Aug. 14, 1945. M. E. FERNALD 2,381,893

DISTRIBUTING APPARATUS

Filed March 11, 1942 4 Sheets-Sheet 1

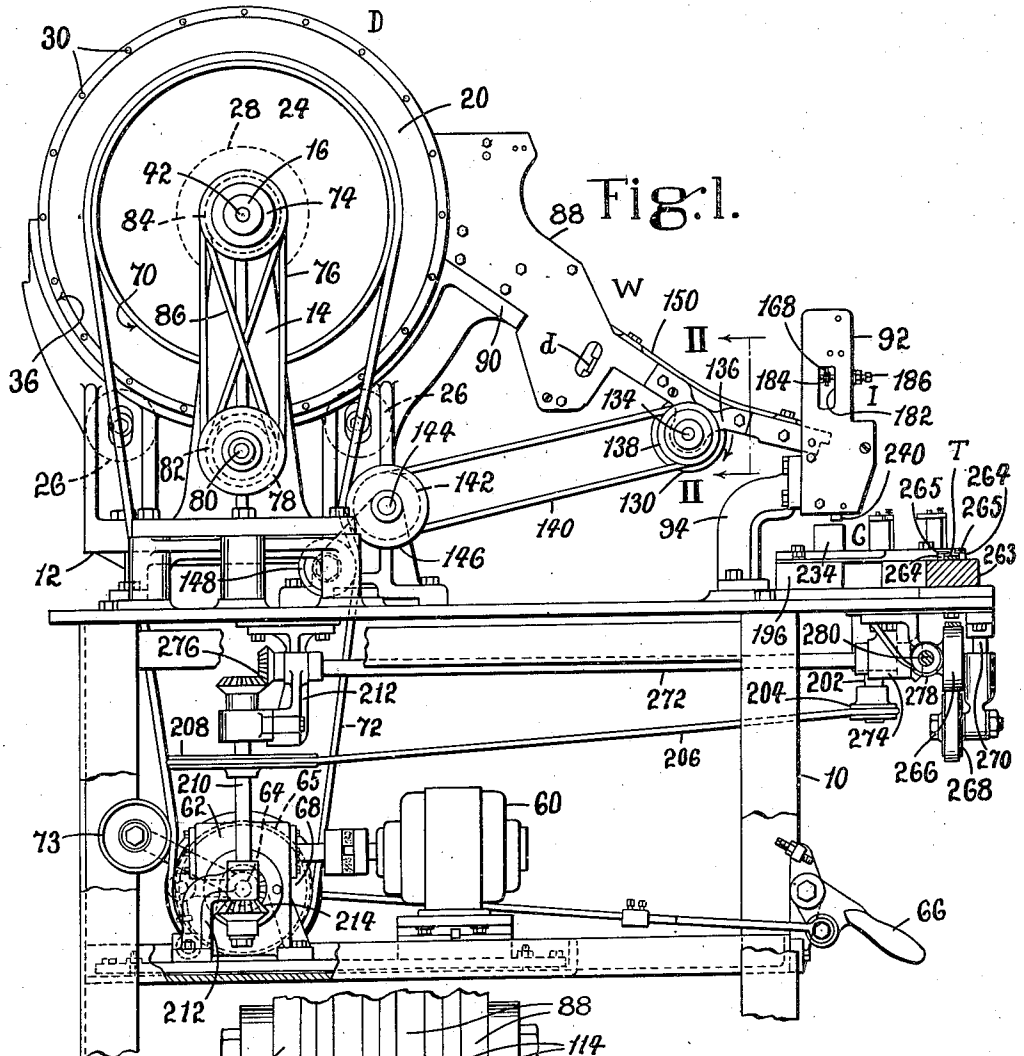


Fig. 1.

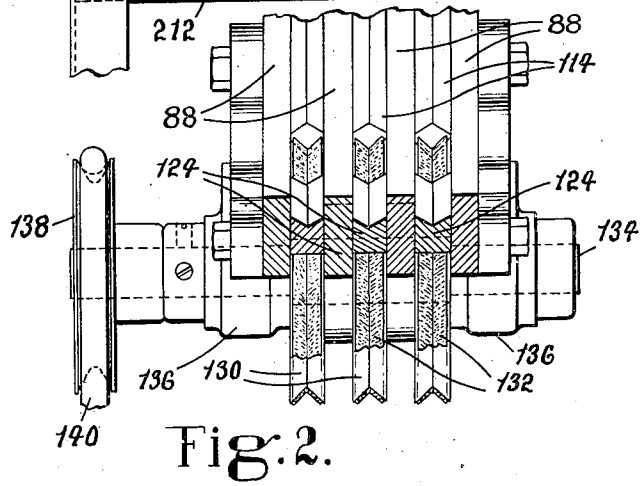


Fig. 2.

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Clarence A. Seeley

Aug. 14, 1945. M. E. FERNALD 2,381,893

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Filed March 11, 1942 4 Sheets-Sheet 2

Fig. 3.

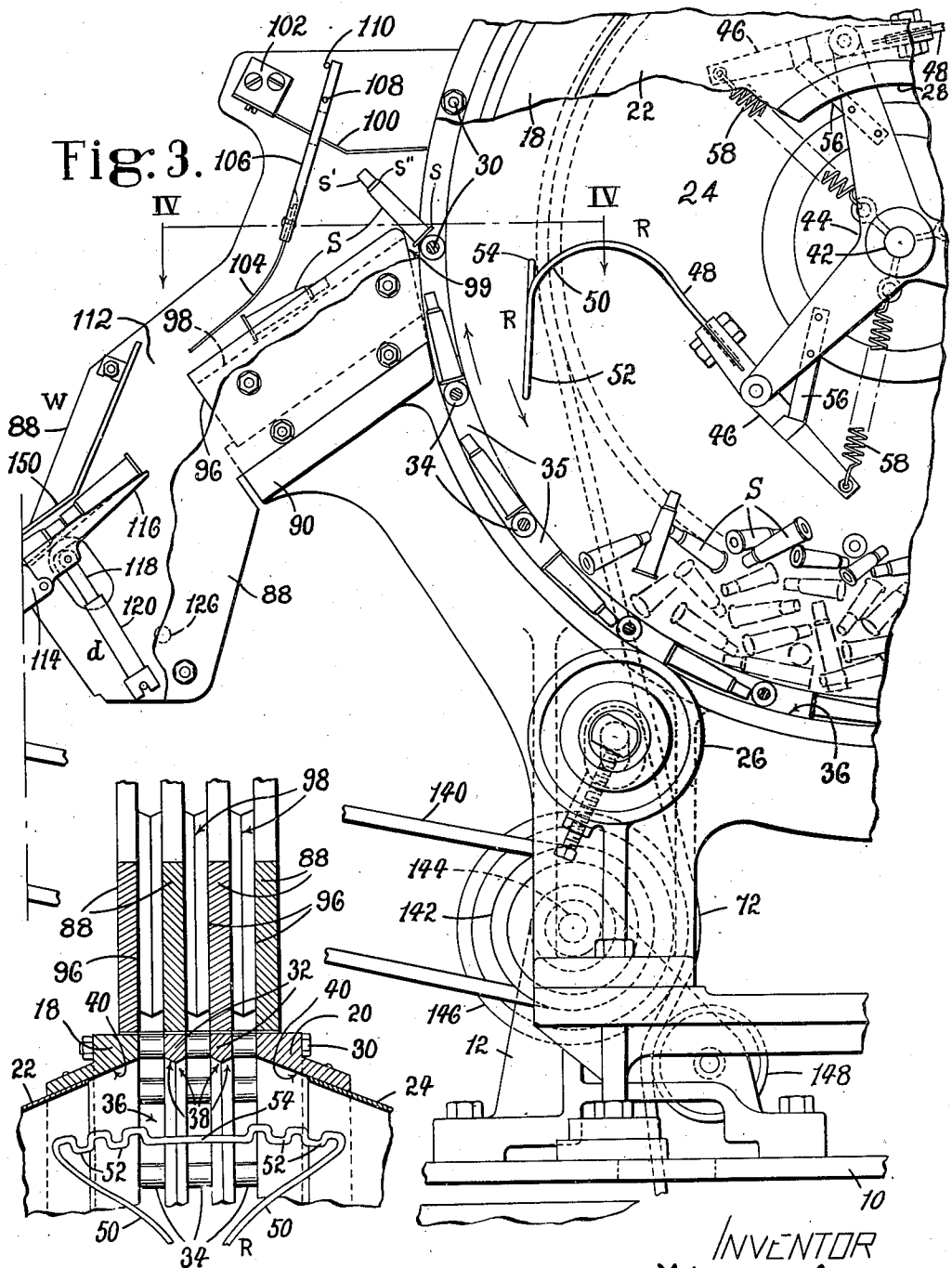


Fig. 4.

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Aug. 14, 1945. M. E. FERNALD 2,381,893

DISTRIBUTING APPARATUS

Filed March 11, 1942 4 Sheets-Sheet 3

Fig. 6.

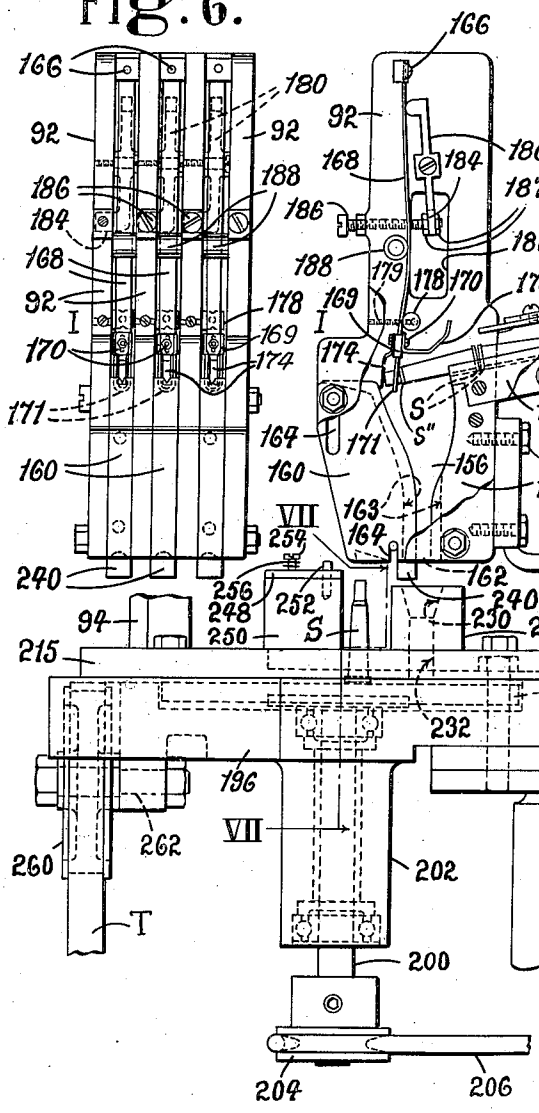
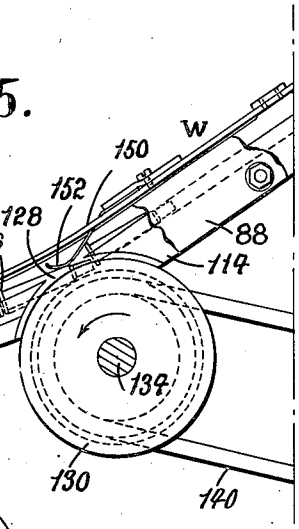


Fig. 5.



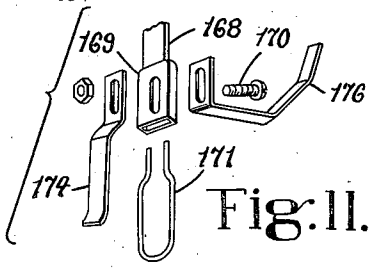


Fig. 11.

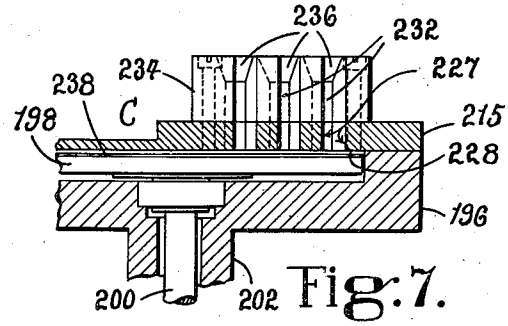


Fig. 7.

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Aug. 14, 1945. M. E. FERNALD 2,381,893

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Filed March 11, 1942 4 Sheets-Sheet 4

Fig. 8.

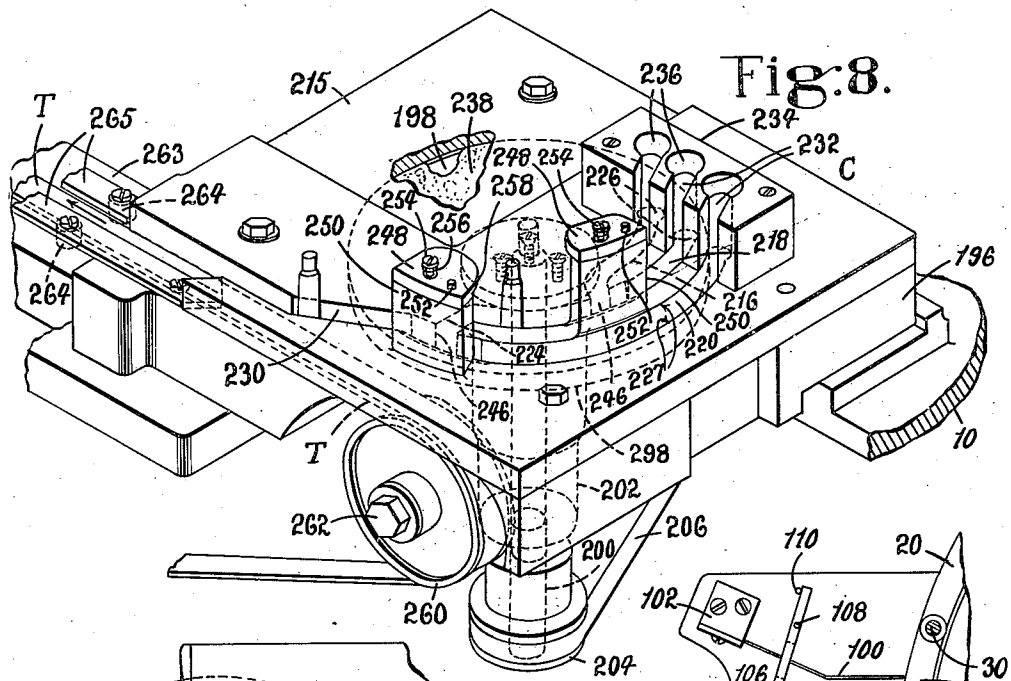


Fig. 9.

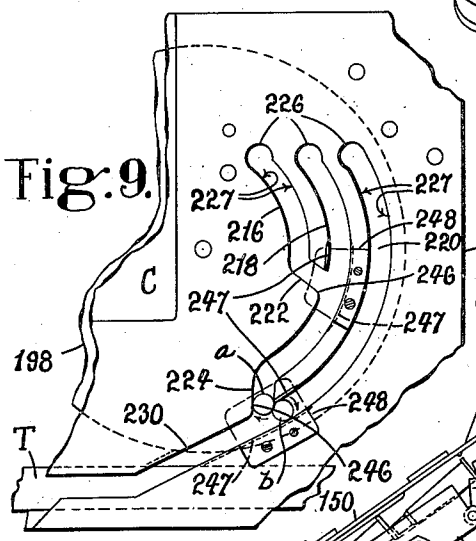


Fig. 10.

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Patented Aug. 14, 1945 2,381,893

UNITED STATES PATENT OFFICE

2,381,893

DISTRIBUTING APPARATUS

Mark E. Fernald, Beverly, Mass., assignor to United Shoe Machinery Corporation, Flemington, N. J., a corporation of New Jersey

Application March 11, 1942, Serial No. 434,301

19 Claims. (Cl. 198—32)

My invention relates to apparatus by which articles may be taken from a mass and arranged or distributed in accordance with a definite plan, it being herein disclosed in connection with such a disposition of shells to be used in the production of cartridges for fire-arms.

In the manufacture of cartridges, metal shells or casings are drawn to cylindrical form and closed or flanged at one end, the opposite open end being with or without a reduced neck. This open end is heat-treated to facilitate further operations upon the cartridge. An effective way of applying heat to the shells is to support them upon their flanged heads in a series upon a conveyor, which advances them for a predetermined period through an electric annealing oven. The feeding of the shells to the conveyor has heretofore generally been accomplished manually, a procedure which is very slow. An object of my invention is to supply the shells or other articles for their treatment, accurately positioned and at a rapid rate.

In achieving the above object, I combine with a receptacle for a mass of the articles, a plurality of raceways to which said articles are delivered in plural series, and mechanism by which such plural series are received and combined in a single series. This single series, comprising articles from all the raceways, may be delivered upon a conveyor which advances them for their treatment. Cartridge-shells rest upon their heads for the combining operation, being thus arranged for the later application of heat. The rate at which the articles are delivered by the combining mechanism may be about ten a second, which is much more than can be attained in any known manner and with greater certainty as to position. For the combining of the plural series, there is provided a channel to which each raceway delivers individually, and a channel receiving articles from all the raceway-channels, there being means movable to advance the articles along the channels and force them between articles in other channels. This forced introduction may also product rotation of the articles to prevent clogging. As herein disclosed, arcuate channels are furnished by concentric guideways or slots in a guide-plate or member, with a single guideway or slot to which the concentric portions deliver. A rotatable feed member engages the articles to advance them along all the guideways. Angular connecting guideways between the arcuate guideways are so arranged that they transfer the articles from one to another in such a manner as to aid in the prevention of clogging. Since articles differing at their opposite ends are to be selectively positioned, as the cartridge-shells which are to be supported upon their heads for the combining and succeeding operations, inverting mechanism receives the articles from the raceways and delivers them correctly placed to the combining mechanism. Into the inverting mechanism, each series of articles in the raceways is preferably forced, as by a rotatable roll extending into each raceway and engaging the successive articles therein. Because delivery from the article-receptacle to the raceways is best in excess of the rate at which they are used after their emergence from the combining mechanism, means is included in each raceway for discharging articles therefrom if they accumulate. This means may consist of a displaceable member held yieldably in its normal position by a spring-actuated device and deflected by articles gathering upon it.

The positioning device of this case has been made the subject of a divisional application, filed in my name in the United States Patent Office on March 30, 1943 and bearing the Serial Number 481,113.

In the accompanying drawings illustrating one of the many possible embodiments of the invention,

Fig. 1 shows my improved distributing apparatus in side elevation;

Fig. 2 is an enlarged transverse section through the raceways on the line II—II of Fig. 1.

Fig. 3, an enlarged fragmentary longitudinal section, partially in elevation as seen from the side opposite that of Fig. 1, and including a portion of the drum and associated raceways;

Fig. 4, a horizontal sectional detail on the line IV—IV of Fig. 3;

Fig. 5, a view, similar to Fig. 3, at the delivery end of the raceways;

Fig. 6, a front elevation of the selecting and inverting devices viewed from the left in Fig. 5;

Fig. 7, a vertical sectional detail on the line VII—VII of Fig. 5;

Fig. 8, a perspective view of the mechanism by which articles in plural channels are combined and delivered to a single channel;

Fig. 9, a broken top plan view of the combining plate;

Fig. 10, a broken side elevation of the raceways, particularly illustrating the overfeed-discharging means; and

Fig. 11, a separated perspective of elements of the inverting device.

The invention, as herein disclosed, is adapted

for operation upon such articles as cartridge-shells S, those illustrated having cylindrical bodies or barrels, at one end of each of which is a flange *s* and at the opposite end a reduced neck *s'*, between which neck and the barrel is a shoulder *s''*. These shells are taken from a mass in a rotatable drum D, arranged therein by oppositely rotating rakes R, distributed from the drum to a plurality of raceways W, and delivered by a selecting and inverting mechanism I, with their flanged ends down, to a combining mechanism C. Here, the shells are collected from the plural raceways and combined in a single series upon a conveyor T, by which they are transferred to an operating point.

Referring to Figs. 1 and 3 of the drawings, there appears a frame **10** carrying the apparatus with its driving means. Upon the upper portion of the frame, a base **12** is mounted, this furnishing the principal support for the elemens of the apparatus. From one side of this base rises a standard **14**, in which is journaled a short hub **16** projecting from one side of the drum D containing in a mass of the shells or other articles to be operated upon. The drum is shown as made up of two heavy rings **18** and **20** (Fig. 4), from which project outwardly lighter conical heads **22** and **24**, respectively, to the latter of which is secured the hub **16**. The ring **18** rests upon two spaced rolls **26**, **26**, rotatable about horizontal axes upon the base **12**. The head **22** is open at the center at **28**, to permit the introduction to the drum of its contents. Between the rings **18** and **20** are clamped by bolts **30** two narrow rings **32**, **32**, spaced equally from each other and from the outer rings **18** and **20** by sleeves **34** surrounding the bolts. This produces an annular series of spaces **35**, each of which is of such dimensions that it may receive one of the shells S to be distributed. These settle themselves from the mass within the drum into the spaces, there resting temporarily upon an arcuate surface **36** formed in the base **12** and into which the periphery of the drum fits. To facilitate entrance of the shells into the successive sets of three spaces each from the mass of shells riding above them, the inner edges of the rings **32** diverge outwardly at **38**, and the inner sides of the rings **18** and **20** are similarly inclined at **40**.

To level the massed shells in the drum D, and temporarily retain them in the lower portion to settle into the spaces **35**, a plurality of the rakes R revolve within said drum and in the opposite direction, as indicated by the arrows in Fig. 3. In an axial bore in the hub **16** of the drum is journaled a shaft **42**, to the end of which at the center of said drum is fixed a spider **44**, having three radial arms. To the outer end of each arm is pivoted a lever **46**, extending generally in the direction of revolution and having in its rear extremity a slot, in which is clamped one of the rakes. As may be seen in Figs. 3 and 4, this rake is formed of bent wire, it having a double shank **48** by which it is clamped. From the shank it is curved rearwardly and outwardly, and then the opposite sides are separated at **50**. Between these sides, the wire is bent alternately forwardly and rearwardly to form two sets of teeth **52**, which act over the interior of the drum at the opposite sides of the spaces **35**. The sets of teeth are joined at the rear by a cross-run **54** of the wire, which travels over and is somewhat removed from the spaces **35**, so the shells which are entering these shall not be interfered with. Each of the levers **46** is held yieldably back against a stop-arm **56**, projecting from the corresponding spider-arm, by a tension-spring **58** connecting the forward end of the lever to the hub of the spider. This permits the rake to accommodate itself to irregularities in the mass of shells, and to yield still more if clogging occurs.

To rotate the drum D and the spider **44**, there appears in Fig. 1, mounted upon the frame **10** below the base **12**, a motor **60**. This, through reduction gearing contained in a case **62**, rotates a horizontal shaft **64** journaled upon the frame. The shaft, through clutch mechanism **65** controlled by a hand-lever **66**, drives a pulley **68** about which, and about a belt-surface **70** upon the drum D, passes a belt **72**. By this connection, the drum is rotated at a relatively low speed. A roll **73**, adjustably mounted upon the base, engages the belt to maintain it under the desired tension. Fixed to the hub **16** is a belt-pulley **74** connected by an open belt **76** to a pulley **78**, rotatable about a spindle **80** projecting horizontally from the lower portion of the standard **14**. The pulley **78** has a second-belt surface **82** of less diameter than that for the belt **76**, and about this and a pulley **84**, secured to the shaft **42**, passes a crossed belt. By this belt-gearing, the rakes R are revolved at a somewhat greater speed than the drum and oppositely thereto. The rate of speed is such as to insure a continuous action of the rakes over that portion of the drum which is rising to its discharge-point.

As the shells S are elevated upon the sleeves **34** in the spaces **35** along the arcuate base-surface **36**, they arrive at the upper forward extremity of said surface, where they are delivered to the raceway-structure W, carried in successive sections between spaced plates **88**, here shown as four in number (Fig. 4). These plates are secured to a forward projection **90** of the base **12**, and thence are inclined downwardly to a set of vertical plates **92** of the selecting mechanism I, to be later described, rising from a bracket **94** attached to the frame **10** (Fig. 1). Between the plates **88**, just above the upper end of the base-surface **36**, are clamped three short bars **96**, having formed in their upper edges V-grooves **98** furnishing downwardly inclined raceways. As appears in Fig. 3 of the drawings, as the rising shells upon the sleeves **34** pass from the arcuate surface **36**, they contact with the end-surfaces **99** of the bars **96**, these ends being inclined upwardly and forwardly from the vertical. Reaching the grooves **98**, the shells tilt forward and overbalance, to slide down the grooves. If a shell remains erect upon a sleeve, it might fail to be delivered properly, being thrown out of the apparatus. To prevent this, its upper end engages a leaf-spring **100**, which projects inwardly from a supporting block **102** secured to one of the plates **88**. The shell, in its ascent, tensions the spring, bending this upwardly until, as the shell leaves it, a force is exerted which snaps said shell back into the drum, to be again elevated. The shells received by each raceway pass under a light curved spring-finger **104**, fixed to the end of an arm **106** pivoted at **108** upon one of the plates **88**, and held by gravity against a stop-pin **110**. If there is a tendency for the shells to overlap and ride upon one another, the upper one contacts with the finger and is held back as said finger floats upon it, until it assumes its correct position behind the leading shell.

It is desired that there be delivered by the drum a somewhat greater quantity of articles than can be utilized, this being to ensure an unbroken sup-

ply at the operating point. Clogging may also occur in advance of the raceway-bars 96. To dispose of any excess which may thus accumulate, the bars 96 are spaced at 112 from bars 114 of the succeeding raceway-section. The latter bars are clamped between the plates 88, similarly to the bars 96, and are grooved and forwardly and downwardly inclined in a like manner. Pivoted to each bar 114 is a displaceable terminal-portion 116. This terminal is held normally up into alinement with the body of the bar, as appears in Fig. 3, by a spring device *d*. Pivoted to each terminal 116 is a plunger 118, reciprocable in a cylinder 120 pivoted upon one of the bars 88. Interposed between the inner end of the plunger and the opposed cylinder-end is a spring 122, the expansive force of which maintains the terminal normally raised. As the shells are projected from the raceway-bars 96 across the space 112 under the influence of gravity, they fall, one by one, upon the terminals 116 to continue along the raceway-bars 114. If for any reason the shells back up upon any one of the latter bars, as appears in Fig. 10, they will finally reach the terminal. The force of the spring is such that one shell will not displace said terminal, which may, however, be lowered by a second shell falling upon the first, and if a third strikes those preceding it, the spring will yield sufficiently to spill all into the space between the bars 88 to waste into a receptacle. This action will continue until advance of the shells along the raceway is resumed below the space. It will be noted that one arm of a toggle-lever is furnished by each terminal 116 between its pivot and that of the plunger, and a second arm between the plunger-pivot and that of the cylinder. As the load upon the terminal increases, the deflection of said terminal tends to straighten the toggle (Fig. 10), the compression of the spring 122 causing it to offer greater resistance. But the leverage through which the received shells act becomes more effective. There is thus approximated a uniform resistance of the terminal to deflection. The discharging deflection of the terminal will be to such an angular position that it will strike a stop-pin 126 projecting from one of the plates 88. Under the influence of gravity, aided by the jar produced by the contact with the pin, the shells will slide from the terminal. The rebound from the pin assists the spring 122 in returning the terminal promptly to its normal position to receive and direct the succeeding shell upon the raceway-bar 114.

The raceways are extended beyond the bars 114 by bars 124, curved upwardly to give more nearly horizontal movement of the shells as they leave the raceway, and being spaced from said bars 114 at 128 (Figs. 5 and 10). Situated in these spaces is means for more positively and uniformly advancing the shells. This consists of a roll 130 having a grooved or V-shaped periphery, which may be faced with some such friction-material as leather 132 (Fig. 2). The rolls for all three raceways are fast upon a shaft 134 rotatable in spaced brackets 136 (Fig. 1), attached to the outer sides of the outer plates 88. Secured to the shaft is a pulley 138, through which the rolls are rotated in the direction of the arrow by a belt 140, passing over a pulley 142 upon a horizontal shaft 144 journaled in the base 12. A pulley 146 turns with the pulley 142 and is driven through engagement with it of the belt 72 by which the drum D is rotated. Rotatable upon the base is shown a guide-roll 148, holding the belt 72 in proper engagement with the pulley 146. Opposite each space 128, and secured to a removable cover 150 for the corresponding raceway, is a leaf-spring 152, it passing through an opening in the cover and having a downwardly curved portion opposite the periphery of the roll 130. The space between the roll and spring is such that each shell traveling between them is held against said roll to be urged forward by its rotation. To cause the force thus exerted to be applied to an unbroken series of the shells, there is shown as projecting through the raceway-cover a second leaf-spring 154 bearing against the last shell which rests wholly upon the raceway. The shells below the roll are therefore held in contact with one another against the action of gravity.

Since the present apparatus is designed to operate upon articles with their opposite ends differently formed and to deliver them with the same end in one direction, there is situated beyond the raceway-sections 124 the selecting and inverting mechanism I mounted upon the plates 92 (Figs. 5 and 6). Between the plates and individual to each raceway, a delivery-throat 156 is formed between an inner filler-plate 158 and an outer filler-plate 160, tapering downwardly and inwardly to a discharge-passage 162. At 163 the opposite edges of the filler-plates are grooved to facilitate the movement of the shells between them. The outer filler-plate is arranged by slot-and-pin mountings 164, 164 to swing outwardly and upwardly, so access may be had to the throat to relieve clogging. Supported at 166, between the upper portions of the plates 92 above each delivery-throat, is a leaf-spring 168 having secured to its lower extremity a clamping plate 169, provided with front and rear spaced walls (Fig. 11). Between these walls, by a bolt 170, the spaced arms of a loop 171 are held for vertical adjustment. Also vertically adjustable, by slots through which the bolt passes, is a wall or abutment 174 lying outside the spring 168 and a contact-projection 176 extending inwardly and upwardly therefrom. Each spring with the loop, abutment and contact member, is variable as to its normal position by engagement at the inner side with an eccentric stop 178, having projecting spindles rotatable in the plates 92, and which may be turned to different angular positions and fixed by a set-screw 179, threaded into one of the plates 92 and engaging one of the spindles. The tension of the spring may be changed by a lever 180, fulcrumed between the plates 92 and bearing at its upper extremity against the inner side of the spring. The lower end of each lever lies opposite openings 182 in the plates 92, and has an angular projection 184 extending into one of these openings. A screw 186 is threaded horizontally through the outer edge of one of the plates and into the opening, where it carries nuts 187 engaging the opposite sides of the projection. As the screw is turned and the upper end of the lever swung outwardly or inwardly, the spring 168 is urged with greater or less force against an abutment 188, arranged between the plates 92, and also against the stop 178. The tension of the spring is thereby increased or decreased, and the resistance to displacement of the lower end of the spring and the elements which it carries correspondingly varied.

In each raceway, below the roll 130, a series of the shells S, retained by the spring 154, will lie end-to-end, they approaching the throat 156 with either the flanged end *s* or the neck-end *s'* in advance. In Fig. 5 of the drawings, the neck of the leading shell is forward. As the series of shells is forced ahead by the roll, the neck passes into the space within the loop 171, with the

shoulder s'' bearing against the arms of said loop. The flanged end of the shell rests in proximity to the forward end of the raceway-bar 124. As the advance of the series of shells by the roll continues, the loop and supporting portion of the spring are deflected outwardly, the necked end of the shell passing above the groove in the upper edge of the filler-plate 160. This continues until the flanged end of the shell has left the raceway-bar 124. At this time, the deflection of the spring has brought the contact member 176 against the upper side of the shell, and exerts thereon a force urging the flanged end sharply down, so it is turned in the throat 156 about the closed lower end of the loop 171, as a pivot, and falls, flange down, into the discharge-passage 162. To render certain the downward direction of the flanged portion, the upturned end of the contact member 176 continues the pressure upon the shell, as the spring bends. Had the shell left the raceway flanged end first, the weight of this would have been sufficient to overbalance it upon the end of the raceway before the loop had been reached. This shell also would fall flange foremost into the discharge-passage. If shells or other articles have a portion beyond the flanged or heavy end cylindrical throughout, instead of necked at the open end, the space between the arms of the loop would be made of sufficient width to pass this end of the shell without deflection of the spring, the arms acting merely as lateral guides. The wall 174 now becomes effective to bend the spring outwardly, the delivery of the shell, flanged end down, being as already described. It is to be noted that this wall 174 may also be utilized for the delivery of necked shells, the space between the arms of the fork being of a width which will pass the barrel, as well as the neck.

Upon leaving the selecting mechanism I, the discharged articles enter the combining mechanism C, by which the series of articles from all the raceways are brought together into a single series. Carried upon the top of the frame 10 beneath the mechanism I is a block 196 (Figs. 5, 7 and 8), recessed at its upper face to receive a rotatable disk 198. This disk is fixed to the upper extremity of a vertical shaft 200, rotatable in a depending portion 202 of the block. A pulley 204 secured to the lower end of the shaft is joined by a belt 206 to a pulley 208 (Fig. 1), fixed to a vertical shaft 210 journaled in brackets 212, 212 upon the frame, and driven constantly from the shaft 64 through bevel-gearing 214. Resting upon the block 196 above the disk 198 is a plate 215, in which are three concentric arcuate slots 216, 218 and 220 furnishing channels or guideways successively spaced from one another (Fig. 9). The inner slot 216 is connected to the adjacent slot 218 by a slot 222, which lies at such an angle that its entrance into said slot 218 is not greatly widened over that which it joins. The slot 218 is similarly united to the slot 220 by a slot 224. These connecting slots are spaced from each other along the arcuate slots. The entrance-ends 226 of the three arcuate slots are of sufficient diameter to admit the leading flanged ends of the shells S. The slots 216, 218, 222, 220 and 224 are of less width, having opposite walls 227 sufficiently spaced to pass said shells, while the under face of the guide-plate 215 is spaced from the upper face of the disk at 228 to admit the shell-flanges. Beyond the connecting slot 224, the outer arcuate slot 220 is continued by a slot 230 providing a terminal-guideway or -channel, which may be straight. Registering with the openings 226 are passages 232 in a guide-block 234, attached to the upper face of the plate 215. Upwardly expanding throats 236 at the top of the passages 232 register with and facilitate the entrance of the shells discharged by the respective passages 162.

As the shells, delivered by the three raceways, descend flanged ends down through the passages 162 and 232, they fall upon the upper face of the disk 198, which may be covered with such material as leather, indicated at 238, to increase the frictional effect. Projections 240, depending from the inner edge of each filler-plate 160 and lying close to the upper extremities of the shells as they rest upon the disk, guard them from falling forward in their descent. When the flanged ends of the shells rest upon the friction-covering of the disk in any one of the passages 232, they are at once urged forward into the corresponding channel furnished by one of the slots 216, 218, 220, and along these in series toward the terminal-slot 230.

As a shell in the channel 216 reaches the connection 222, or one in the channel 218 arrives at the connection 224, they are delivered, respectively, to the channels 218 and 220. In each case, the series join to reach the terminal-channel 230 in a single series made up of shells from all three of the raceways and their discharge-passages 162. As the series of shells meet, they may be so related in the extent of their advance, that one emerging from a connecting channel will enter readily between two shells in the receiving channel, or the reverse may be true, the shell from the receiving channel arriving in advance of the other. The meeting shells may, however, so engage each other that there is a tendency for both to be locked against advance. This is as shown in Fig. 9 by the shells *a* and *b*. But the inner shell *a* is held back in its bodily movement under the influence of the rotating disk 198 by contact with the angular corner 246 of the plate 215. The frictional effect of the disk upon the outer portion of the head of the shell, which projects beyond the connecting channel, is to start it in clockwise rotation about its vertical axis, and to tilt it outwardly and rearwardly against the shell *b* in the outer channel, starting this in opposite rotation by the engagement. The inner wall 227, just at the rear of the connecting channel through which the shell *a* is arriving, and the outer wall 227, opposite said connecting channel, are both inclined slightly upwardly and inwardly at 247 to facilitate this tilting engagement. As the two shells roll upon each other, the effect is to initiate movement of the inner shell back into the connecting channel, while the outer, acted upon by the disk with a greater force, due to the longer radius and consequent increased rate of travel, advances, pushing the inner shell out of its path. This inner shell is thus left ready to enter behind the outer shell, and no clogging can occur.

Shells at the junctures of the channels 218 and 222 and 220 and 224 may be in rotation about their vertical axes, and are at this time free from retaining effect produced by the extension of their flanges into the space 228 beneath the plate 215. When thus free, their rotation may exert an upward force, tending to lift them spirally from the channels. To prevent such displacement, there extends over each of the channel-junctures a horizontal guard-wall 248 (Fig. 8), which lies close to the upper ends of the shells, and which

is engaged by them if they rise. Each guard-wall is supported upon a vertical wall **250**, secured to the plate **215** opposite one of the connecting channels. To prevent interference with the advance shells having irregular ends, the walls **248** may be arranged to yield upon the supporting walls. For this purpose, they are free to lift along guide-pins **252** and **254** projecting above the walls **250**. The pin **254** is headed, and between the head and the wall **248** a compression-spring **256** is interposed, this yielding against any substantial force applied by a shell. At **258**, the rear edge of each wall **248** is inclined downwardly and in the direction of travel of the shells. If the upper end of a lengthened shell strikes this incline, it will displace the plate and pass on without interference.

At its exit-end, the terminal-channel **230** bends into parallelism with the conveyor-belt T, which is shown in Figs. 5 and 8 as operating over a pulley **260**, rotatable about a spindle **262** projecting horizontally from the outer side of the block **196**. The upper forwardly traveling run of the belt T moves over a horizontal supporting table **263**, extending from the block. Spacing thimbles **264** rise from the table at each side of the belt and carry overhanging strips **265** beneath which the flanges *s* of the shells pass, preventing these from tipping. At the outer extremity of the table, the conveyor-belt passes about an unillustrated pulley and returns over a driving pulley **266** (Fig. 1) and a tightening pulley **268**. This pulley **268** is mounted for vertical adjustment at **270**, so its position and effect upon the conveyor-belt may be varied. The pulley **266** is secured to the outer end of a horizontal shaft **272** journaled in the bracket **212** and in a second bracket **274** attached to the frame **10**. At its inner end, the shaft is joined through bevel-gearing **276** to the constantly rotating vertical shaft **210**. By bevel-gearing **278**, the shaft **272** is connected to a horizontal shaft **280**, one extremity of which is seen in Fig. 1 as rotatable in the bracket **274**. The shaft **280** may serve to drive other conveying means to which the conveyor T delivers. It may be that this second conveying means should be actuated continuously; if, for example, the shells are to be passed through an annealing oven to receive for a predetermined period heat-treatment of the necks *s'*. This result is attained by the driving system illustrated, since, although the distributing mechanism may be entirely stopped by manipulation of the clutch-lever **66**, as for the making of adjustments or the clearing of clogging, the rotation of the shaft **210**, and therefore the travel of the conveying system, continues as long as the motor **60** is in operation. Consequently, any shell which the distributor has delivered to the conveyor T, will be forwarded for the reception of its complete treatment.

In using the apparatus for the distribution of cartridge-shells, these are supplied through the opening **28** of the rotating drum D, they gathering in a mass at the lower portion thereof. The rakes R, moving oppositely to the drum, even the mass to facilitate the entrance of the shells into the successive transverse sets of three spaces **35** between the revolving sleeves **34**. These sleeves elevate the shells in sets along the base-surface **36**, and the ends of the bars **96** in the raceway-structure W. Over the upper edges of the bars the shells tilt outwardly, to slide down the grooves **98** to form plural series. If a shell balances vertically upon its sleeve, it will engage the corresponding spring **100** to be returned thereby to the drum. Shells overriding each other in the grooves **98** are separated by the spring-fingers **104**, and are then projected across the spaces **112** toward the raceway-bars **114**, to be received upon the pivoted terminal-portions **116**. If for any reason shells so accumulate upon a bar **114**, that a plurality gathers upon the terminal, this yields, allowing the received shells to waste until normal advance is resumed. Reaching one of the driven rolls **130**, each shell is urged forward upon the corresponding raceway-bar **124** against the series preceding it, toward the inverting elements carried by the spring **168** in the mechanism I. If the headed or flanged end *s* of a shell happens to be forward, its weight is sufficient to tilt it down upon the end of the bar **124**, so it falls, thus positioned, into the discharge-passage **162**. If the reduced neck *s'* of the shell leads, it enters and is held up by the loop **171** of the spring, until, as said spring yields under the pressure of the advancing series, the headed end of the shell leaves the raceway and falls, assisted by the force exerted by the tensioned spring, into the discharge-passage. Delivered to the mechanism C, through the passages **162** and **232**, the series of shells are received side by side in the three channels **216**, **218** and **220** in the plate **215**, with their headed ends resting upon the rotating disk **198**. Through the connections between these channels at predetermined points, the three series of shells are combined in a single unbroken series in the channel **230**, to be received and transferred by the conveyor T at a high rate of speed to a point at which they are to be operated upon.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In an apparatus for distributing articles, a receptacle for a mass of the articles, a plurality of raceways to which the articles are delivered from the receptacle in plural series, and combining mechanism by which such plural series are received, carried side by side and combined in a single series, said combining mechanism having means for forcing articles in one series between those of another series at predetermined points and for rotating the thus-engaged articles in contact with one another.

2. In a distributing apparatus, a receptacle for a mass of articles, a plurality of raceways arranged to receive articles from the receptacle and to advance them in plural series, a channel individual to each raceway and to which said raceway delivers its series of articles, the individual channels delivering to other channels at points successively separated in the direction of travel, a terminal-channel receiving articles from the individual channel having the most advanced point of delivery, and means movable to advance the articles along the channels and to force said articles from individual channels between those in other channels.

3. In an article-distributing apparatus, a plurality of arcuate guideways, connecting guideways between adjacent arcuate guideways, said connecting guideways being spaced from one another along the arcuate guideways, a single guideway to which all the other guideways deliver, means for supplying articles to each of the arcuate guideways, and a rotatable feed member engaging the articles to advance them along the guideways.

4. In an article-distributing apparatus, a plurality of arcuate guideways, each of the inner guideways having an angular connecting portion

leading into the adjacent outer guideway, a single guideway continuing the outer arcuate guideway, and a rotatable feed member engaging the articles to advance them along the guideways.

5. In an article-distributing apparatus, a plurality of arcuate guideways, each of the inner guideways having an angular connecting portion leading into the adjacent outer guideway, a wall of the guideway to which the angular portion is connected being inclined from the vertical, a single guideway continuing the outer arcuate guideway, and a rotatable feed member engaging the articles to advance them along the guideways.

6. In an article-distributing apparatus, a plurality of arcuate guideways, each of the inner guideways having an angular connecting portion leading into the adjacent outer guideway, retaining means extending over the junctures of the connecting portions with the outer guideways, a single guideway continuing the outer arcuate guideway, and a rotatable feed member engaging the articles to advance them along the guideways.

7. In an article-distributing apparatus, a plurality of arcuate guideways, each of the inner guideways having an angular connecting portion leading into the adjacent outer guideway, retaining means extending over the junctures of the connecting portions with the outer guideways, said retaining means being arranged to yield away from such junctures, a single guideway continuing the outer arcuate guideway, and a rotatable feed member engaging the articles to advance them along the guideways.

8. In a distributing apparatus, a guide-plate having extending through it a plurality of concentric slots and a single slot to which all the concentric slots deliver, means for supplying articles to each of the concentric slots, and a rotatable feed member engaging the articles to advance them along the slots.

9. In a distributing apparatus for cartridge-shells, a horizontal guide-plate having extending through it a plurality of concentric arcuate slots, each of the inner slots delivering to the adjacent outer slot and a slot continuing the outer arcuate slot, a disk rotatable beneath the plate and upon which the shells in the slots rest, and means for supplying shells to the arcuate slots.

10. In a distributing apparatus for cartridge-shells, a horizontal guide-plate having extending through it a plurality of concentric arcuate slots, each of the inner slots delivering to the adjacent outer slot and a slot continuing the outer arcuate slot, a retaining wall extending over the juncture of an inner and outer slot, a disk rotatable beneath the plate and upon which the shells in the slots rest, and means for supplying shells to the arcuate slots.

11. In a distributing apparatus for cartridge-shells, a horizontal guide-plate having extending through it a plurality of concentric arcuate slots, each of the inner slots delivering to the adjacent outer slot and a slot continuing the outer arcuate slot, retaining walls extending over the junctures of the inner and outer slots, a mounting upon which each retaining wall is movable, a spring interposed between each mounting and its wall, a disk rotatable beneath the plate and upon which the shells in the slots rest, and means for supplying shells to the arcuate slots.

12. In a distributing apparatus for flanged cartridge-shells, a horizontal guide-plate having extending through it a plurality of concentric arcuate slots, each of the inner slots delivering to the adjacent outer slot and a slot continuing the outer arcuate slot, a rotatable disk spaced from the underside of the plate and upon which the shells may rest, the bodies of the shells lying in the slots and their flanges extending beneath the plate, and means for supplying shells to the arcuate slots.

13. In an apparatus for distributing headed articles, a receptacle for a mass of the articles, a plurality of raceways to which the articles are delivered from the receptacle in plural series, combining mechanism by which such plural articles are combined in a single series, inverting mechanism receiving articles from the raceways and delivering them to the combining mechanism, and means acting upon articles in the raceways for urging said articles toward the inverting mechanism and thereby rendering it effective.

14. In an apparatus for distributing headed articles, a receptacle for a mass of the articles, a plurality of raceways to which the articles are delivered from the receptacle in plural series, mechanism by which such plural series are combined in a single series, an inverting mechanism receiving articles from the raceways and delivering them to the combining mechanism, and means associated with each raceway for forcing the series of articles out of the raceways in engagement with the inverting mechanism.

15. In an apparatus for distributing headed articles, a receptacle for a mass of the articles, a plurality of raceways to which the articles are delivered from the receptacle in plural series, combining mechanism by which such plural series are combined in a single series, an inverting mechanism receiving articles from the raceways and delivering them to the combining mechanism, and a rotatable roll extending into each raceway and engaging successive articles to force the series out of the raceways in engagement with the inverting mechanism.

16. In an apparatus for distributing headed articles, a receptacle for a mass of the articles, a plurality of raceways to which the articles are delivered from the receptacle in plural series, combining mechanism by which such plural series are combined in a single series, an inverting mechanism receiving articles from the raceways and delivering them to the combining mechanism, a rotatable roll extending into each raceway and engaging successive articles to force the series out of the raceways in engagement with the inverting mechanism, and means for pressing the articles in each series against the corresponding roll.

17. In an apparatus for distributing articles, a receptacle for a mass of the articles, a plurality of raceways to which the articles are delivered from the receptacle in plural series, mechanism by which such plural series are received, carried side by side, combined in a single series and delivered for utilization, the supply from the receptacle to the raceways being always in excess of the delivery from the combining mechanism, and means included in each raceway for discharging the excess supply of articles therefrom.

18. In an apparatus for distributing articles, a receptacle for a mass of the articles, a plurality of raceways to which the articles are delivered from the receptacle in plural series, each raceway including rear and forward sections spaced from each other, the rear end of the forward section being at a lower level than the adjacent end of the rear section and having pivoted upon it a terminal portion projecting into the

space and being movable by articles as they fall upon it through the space, and mechanism by which the plural series are combined.

19. In an apparatus for distributing articles, a receptacle for a mass of the articles, a plurality of raceways to which the articles are delivered from the receptacle in plural series, each raceway including sections spaced from each other, the forward section having pivoted upon it a terminal portion projecting into the space and being movable by articles accumulating upon it, a spring-actuated device by which the terminal portion is held yieldably in its normal position, said device co-operating with the terminal portion to form a toggle-lever, and mechanism by which the plural series are combined.

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