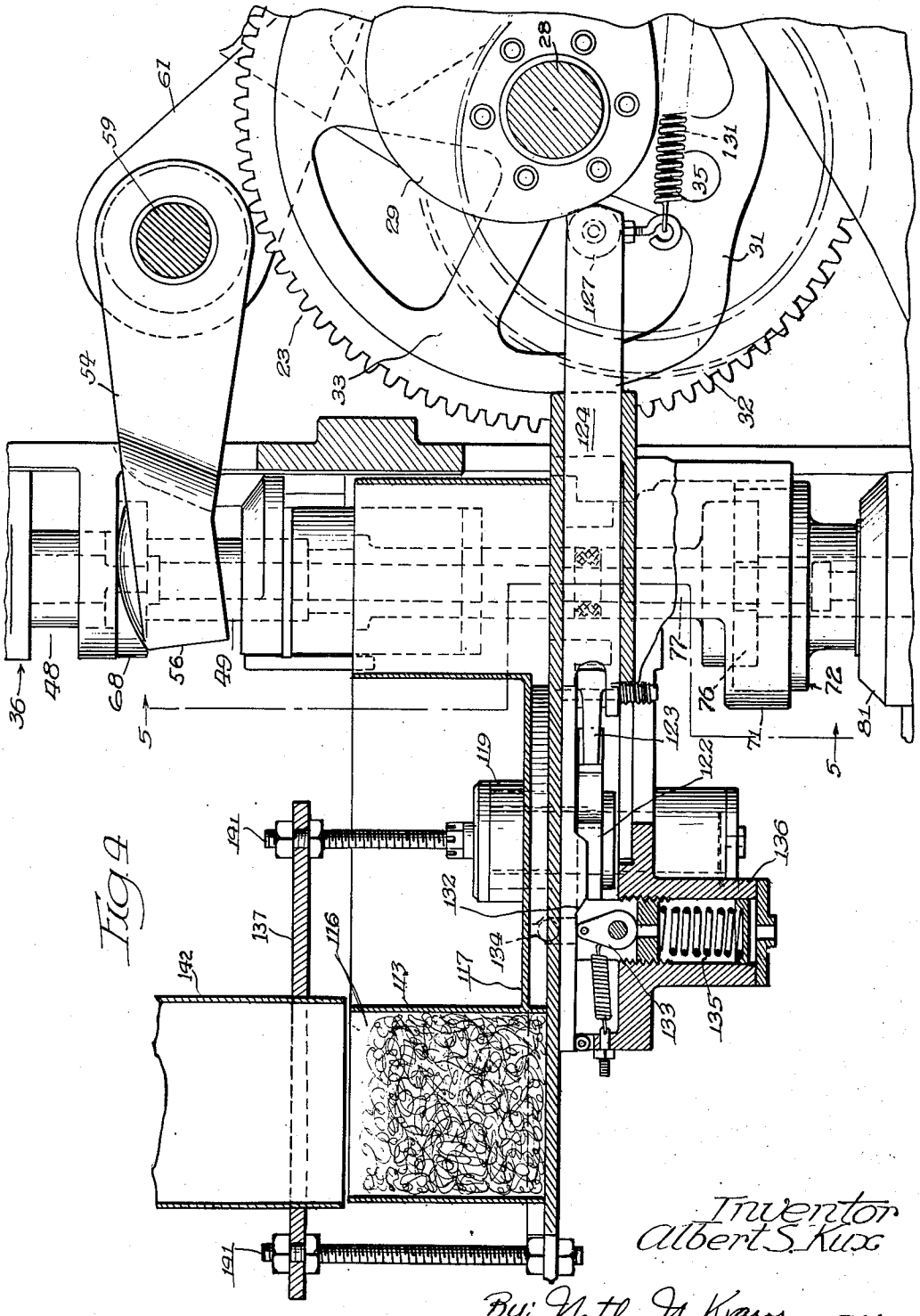


Fig. 4

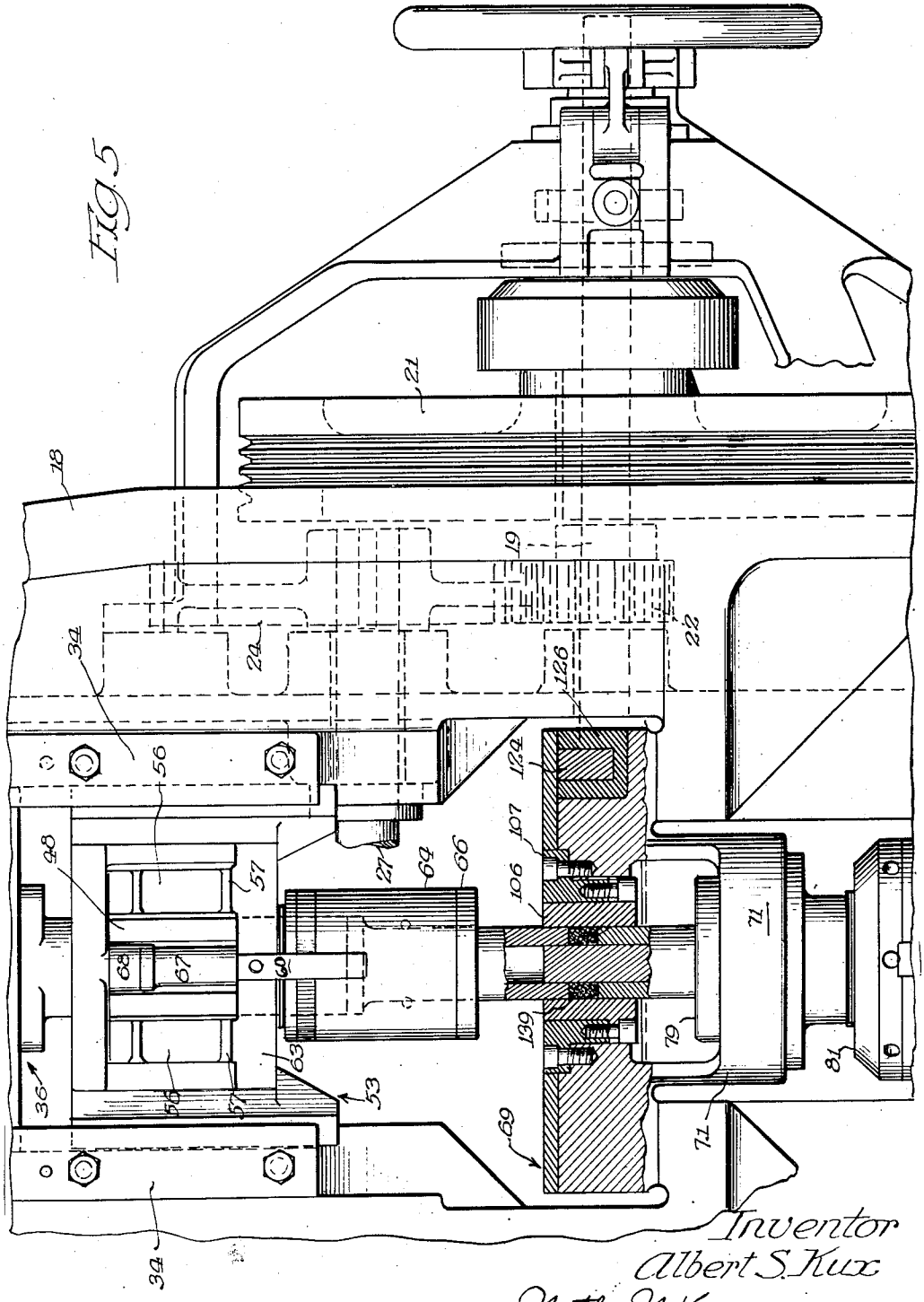
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COMPRESSING MACHINE

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FIG. 5



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Fig. 6.

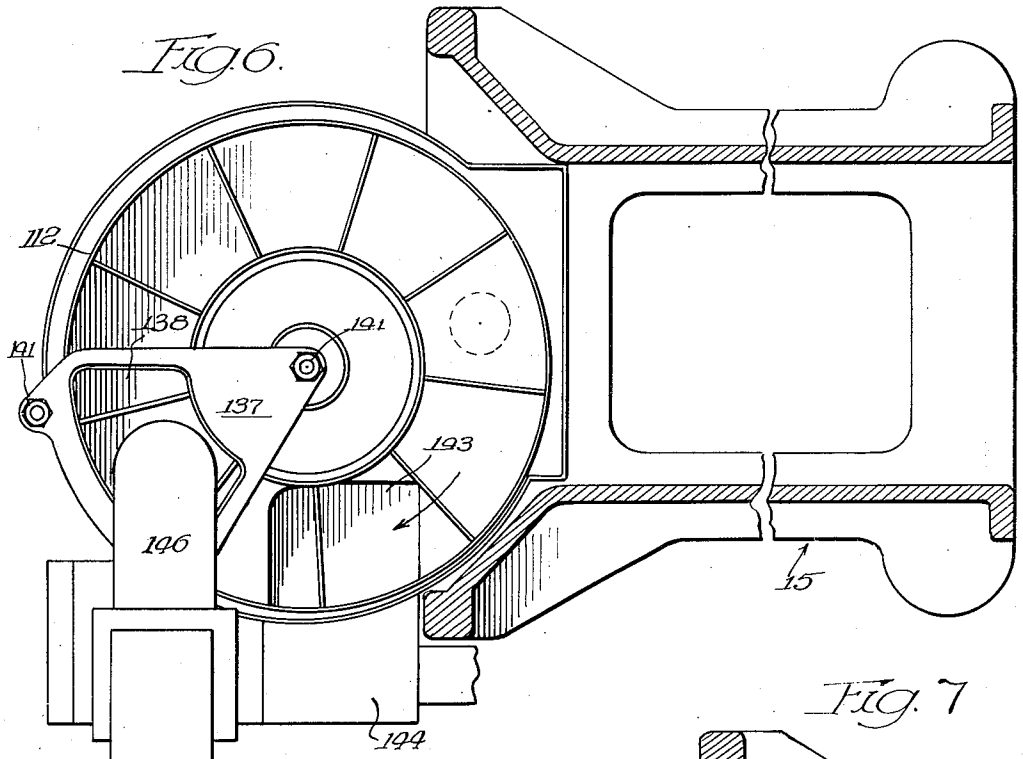
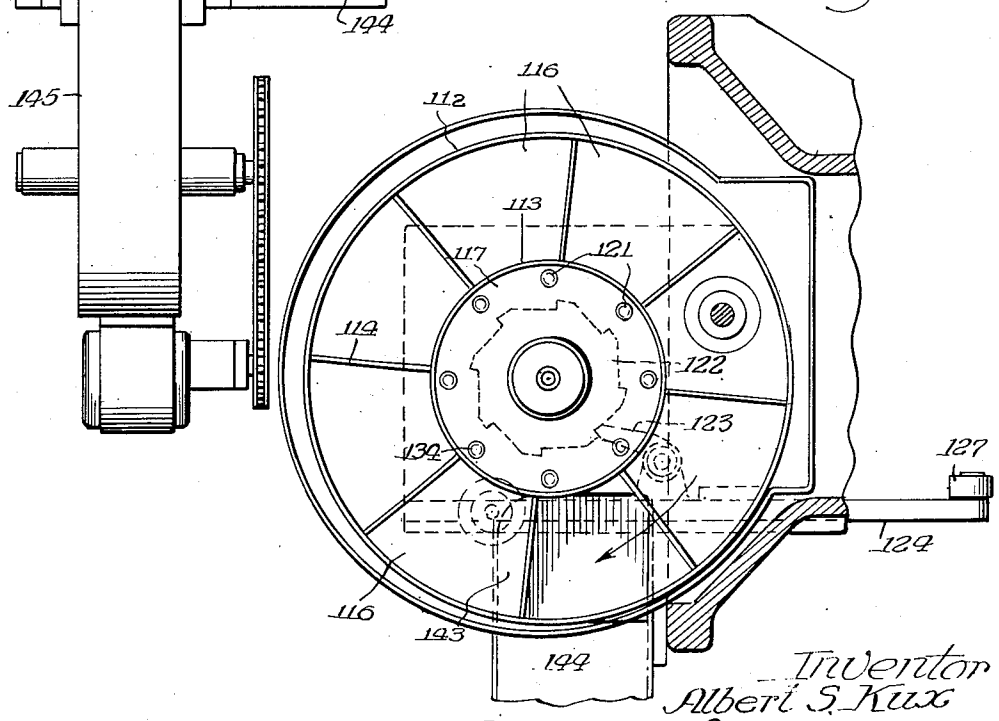


Fig. 7

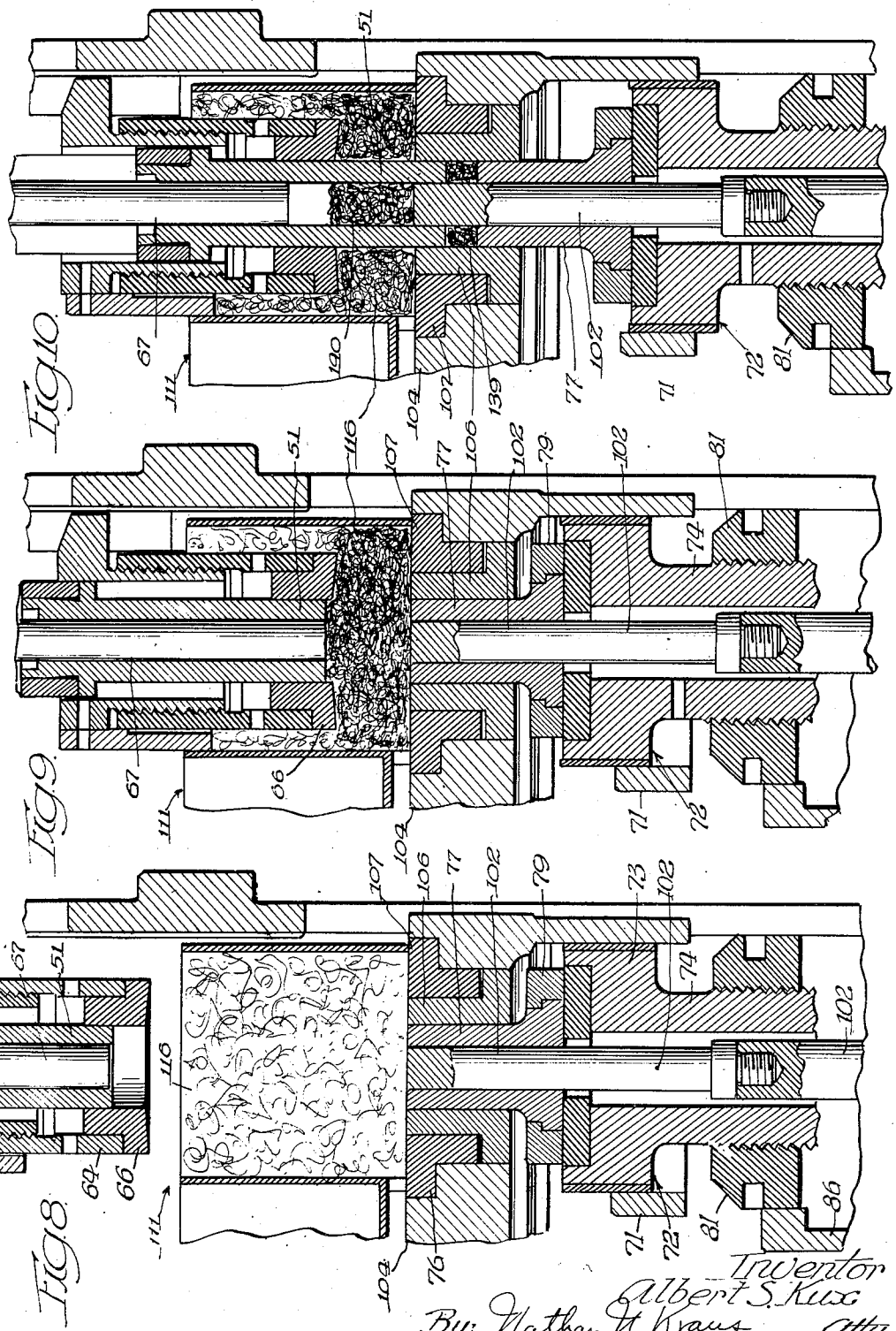


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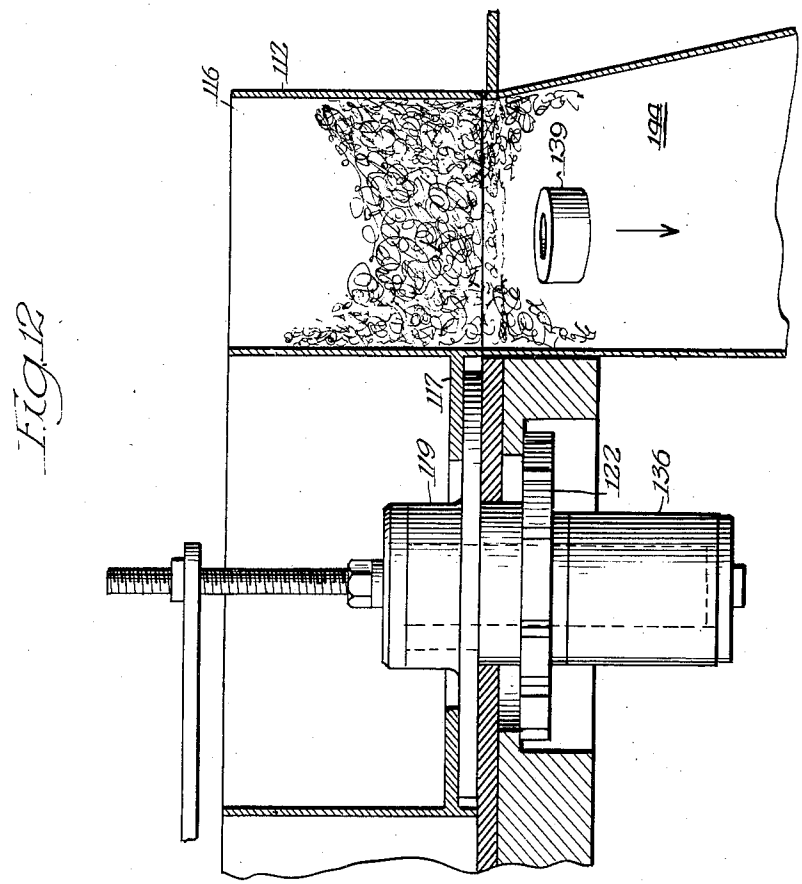


FIG. 12

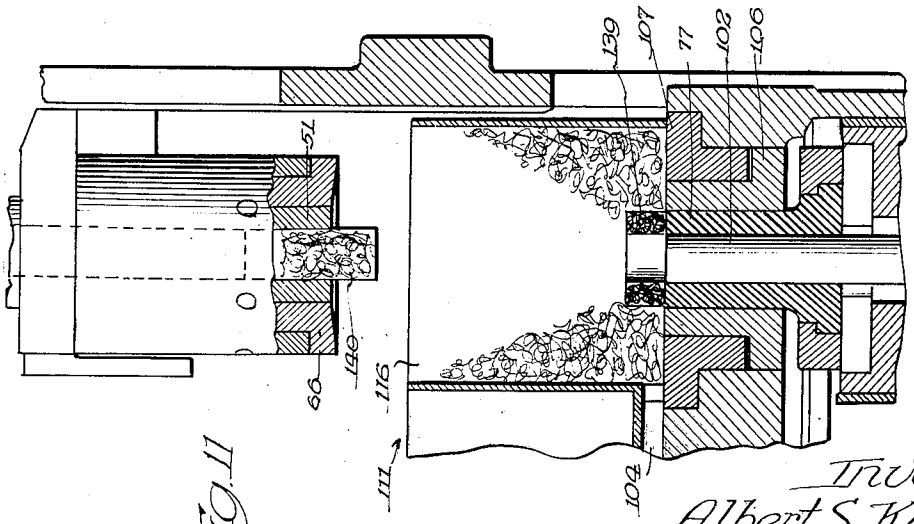


FIG. 11

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UNITED STATES PATENT OFFICE

2,556,475

COMPRESSING MACHINE

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Application November 8, 1947, Serial No. 784,877

10 Claims. (Cl. 18—16)

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This invention relates to compressing machines generally, and more particularly to compressing machines for the automatic production of preforms or tablets from high bulk factor materials.

High bulk factor materials, examples of which are impact type plastics and some forms of asbestos, because of their poor feeding qualities and high compression ratios, in some cases as high as 12 to 1, cannot be automatically tableted or preformed on standard presses presently in use.

Accordingly, it is an object of my invention to provide improved means for automatically producing tablets or preforms from high bulk factor materials.

Another object of my invention is to provide a machine of the foregoing character in which adjustments may be readily made to vary the compression ratios whereby to obtain preforms or tablets of varied densities.

Another object of my invention is the provision of a machine of the foregoing character which produces preforms or tablets having a high degree of uniformity in weight and size and which has a relatively high rate of production.

A further object of this invention is the provision of an improved machine of the foregoing character which is simple and durable in construction and highly efficient in operation.

Other and further objects of the present invention will be apparent from the following description and claims, and are illustrated in the accompanying drawings which, by way of illustration, show exemplary embodiments and the principles thereof. Other embodiments of the invention embodying the same principle may be used, and structural changes may be made as desired by those skilled in the art, without departing from the present invention and the purview of the appended claims.

In the drawings:

Fig. 1 is a front elevational view of a machine in accordance with the invention.

Fig. 2 is a right-hand side elevational view thereof.

Fig. 3 is a vertical sectional view taken on line 3—3 of Fig. 1, on an enlarged scale with parts omitted and looking in the direction indicated by the arrows.

Fig. 4 is a detailed vertical sectional view taken on line 4—4 of Fig. 1 on an enlarged scale with parts omitted and looking in the direction indicated by the arrows.

Fig. 5 is an elevational view partly in section on an enlarged scale taken on line 5—5 of Fig. 4 and looking in the direction indicated by the arrows.

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Fig. 6 is a plan view with parts omitted of the machine shown in Fig. 2.

Fig. 7 is a partial plan view showing in dotted lines certain details of construction.

Figs. 8 to 12 inclusive are vertical sectional views on an enlarged scale showing the compressing elements in various positions of operation.

Referring to the drawings, the numeral 15 designates generally a frame structure of any desired size and configuration supported on a base 16. The frame includes a pair of spaced upright members 17 and 18 between which and on which are supported the operative mechanisms of the machine hereinafter to be described.

Suitably journalled in the upright members 17 and 18 is a driving shaft 19 upon which are fixed for rotation therewith a combination pulley and fly wheel 21 and a pinion 22, the pulley 21 being driven by a belt, not shown, associated with a suitable source of motive power. The power is transmitted to the main driving gear 23 through a gear train which includes pinion 22, gear 24 and pinion 26, the latter two being fixedly supported on shaft 27, and gear 23, which is rotatably supported on fixed shaft 28 suitably journalled in the upright members 17 and 18, the gear 23 having a cam groove 33. Freely supported on shaft 28 for simultaneous rotation thereon are cams 29 and 31, eccentric 32 and gear 23. The cam 29, eccentric 32 and gear 23 are secured together in fixed relationship by a pin 35 extending longitudinally through all of said parts. The cam 29 is secured to the cam 31 for rotation therewith by means of a plurality of screws. A plurality of link members and crank arms hereinafter to be described are actuated by the said cams and eccentric to perform functions, as will be hereinafter described.

The forward portion of the frame 15 is provided with suitable guides 34 in which an upper slide designated generally by the numeral 36 is slidably mounted. The slide 36 may be of any suitable construction and in the embodiment shown includes a socket block member 37 cooperating with a ball member 38 connected to an arm 39 pivotally connected to a crank arm 41 which is pivoted on shaft 42. The crank arm 41 is connected through link 43 to a bell crank 44 connected to an actuating arm 46 which includes an eccentric strap 47 in cooperative engagement with the eccentric 32. Associated with the socket 37 and reciprocally movable therewith is a tubular member 48 having a longitudinally extending diametral slot 49. Received in the lower end of the member 48 and movable therewith is a tubular compressing element 51 provided with a shoul-

der 52 which abuts the lower end of the member 48.

A lower slide structure generally designated by the numeral 53 is slidably mounted in the guides 34 and includes a depending bored portion 63 through which the compressing element 51 and member 48 are arranged to reciprocate. Clearance is provided on each side of the slide structure to accommodate the bifurcated arm of a bell crank 54, the legs 56 of which are arranged to bear on semi-cylindrical bearing shoes 57 positioned on the structure as shown, the legs 56 being provided with complemental bearing surfaces to engage the bearing shoes 57. The bell crank 54 is pivoted on shaft 59 and is provided at the end of arm 61 with a cam follower roller 62 which engages in the cam groove 33 of gear 23.

The slide structure 53 is provided with a depending bored portion 63 which is in threaded engagement with an outer sleeve 64, the lower end of which receives a pressure pad 66. It will be seen by reference to the drawings that the upper compressing element 51 is adapted to reciprocate within the bore of the portion 63 and the bore of the pressure pad 66.

A clamp member 69 secured to portion 63 is adapted to frictionally engage the peripheral surface of the sleeve 64 and lock the same in a position of adjustment.

Arranged for freely sliding movement within the bore of the member 38 and upper element 51 is a core ejecting rod 67 connected to a bar member 68 which extends through the diametral slot 49 of the member 48. The ejecting rod 67 is secured to and is arranged to move substantially simultaneously with the lower slide structure 53.

The frame 15 is provided with a bed indicated generally at 69 arranged between the upright members 17 and 18. Supported on the bed 69 is a forwardly extending die table 104. Depending from the die table 104 is a tubular portion 71 which serves as a guide for the member indicated generally at 72. The said member is provided with an enlarged portion 73 slidably received in the portion 71 and with a body portion 74 which is threaded substantially for its full length. Arranged in an annular recess at the top end of the member 72 is a plate 76 which supports the lower compressing element 77. The said element is provided with a shoulder which is engaged by a cooperating collar 79 for securing the said element in position. Upper and lower collars 81 and 82 respectively, are in threaded engagement with the body portion 74 and serve as shoulders which cooperate with bifurcated arms of bell cranks 84 and 91, as will be hereinafter described, for reciprocating the member 72 and correspondingly the compressing element 77. The collars 81 and 82 are adjustable longitudinally of the member 72 and may be locked in a position of adjustment by means of the clamp bar 86 which engages serrations provided on the peripheral surfaces of the collars 81 and 82.

The bell crank 84 is pivoted on shaft 87 and is provided on its forward arm with a bifurcated portion, the legs 88 of which straddle the body portion 74. The said legs are formed to support semi-circular bearing shoes 28 which are adapted to engage the collar 81. The other arm 85 of the bell crank 84 is provided with a cam follower roller 89 which cooperates with the cam 31 to actuate the bell crank 84 which acts to reciprocate the lower compressing element 77, the upward travel of said element serving to eject the compressed tablet from the die chamber as will be hereinafter described.

An arm 91 similarly formed with a bifurcated end providing legs 92 which cooperate with bearing shoes which are adapted to engage the collar 82 is pivoted on shaft 93. The rearward end of the arm 91 is provided with a cam surface 94 which cooperates with a roller 96 carried on arm 97 pivoted on shaft 98. The arm 97 is connected through a link 99 to a perforated ear 101 integral with the eccentric strap 47. Thus when the eccentric 32 is rotated the link 99 rocks the arms 97 about its shaft 98 and causes the roller 96 to ride on the cam surface 94 which in turn rocks the arm 91 to reciprocate the lower element 77 which, in its upward travel, cooperates with the upper compressing element 51 which is then travelling downwardly to compress the tablet in desired final form. Both the lower compressing element 77 and the member 72 are hollow and house therein a core rod 102 which may be of sectional construction and which remains stationary during the movement of the member 72 and the lower compressing element 77. A threaded member 103 is provided for adjusting the position of the core rod 102.

A die 106 is supported on the die table 104 in alignment with the compressing elements 51 and 77 and is retained in position by a stepped annular ring 107 suitably bolted to the die table 104.

Suitably supported for rotation on a spindle 108 carried in a boss 109 depending from the die table 104 is a turret indicated generally by the numeral 111 and formed of concentric cylindrical shells 112 and 113 connected by radial webs 114 to provide a series of annularly arranged compartments 116, said compartments each being open at the top and the bottom. The turret is adapted to be rotated, as will be hereinafter explained, so that the compartments 116 are successively brought into register with the upper and lower compressing elements 51 and 77. This occurs when the element 51 and the sleeve 64 are in retracted position.

The inner shell 113 is connected to a circular plate 117 which is bolted to the flange 118 of a bearing member 119 mounted on the spindle 109, the flange being provided with a plurality of spaced annularly arranged apertures 121, one for each compartment 116. Carried on the spindle 108 and connected thereto below the die table 104 is a ratchet wheel 122. The said ratchet wheel is actuated by a spring-biased pawl 123 pivotally mounted on an actuating bar 124 slidably carried in a channel guide 126. The rearward portion of the bar 124 is provided with a cam roller 127 arranged to cooperate with cam 29 for reciprocating said bar. A tension spring 131 connected to the bar 124 serves to maintain the roller 127 in operative engagement with the cam 29.

The forward portion of the actuating bar 124 is provided with a cam surface 132 adapted to cooperate with the roller mounted on the pivoted member 133 which is suitably connected to a pin 134 which reciprocably projects through an aperture in the table 104, the pin 134 being adapted to register in one of the annularly arranged apertures 121 to lock the turret 111 in one of a series of positions. It will be apparent that as the arm 124 is caused to slide forwardly of the machine the pawl 123 will engage the ratchet wheel 122 to index the turret 111 to the next succeeding position. In synchronism with such

movement, but slightly in advance thereof, the cam surface 132 actuates the member 133 to move the locking pin 134 out of registration with the aperture in which it is engaged to permit indexing of the turret to the next succeeding position. Retraction of the actuating rod 124 permits the member 133 to return to upright position and effects registration of the locking pin 134 in the aperture in alignment therewith to lock the turret 111 against rotation. The member 133 is biased by a spring 135 contained in a housing 136 depending from the die table 104.

A substantially triangularly shaped member 137 provided with an arcuately shaped aperture 138 is carried on supporting standards 141. The said member 137 is disposed in a plane above the top surface of the turret 111 and serves to support a vertical chute 142 which extends through the aperture 138. The lower edges of the chute 142 are spaced slightly from the top edges of the turret 111 to provide clearance for rotation of the turret, but sufficiently close substantially to effect a shearing action on the column of material being fed into the turret compartment. Thus each compartment 116 is filled with material uniformly flush with the top edges thereof.

The table 104 is provided with a discharge opening 143 arranged so that each compartment 116 of the feed turret 111 sweeps thereover in its rotation. The said discharge opening serves as a means through which the compressed tablets and unused material are dropped onto an inclined vibrating screened chute 144 which effects a separation of the unused material from the compressed tablet. A suitable conveyor means indicated generally by the numeral 145 is associated with the chute 144 and with a hopper 148, in the latter of which is stored a supply of material, the conveyor means being arranged to carry the material upwardly to an inclined chute 146 which connects with vertical chute 142.

It is thought that the operation of this machine will be clearly understood from the foregoing, but briefly stated it is as follows, reference being had particularly to Figs. 8 to 11, it being understood that the cams and devices for operating the various parts are so arranged that they will operate the respective parts in timed relation with respect to each other.

The high bulk factor material to be compressed into tablets is elevated by the conveyor 145 and fed into the chute 142 where it falls by gravity into one of the compartments 116, then in registration therewith. The turret 111 is caused to advance to bring successive compartments in registration with the chute 142 so as to uniformly fill each of such compartments with the material to be compressed. Correspondingly, one of the compartments 116 leading the one being filled is brought into register with the compressing elements 51 and 77 and the turret 111 is locked in position.

At the beginning of the compression stroke the element 51 and pressure pad 66 are in retracted position substantially as shown in Fig. 8 to provide clearance for the indexing and rotation of the turret 111. The face of the lower element 77 is substantially flush with the surface plane of the die table 104.

In the next advancing movement shown in Fig. 9 the element 51, pad 66 and core ejecting rod 67 move substantially simultaneously into the space of the compartment 116. The said three elements in combination provide a solid ram or plunger which in this case is of circular cross-sectional area and which acts to partially compress the material in said compartment. At the stage of movement shown in Fig. 9, the top surface of the lower element 77 and the core rod 102 are substantially flush with the top surface of the die table 104, thus presenting a flat plane against which a relatively large mass of material is partially compressed and firmly held.

In the next stage, illustrated in Fig. 10, the pressure pad 66 is shown as having reached the limit of its stroke. The upper compressing element 51, however, continues downwardly, and simultaneously therewith the lower element 77 recedes downwardly providing an annular chamber in the die 106, the core rod 102 at all times remaining stationary. A tablet 139 substantially in the form of an annulus is sheared from the partially compressed mass by the continued movement of compressing element 51. The core 140 of the partially compressed mass is caused to enter into the bore of the upper element 51, while the tablet 139 is pushed downwardly into the chamber of die 106 where it is fully compressed by the action of the upper and lower compressing elements 51 and 77 respectively which move toward each other.

In the next stage of operation, as shown in Fig. 11, both the upper element 51 and pressure pad 66 move upwardly to clear the top of the turret 111 to permit indexing of the same to the next succeeding position. In this movement the partially compressed core 140 still in the bore of the upper element 51 is carried into engagement with the core ejector rod 67 which cooperates with the movement of the element 51 to eject the core 140, which drops into the turret compartment immediately below it. Simultaneously, the lower element 77 rises to its normal position, flush with the surface of the die table 104, and in so doing ejects the compressed tablet 139 from the die. The next indexing of the turret 111 sweeps the contents of the compartment 116, which includes the finished tablet, partially compressed and non-compressed material, over the discharge opening 143 in the die table 104 through which they fall onto the vibrating screened chute 144, which acts to separate the finished tablet from the rest of the material, the said material falling through the perforations in the screen of the chute 144 and being carried with new material from the hopper 148 by the conveyor 145 to the chute 146.

When the compartment 116 just described is disposed over the discharge opening 143 the trailing compartment 116 immediately adjacent is operatively aligned with the compressing elements 51 and 77, and the same cycle of operations hereinabove described is repeated.

It will be understood that the invention is not limited to forming tablets only of the shape herein described, but that tablets of other desired shapes may be formed therewith. For example, by using compressing elements of solid cylindrical or polygonal cross section instead of annular cross section as shown in the drawings and omitting the core rods, tablets of solid cylindrical or polygonal shapes may be formed.

It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to, without departing from the spirit of my invention, or the scope of the appended claims.

I claim:

1. In a machine for compressing material into tablet form a forming chamber, upper and lower compressing elements movable in said chamber in directions toward and away from each other, a rotatable turret including a plurality of compartments, each open on the top and bottom, said turret being so disposed that each of said compartments may be successively aligned with said compressing elements to permit said upper element to pass therethrough, means for delivering to each of said compartments successively a quantity of material to be compressed, means for advancing said compartments to bring the same successively into alignment with said compressing elements, means for partially compressing the mass of said material within said compartments and for actuating said compressing elements to further compress a portion of said partially compressed mass in said chamber in tablet form.

2. In a machine for compressing material into tablet form, a forming chamber, upper and lower compressing elements movable in said chamber in directions toward and away from each other, a sleeve telescoped over said upper compressing element, a rotatable turret including a plurality of compartments, each open on the top and bottom, said turret being so disposed that each of said compartments may be successively aligned with said compressing elements to permit entry therein of said upper compressing element and said sleeve, means for delivering to each of said compartments successively a quantity of material to be compressed, means for advancing said compartments to bring the same successively into alignment with said compressing elements, means for actuating said sleeve and separate means for actuating said upper element to partially compress a mass of material within a compartment, said last-recited means further actuating said upper element to compress in said chamber a portion of said partially compressed mass into tablet form.

3. In a machine for compressing material into tablet form, a forming chamber, upper and lower compressing elements movable in said chamber in directions toward and away from each other, a sleeve telescoped over said upper compressing elements, a rotatable turret including a plurality of compartments, each open on the top and bottom, said turret being so disposed that each of said compartments may be successively aligned with said compressing elements to permit entry therein of said upper compressing element and said sleeve, means for delivering to each of said compartments successively a quantity of material to be compressed, means for advancing said compartments to bring the same successively into alignment with said compressing elements, means for actuating said sleeve and separate means for actuating said upper element to partially compress a mass of material within a compartment, said last recited means further actuating said upper element to compress in said chamber a portion of said partially compressed mass into tablet form, and means for ejecting said tablet from said chamber into said compartment.

4. In a machine for compressing material into tablet form, a forming chamber, upper and lower compressing elements movable in said chamber in directions toward and away from each other, a sleeve telescoped over said upper compressing element, a rotatable turret including a plurality of compartments, each open on the top and bottom, said turret being so disposed that each of said compartments may be successively aligned with said compressing elements to permit entry therein of said upper compressing element and said sleeve, means for delivering to each of said compartments successively a quantity of material to be compressed, means for indexing said turret to successive operative positions, means for locking said turret in said positions against movement, means for actuating said sleeve and separate means for actuating said upper element to partially compress a mass of material within a compartment, said last-recited means further actuating said upper element to compress in said chamber a portion of said partially compressed mass into tablet form, and means for actuating said lower compressing element to eject said tablet from said chamber into said compartment.

5. A machine for compressing material into tablet form comprising an upper compressing element, a lower compressing element, a chamber in which said elements are reciprocable, a sleeve closely surrounding said upper element and telescopically movable relative thereto, actuating means individual to the elements and to said sleeve, means for delivering between said elements material to be compressed, said means including a rotatable turret having a plurality of annularly disposed compartments arranged so that each of said compartments may be successively aligned with said compressing elements to permit said upper element and said sleeve to enter therein, means for delivering to each of said compartments a quantity of material to be compressed, means for advancing said compartments to bring the same successively in alignment with said compressing elements, means for locking said turret in such positions, motion-imparting means for said actuating means arranged to cause said upper element and said sleeve to partially compress a mass of said material within a compartment alined therewith and to cause said sleeve to secure said mass within an annular area surrounding said upper element while said upper element is actuated to further compress a portion of said partially compressed mass into a tablet form, said lower element being finally actuated to expel said tablet from said chamber.

6. A machine for compressing material into tablet form embodying a chamber comprising elements reciprocable in the chamber in directions towards and away from each other, means for confining a surplus of the material to be compressed and delivering the same between said elements, one of said elements being constructed of relatively movable sections, both of said sections being movable in unison and simultaneously operating upon the confined material to initially compress a mass of said material in zones individual to the sections and means individual to one of said sections for positively operating it will respect to the other section to shear a tablet from said initially compressed mass in its respective zone after the said other section has reached the limit of its compression movement.

7. A machine for compressing material into tablet form embodying a chamber comprising elements reciprocable in the chamber in directions towards and away from each other, means for confining a surplus of the material to be

compressed and delivering the same between said elements, one of said elements being constructed of relatively movable sections, both of said sections being movable in unison and simultaneously operating upon the confined material to initially compress a mass of said material, in zones individual to the sections, and means for actuating said other element for imparting a compression movement in a direction opposite the movement of said movable section to further compress said tablet within said chamber.

8. In a machine for compressing material into tablet form, a table having a forming chamber, upper and lower compressing elements movable in said chamber in directions toward and away from each other, means for automatically confining a predetermined quantity of material and delivering the same between said elements, means cooperating with said upper compressing element for partially compressing between said means and said table and between said compressing elements a mass of said confined material, and means for actuating said upper and lower elements first to shear a portion from said partially compressed mass and then to further compress said portion into tablet form within said chamber.

9. A machine for compressing material into tablet form comprising a table having a forming chamber therein, a lower compression element reciprocable in said chamber and at the limit of its movement in one direction having its compressing face in the plane of said table, a reciprocable compression element being constructed of relatively movable sections, with one of said sections being reciprocable in said chamber, means for delivering and confining between said table and said upper element a surplus of material to be compressed, both of said sections being movable in unison and simultaneously operating upon the confined material to initially compress a mass of said material in zones individual to said sections, means for positively operating one of said sections with respect to the other and said lower compression element to shear a tablet from said initially compressed mass in its respective zone after the other section has reached the limit of its compression movement and means for actuating said lower compression element simultaneously in a direction opposite the movement of said movable section to further compress said tablet within said chamber.

10. In a machine for compressing material into tablet form, a table having a forming chamber, compression elements movable in said chamber in directions towards and away from each other, a compression sleeve associated with one of said compression elements and movable relative thereto, means for delivering and confining in the zones of said elements and said sleeve a surplus of material to be compressed, said sleeve and associated element being movable in unison and simultaneously operating upon the confined material to initially compress a mass of said material in zones individual to said elements and said sleeve while said other element is at the limit of its compression movement, means for individually actuating said elements simultaneously while a constant and unyielding pressure is maintained on said partially compressed material by said sleeve to shear from said material a tablet and then further to compress said tablet within said chamber.

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