July 20, 1943. O. E. COTE 2,324,767

VARIABLE CAM MECHANISM

Filed April 17, 1942 4 Sheets-Sheet 1

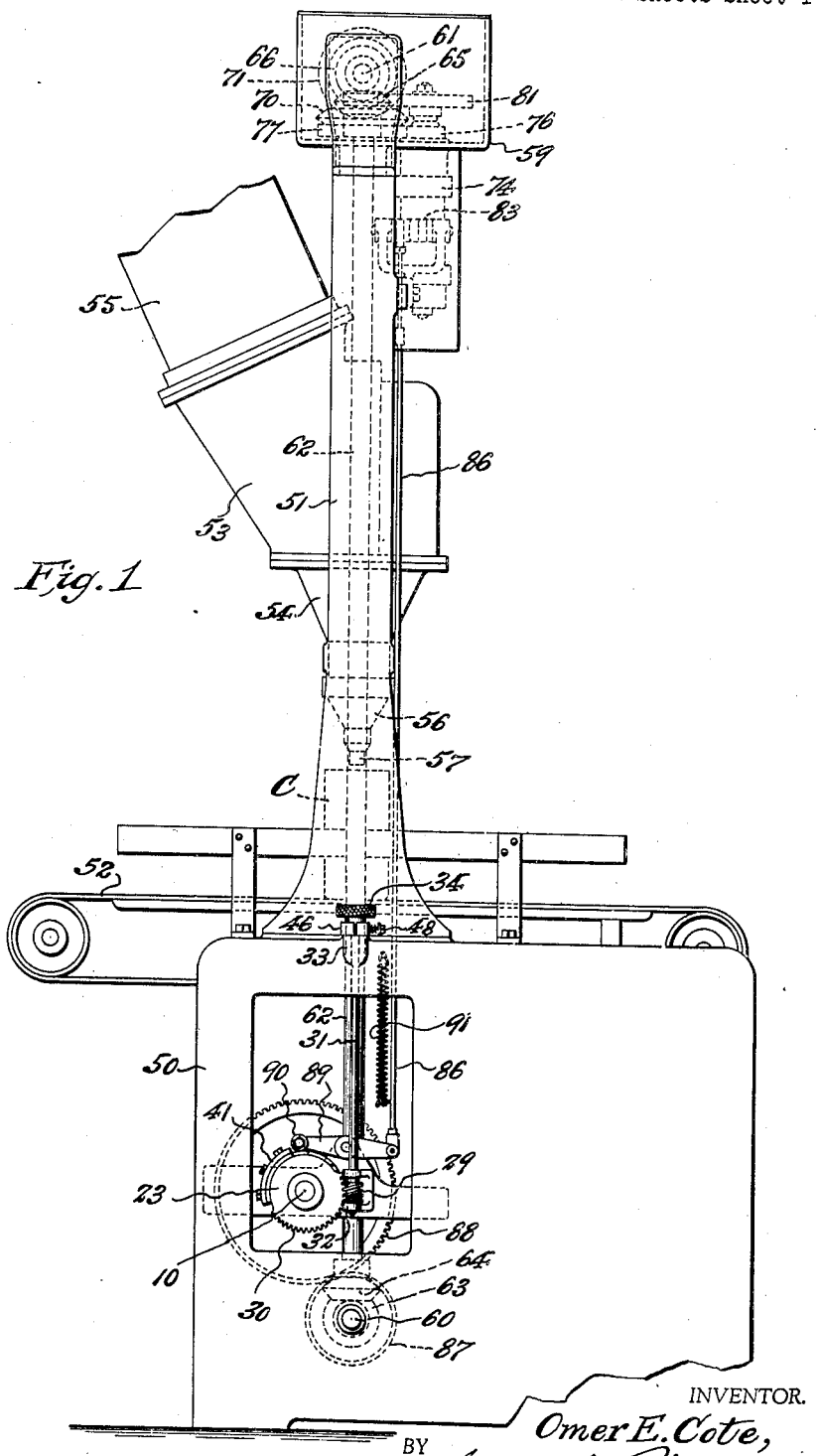

Fig. 1

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VARIABLE CAM MECHANISM

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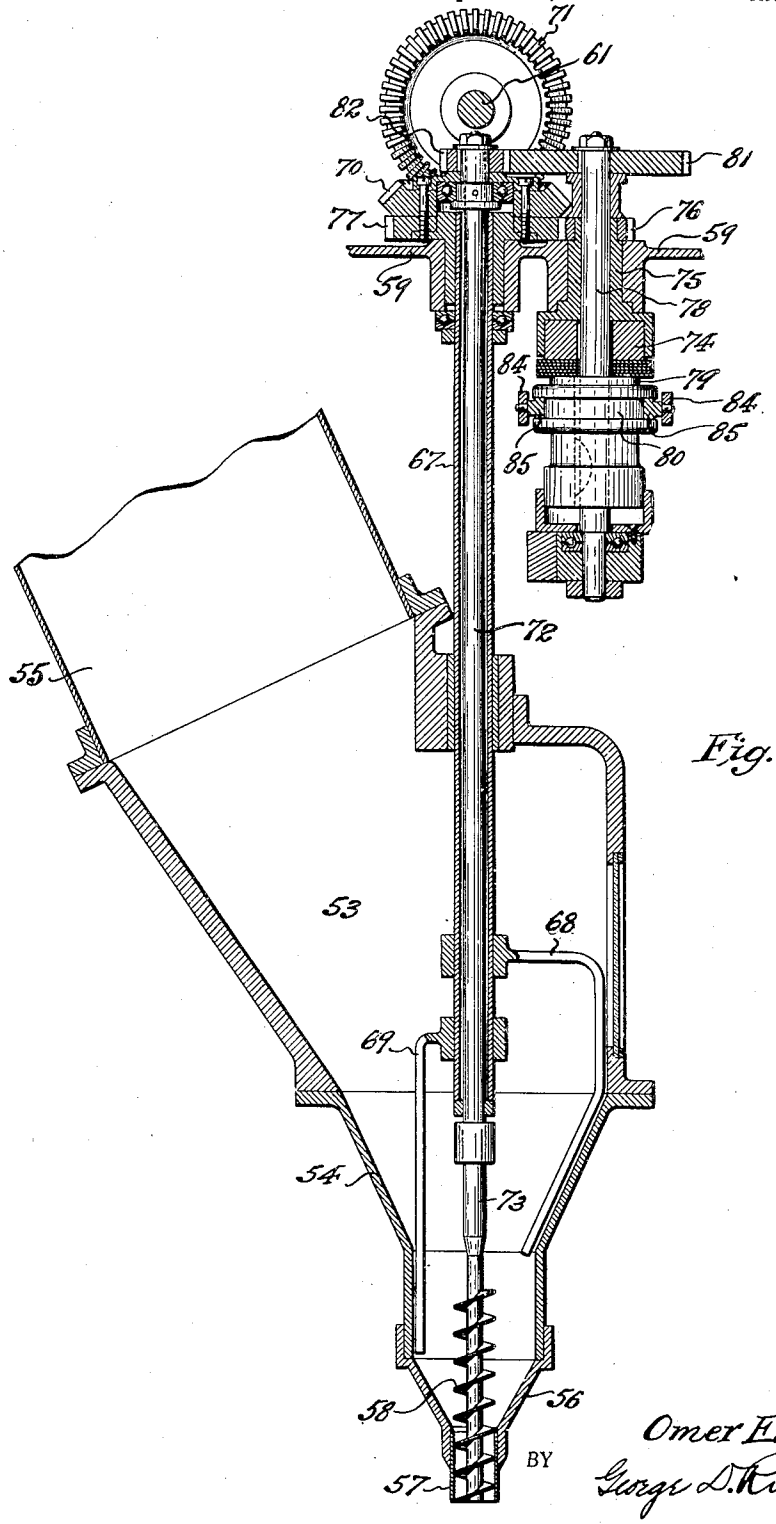

Fig. 2

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VARIABLE CAM MECHANISM

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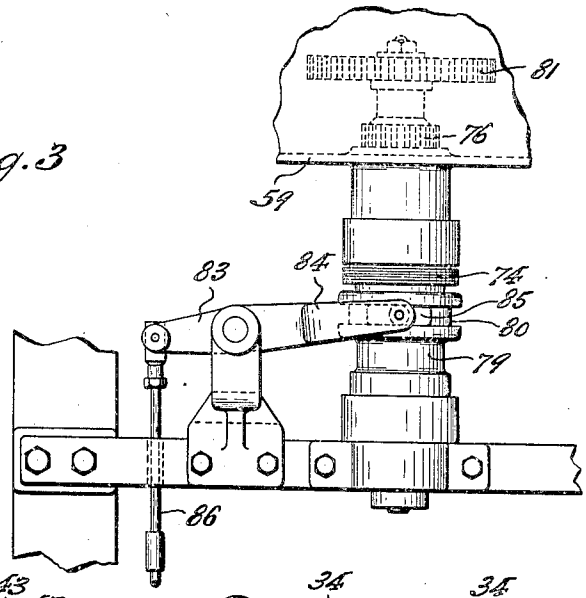
Fig. 3



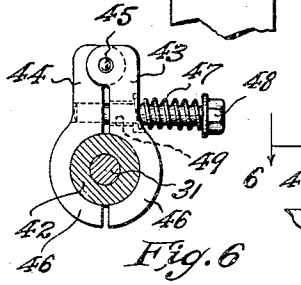
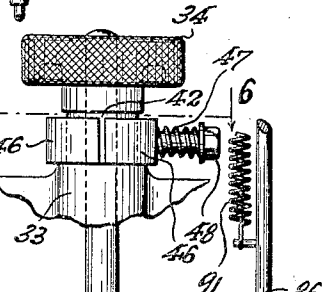


Fig. 6



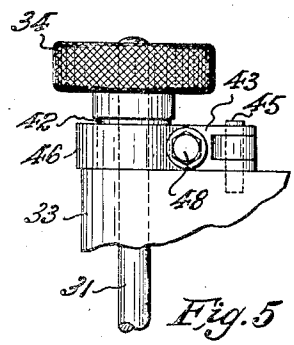


Fig. 5

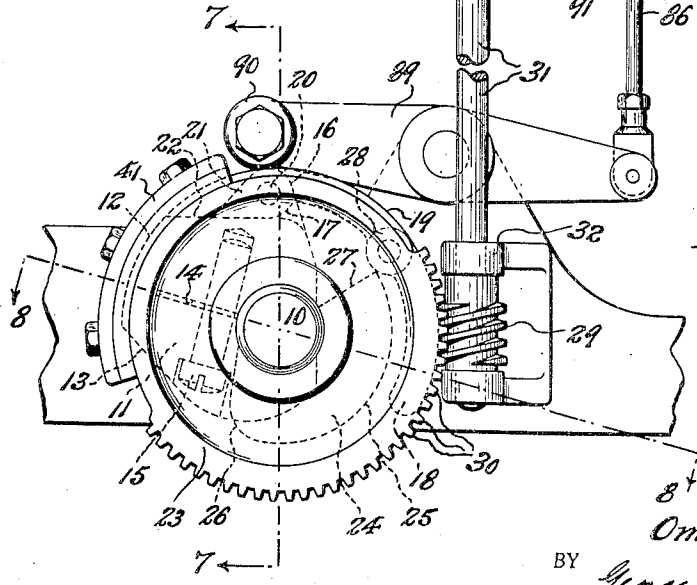


Fig. 4

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VARIABLE CAM MECHANISM

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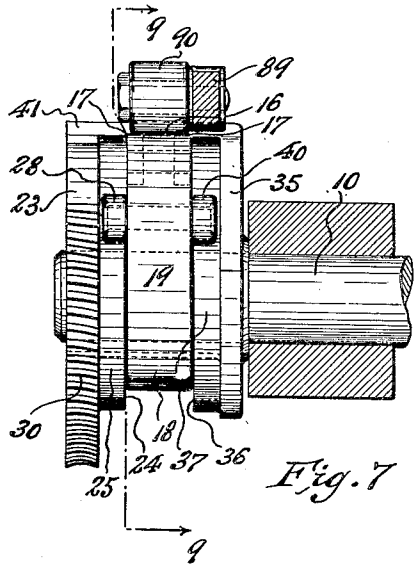

Fig. 7

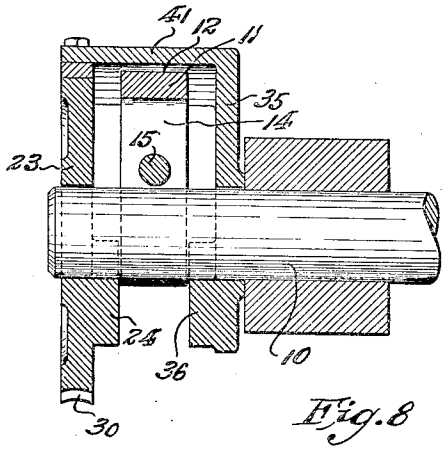

Fig. 8

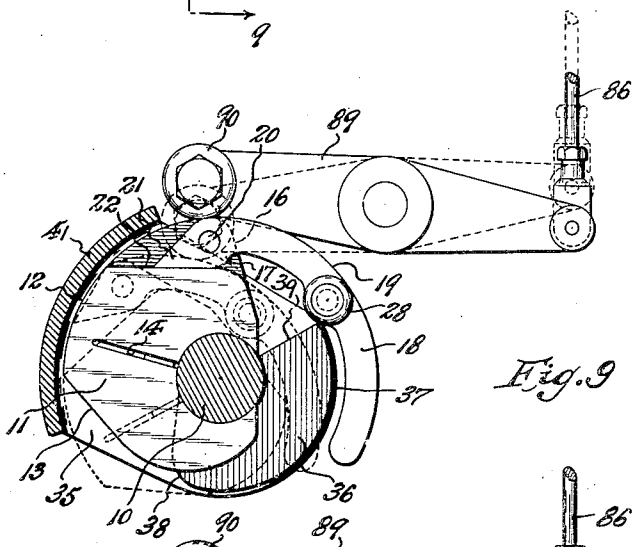

Fig. 9

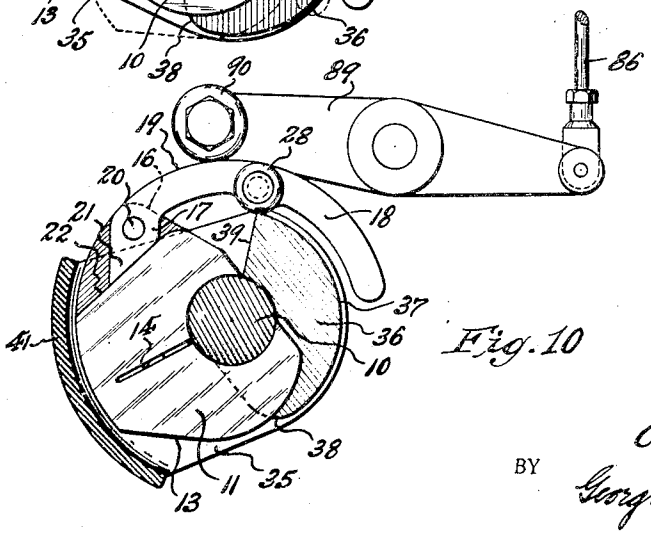

Fig. 10

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2,324,767

UNITED STATES PATENT OFFICE

2,324,767

VARIABLE CAM MECHANISM

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Application April 17, 1942, Serial No. 439,344

12 Claims. (Cl. 74—568)

This invention relates to improvements in machine elements; and the invention has reference, more particularly, to an improved construction of variable cam mechanism.

In many types of machines which include intermittently actuated mechanism, it is desirable to vary the period of operation of the latter, whereby to increase or decrease the same. It is therefore an object of this invention to provide improved means for controlling, among other purposes, the operation of intermittently actuated mechanism, which includes novel means for adjusting such control means so as to vary its operative effect, whereby to increase or decrease at will the period of operation of the mechanism controlled thereby. To this end, the present invention provides a novel construction of rotary control cam mechanism, including means to adjust the same for varying its operative effect.

The invention has for another object to provide a novel construction of rotary cam mechanism which is subject to adjustment for varying its operative effect while it continues in motion; thus avoiding necessity for interrupting the operation of the machine, of which it is a part, in order to make such adjustments.

The invention has for another object to provide an improved rotary cam device having novel means for increasing or decreasing its effective cam surface between maximum-minimum limits, together with manipulatable means for so adjusting the same which may be effectively operated both while the cam is running as well as when it is stopped.

A further and more specific object of this invention is to provide a variable cam mechanism of the kind mentioned in combination with means for intermittently driving a material feed auger of an automatic auger type container filling machine, whereby to vary the period of operative revolution of such feed auger.

Other objects of this invention, not at this time more particularly enumerated, will be understood from the following detailed description of the same.

An illustrative embodiment of this invention is shown in the accompanying drawings, in which:

Fig. 1 is an elevational view of an automatic auger type container filling machine equipped with the novel variable cam mechanism according to this invention; Fig. 2 is a fragmentary vertical longitudinal sectional view of said filling machine showing a feed auger and its driving mechanism, said view being drawn on an enlarged scale; Fig. 3 is a fragmentary side elevation, also drawn on an enlarged scale, of the feed auger drive shaft and the clutch mechanism therefor which is automatically controlled by the variable cam mechanism according to this invention.

Fig. 4 is a side elevational view on an enlarged scale of the variable cam mechanism and its manipulatable adjusting means; Fig. 5 is a fragmentary side elevation of the friction brake means included in the manipulatable means for adjusting the variable cam mechanism; and Fig. 6 is a horizontal section through said brake means, taken on line 6—6 in Fig. 4.

Fig. 7 is a transverse vertical sectional view, taken on line 7—7 in Fig. 4, but showing the variable cam device in elevation; Fig. 8 is a transverse sectional view of said variable cam device, taken on line 8—8 in Fig. 4; Fig. 9 is a sectional view of the variable cam device, taken on line 9—9 in Fig. 7; and Fig. 10 is a view similar to that of Fig. 9, but showing the cam device adjusted to increase its effective cam surface.

Similar characters of reference are employed in the above described views, to indicate corresponding parts.

The variable rotary cam device according to this invention is operated by a suitably driven continuously running cam shaft 10. Fixed on said cam shaft 10, so as to rotate therewith, is a main cam member 11 having an effective peripheral surface 12 of suitable length which is concentric to the axis of said cam shaft 10. At its leading end, said main cam member is provided with a suitably shaped lift or thrust surface 13. Said main cam member 11 may be fixed on the cam shaft 10 in any suitable manner. Illustratively, as shown, said cam member 11, is split radially, as at 14, to provide opposed contractible sections to embrace the cam shaft 10; said sections being drawn together into frictionally gripping relation to the cam shaft 10 by means of a clamp screw 15, which is engaged therewith.

The trailing end of said main cam member 11 is provided with a perforate ear 16 of reduced width. Pivotally connected with said cam member ear 16, by its bifurcate inner end portion 17 which straddles said ear, is a cam extension segment 18 of suitable length. Said cam extension segment is adapted to extend rearwardly from the main cam member 11. When said cam extension segment 18 is disposed in normal or outswung position, its outer surface 19 lies concentric to the axis of the cam shaft 10, and thus

forms a continuation of the effective surface 12 of the main cam member 11. The bifurcate inner end portion 17 of said cam extension segment is swingably coupled to the main cam member ear 16 by a transverse pivot pin 20, and said inner end portion 17 is provided with stop projection means 21, which normally abuts the shouldered portion 22 at the base of the ear 16 of said main cam member 11, whereby to limit the out-swung movement of said cam extension segment so as to determine its aforesaid normal position.

Adjustable means is provided for both supporting the cam extension segment 18 in normal cut-swung position for operative extension of the effective peripheral surface of the main cam member 11, as well as for determining the moment of release and in-swinging movement of the cam extension segment, whereby to correspondingly determine the effective length of total cam surface within maximum-minimum limits. An illustrative embodiment of such means comprises a track cam plate 23, which is mounted on the cam shaft 10 so as to freely turn about the same, adjacent to one side of the main cam member 11 and its cam extension segment 18. On its inner side, said plate 23 is provided with an inwardly offset track cam 24, having a supporting track surface 25 of suitable length and concentric to the cam shaft axis. At its rearward end, said track cam 24 is provided with a suitably shaped lift surface 26 leading onto said track surface 25, and at its forward end said track cam is provided with a radial "drop-off" end 27, which terminates the track surface 25. The cam extension segment 18 is provided with laterally projecting roller means 28 adapted to be operatively engaged by said track cam 24.

Means is provided for rotatively adjusting said track cam plate 23, whereby to advance or retract the forward "drop-off" end 27 of its track cam 24 relative to the trailing end of the main cam member 11. Means for so adjusting the track cam plate 23 is subject to considerable variation in form, but a preferred embodiment thereof comprises a rotatable adjusting worm 29 adapted to operatively engage worm gear teeth 30 with which a suitable extent of the periphery of said track cam plate 23 is provided. Said adjusting worm 29 is fixed on a worm shaft 31 which is journaled in a suitable supported worm bearing bracket 32. The opposite end of said worm shaft 31 is journaled in a suitable bearing support 33, and to said latter end is affixed a hand knob 34, whereby the shaft and worm may be manually turned.

Preferably, although not essentially, a second track cam plate 35 is mounted on the cam shaft 10 adjacent to the opposite side of the main cam member 11 and its cam extension segment 18. Said second track cam plate 35 is provided on its inner side with an inwardly offset track cam 36 corresponding in shape, position and size, to the track cam 24 of plate 23, and so as to provide a corresponding track surface 37, lift surface 38 and "drop-off" end 39, to operatively engage corresponding laterally projecting roller means 40 carried by the cam extension segment 18. Said track cam plate 23 and track cam plate 35 are coupled together for common rotative adjusting movements by means of a coupling bridge member 41 affixed to and extending between their respective peripheries, exteriorly of the main cam member 11 and its cam extension segment 18.

In order to prevent displacement of the cam track plate or plates from a given position to which they have been adjusted, due to jarring or vibration of the machine in which the variable cam mechanism is incorporated, a friction brake means is provided to cooperate with the adjusting worm shaft 31 or its manipulating hand knob 34. For example, the hand knob 34 may be provided with a shank portion 42 adapted to be engaged by such brake means. An illustrative form of such brake means, as shown, comprises a pair of brake members 43—44, pivotally connected by and mounted on a stationary pivot post 45 which is affixed to the bearing support 33 or other stationary part adjacent to the knob 34. Said brake members 43—44 terminate at their free ends in arcuate brake shoe elements 46 which straddle and frictionally engage opposite sides of the shank portion 42 of the knob 34. Said brake members and their brake shoe elements are tensionally urged one toward the other, so as to thus frictionally bind against the knob shank portion 42, by means of a compression spring 47 carried by a cap screw 48 which passes freely through an opening 49 in one brake member, e. g. the brake member 43, and screws into the other brake member, e. g. the brake member 44. Said compression spring 47 is mounted around said cap screw 48, between the head thereof and the brake member 43. Said brake means frictionally binds the knob 34, worm shaft 31 and worm 29 against accidental rotative shift, and consequently, by reason of the intermeshing of the worm gear teeth 30 of the track cam plate 23 with the worm 29, said track cam plate 23, and its companion track cam plate 35 if used, is likewise retained against accidental rotative shift from any given adjusted position.

The variable cam above described is adapted for use in many types of automatic machines for controlling included mechanisms thereof which are desired to be intermittently actuated, subject to increasing or decreasing at will the period of operation within maximum-minimum limits; and consequently, in its broader aspects, this invention comprehends the novel variable cam mechanism per se.

Deemed within the specific scope of this invention, as well as illustrative of the function and operation of the novel variable cam mechanism, the same has been shown in combination with means for controlling intermittent actuation of a feed auger of an automatic auger type container filling machine, whereby the period of operative revolution of the feed auger may be increased or decreased at will.

An illustrative form of automatic auger type container filling machine, as shown, comprises a base frame 50 including side standards 51 upstanding therefrom. Suitably supported between said standard members 51, for disposition above a suitably driven and timed conveyer means 52 upon which containers C are carried to and from filling position, is a material supply hopper 53, having a discharge funnel 54 at its bottom end, and material delivery means 55, leading from a bulk source of material supply, into its upper end. Connected with the outlet end of said discharge funnel 54 is an axially aligned auger funnel 56, terminating at its lower free end in a spout sleeve 57 having an internal diameter to fit the auger 58, which extends through the auger funnel and into said spout sleeve. Supported by the upper ends of said standard members 51 is a top frame 59.

Suitably journaled across the base frame 50 is a continuously driven power shaft 60, and suit-

ably journaled across the top frame 59 is a counter-shaft 61. Said counter-shaft 61 is driven from said power shaft 60 by means of a vertical transmission shaft 62; the latter being driven from its lower end by intermeshing bevel gears 63 and 64 respectively affixed to said power shaft and said transmission shaft, while the counter-shaft 61 is driven from the upper end of said transmission shaft 62 by intermeshing bevel gears 65 and 66 respectively affixed to the latter and to said counter-shaft.

Extending downwardly from the top-frame 59 and axially into said hopper 63 is a hollow stirrer shaft 67, to which are affixed stirrer members 68—69 adapted to be revolved within the hopper interior, whereby to keep the material supplied thereto loosened for assured gravitation to the discharging auger 58. Affixed to the upper end of said stirrer shaft 67 is a bevel gear 70, with which meshes a drive bevel gear 71 affixed to said counter-shaft 61. Since the counter-shaft 61 is continuously driven, the stirrer shaft 67 and its stirrer members 68—69 will also be continuously driven while the filling machine is in operation.

Extending through the hollow stirrer shaft 67 is an independently rotatable auger drive shaft 72, to the lower end of which the shank 73 of the auger 58 is suitably affixed. Clutch controlled transmission means is provided for driving said auger drive shaft, at proper times, from the continuously rotating counter-shaft 61. An illustrative form of such transmission means, as shown, comprises a driver clutch means 74 having a hollow hub 75 which is journaled in the top frame 59, and to which is affixed a pinion 76. Said pinion 76 meshes with a spur gear 77, the latter being suitably affixed to the continuously rotating bevel gear 70 of the stirrer shaft 67, so that said driver clutch means 74 is continuously rotated while the machine is in operation. Extending through said driver clutch means 74 and its hub 75 is a suitably journaled jack-shaft 78, to which is keyed a shiftable driven clutch means 79, including an annularly channeled shift collar 80. Affixed to said jack-shaft 78 is a spur gear 81 which meshes with and drives a pinion 82, the latter being affixed to the upper end of the auger drive shaft 72, whereby said driver shaft and the auger 58 actuated thereby are likewise driven. Suitably supported adjacent to the clutch means is a pivoted clutch shift lever 83, the same having a yoke portion 84 at one end, the arms of which embrace the clutch shift collar 80 and which pivotally support shift shoe elements 85 for operatively engaging in the annular channel of said shift collar 80. A pull rod means 86 for actuating the clutch shift lever 83 is connected with the free end of the latter.

It will be understood that when the driven clutch means 79 is thrust into engagement with the continuously driven driver clutch means 74, the former will be rotated, and will in turn rotate the jack-shaft 78 to transmit, through the gearing 81—82, operative motion to the auger drive shaft 72 and the auger 58 actuated thereby. When, however, the driven clutch means 79 is withdrawn from operative engagement with the driver clutch means 74, rotation of the jack-shaft 78 will cease, and consequently the auger drive shaft 72 and auger actuated thereby will be stopped.

In the described auger type filling machine, the variable cam mechanism is utilized to intermittently engage and disengage the auger control clutch means in timed relation to the delivery and removal of containers C beneath the discharge spot 57. To this end, the cam shaft 10, which is journaled across the machine base frame 50, is driven, in a suitably timed manner, from the machine power 60 through interconnecting gearing 87—88, and suitably mounted for cooperation with the cam device is a pivoted control lever 89, one arm of which carries a roller 90 to be operatively engaged by the effective peripheral surfaces of the main cam member 11 and its cam extension segment 13, while to the opposite arm of which is connected the lower end of the clutch shift lever pull rod 86. Suitably anchored spring means 91 is connected with said pull rod 86 to upwardly move the same in clutch releasing direction, while at the same time causing the control lever roller 90 to yieldingly bear upon the variable cam device.

In the operation of the described auger type filling machine, a container C to be filled is held beneath the material discharge spout 57 for a predetermined period of time, which period is at least equivalent to the time required for the total effective peripheral surface of the main cam member 11 together with its cam extension segment 13 to move past the roller 90 of the control lever 89; such total effective cam surface being adapted to determine the maximum length of time that the auger 58 may be permitted to revolve with material discharging effect, while the effective peripheral surface 12 of the cam member 11 only determines the minimum length of time that the auger 58 may be permitted to revolve.

Due to the hygroscopic and other characteristics of many materials desired to be handled by such auger type filling machines, it is of great advantage to be able to vary the length of time, between said minimum and maximum limits, that the auger 58 is permitted to revolve, whereby to precisely control the discharge of material in assured uniform predetermined container charging amounts at all times, and relative to varying conditions of the material itself. For example, material of hygroscopic character may in damp or humid weather absorb moisture and therefore tend to lag in discharge. To offset such lag it is desirable to increase the period of operation of the auger 58, whereas in dry weather, when flow of such material becomes more free and lively, it is desirable to decrease the period of auger operation.

It is of especial advantage to be able to make such adjustments while the machine is running, since observation of the effects of adjustment enables the operator to quickly determine the degree of adjustment required, and no time is lost by stoppage of the machine. The above described variable cam device provides a highly effective means for attaining such advantages.

In the operation of the cam device, which, as shown, turns in anti-clockwise direction, when the cam member 11 engages the control lever roller 90, the control lever 89 is swung clockwise, thus drawing down the pull-rod 86 to move the clutch shift lever 83 in clutch actuating direction, whereby the auger drive shaft 72 and the auger 58 are operatively rotated. The clutch remains engaged and the auger continues in motion until the cam extension segment 13 drops off the track cams 24—36, thus ending the operative thrust of the cam device upon the control lever 89, and consequently allowing the spring 91 to draw upward said pull-rod 86, whereby to move the clutch shift lever 83 in clutch releasing direction, so as to stop

transmission of power to the auger shaft 72, and thereby arrest operation of the auger 58.

It will be obvious that by turning the hand knob 34 in clockwise direction, the track cam plates 23—35, through the motion transmitting worm and worm gear connection 29—30, will be turned anti-clockwise about the cam shaft 19, whereby to advance the "drop-off" ends 27—39 of the track cams 24—36 in direction of rotation of the cam member 11 and its cam extension segment 18, so that the period of support of the latter against inward collapse is prolonged, and consequently release of the clutch is delayed, thus increasing the period of auger operation. On the other hand, by turning the hand knob 34 in anti-clockwise direction, the track cam plates 23—35 and their track cams 24—36 will be moved in clockwise direction, whereby to move the "drop-off" ends 27—39 of the latter in direction counter to the direction of rotation of the cam member 11 and its cam extension segment 18, whereby the period of support of the latter against inward collapse is diminished, and release of the clutch advanced, thus decreasing the period of auger operation. It will be understood that the amplitude of rotative movement of the track cam plates 23—35 is such that the track cams 24—36 may be positioned in one extreme so as to obtain effective use of the total combined length of the main cam member 11 and its cam extension segment 16 for maximum operative effect, or in the other extreme so as to obtain effective use solely of the length of the cam member 11 for minimum operative effect.

Although the cam device may be adjustably varied while in motion, as above mentioned, it will be understood that it may also be equally well adjusted when idle.

It will be understood that all matter contained in the above description or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense; and that various changes may be made in the above described constructions, and different embodiments of this invention may be made provided they do not depart from the scope of the here following claims.

I claim:

1. The combination with a rotatable shaft of a main cam member fixed thereon to rotate therewith, a cam extension segment pivotally connected with the trailing end of said main cam member, said segment, when held in outswung operative position, being adapted to extend the effective peripheral surface of said cam member, and segment supporting and releasing means pivoted on and adjustable about said shaft, said means being rotatively adjustable to variably support said segment in and release the same from outswung position, whereby to increase or decrease at will the total length of effective cam surface.

2. The combination with a rotatable shaft of a main cam member fixed thereon to rotate therewith, a cam extension segment pivotally connected with the trailing end of said main cam member, said segment, when held in outswung operative position, being adapted to extend the effective peripheral surface of said cam member, track cam means adjustably movable about said shaft and adapted to move said segment to and support the same in operative outswung position, said track cam means having terminal "drop-off" means presented in direction of rotation of said main cam member and segment, whereby to release the latter with cam surface terminating effect, and means to adjustably advance or retract said track cam means, whereby to increase or decrease at will the total length of effective cam surface.

3. The combination with a rotatable shaft of a main cam member fixed thereon to rotate therewith, a cam extension segment pivotally connected with the trailing end of said main cam member, said segment, when held in outswung operative position, being adapted to extend the effective peripheral surface of said cam member, track cam means to move said segment to and support the same in operative outswung position, said track cam means having terminal "drop-off" means presented in direction of rotation of said main cam member and segment, whereby to release the latter with cam surface terminating effect, means freely movable on and about said shaft to carry said track cam means, and manipulatable means to rotatively adjust said latter means to advance or retract said track cam means, whereby to increase or decrease at will the total length of effective cam surface.

4. The combination with a rotatable shaft of a main cam member fixed thereon to rotate therewith, a cam extension segment pivotally connected with the trailing end of said main cam member, said segment, when held in outswung operative position, being adapted to extend the effective peripheral surface of said cam member, track cam means to move said segment to and support the same in operative outswung position, said track cam means having terminal "drop-off" means presented in direction of rotation of said main cam member and segment, whereby to release the latter with cam surface terminating effect, means freely movable on and about said shaft to carry said track cam means, and manipulatable means to rotatively adjust said latter means to advance or retract said track cam means, whereby to increase or decrease at will the total length of effective cam surface, said latter means comprising a worm, worm gear teeth on said track cam carrying means engaged by said worm, a rotatable worm shaft, and a hand knob on said worm shaft for actuating the same and its worm.

5. The combination with a rotatable shaft of a main cam member fixed thereon to rotate therewith, a cam extension segment pivotally connected with the trailing end of said main cam member, said segment, when held in outswung operative position, being adapted to extend the effective peripheral surface of said cam member, track cam means to move said segment to and support the same in operative outswung position, said track cam means having terminal "drop-off" means presented in direction of rotation of said main cam member and segment, whereby to release the latter with cam surface terminating effect, means freely movable on and about said shaft to carry said track cam means, and manipulatable means to rotatively adjust said latter means to advance or retract said track cam means, whereby to increase or decrease at will the total length of effective cam surface, said latter means comprising a worm, worm gear teeth on said track cam carrying means engaged by said worm, a rotatable worm shaft, a hand knob on said worm shaft for actuating the same and its worm, and frictional brake means cooperative with said worm shaft to retain the same, its worm and said track cam carrying means against accidental rotative displacement.

6. The combination with a rotatable shaft

of a main cam member fixed thereon to rotate therewith, a cam extension segment pivotally connected with the trailing end of said cam member, said segment, when held in outswung operative position, being adapted to extend the effective peripheral surface of said cam member, a track cam plate freely movable on and about said shaft adjacent a side of said cam member and segment, said track cam plate having inwardly offset track cam means, said track cam means having segment releasing terminal "drop-off" means presented in direction of rotation of said main cam member and segment, said segment having laterally offset traction roller means engageable by said track cam means to thereby outswing said segment to operative position, and manipulatable means to rotatively adjust said track cam plate, whereby to advance or retract said track cam means for segment release timing effect and resultant increase or decrease at will of the total length of effective cam surface.

7. The combination with a rotatable shaft of a main cam member fixed thereon to rotate therewith, a cam extension segment pivotally connected with the trailing end of said cam member, said segment, when held in outswung operative position, being adapted to extend the effective peripheral surface of said cam member, a track cam plate freely movable on and about said shaft adjacent a side of said cam member and segment, said track cam plate having inwardly offset track cam means, said track cam means having segment releasing terminal "drop-off" means presented in direction of rotation of said main cam member and segment, said segment having laterally offset traction roller means engageable by said track cam means to thereby outswing said segment to operative position, and manipulatable means to rotatively adjust said track cam plate, whereby to advance or retract said track cam means for segment release timing effect and resultant increase or decrease at will of the total length of effective cam surface, said latter means comprising a worm, worm gear teeth on the periphery of said track cam plate engaged by said worm, a rotatable worm shaft, and a hand knob on said worm shaft for actuating the same and its worm.

8. The combination with a rotatable shaft of a main cam member fixed thereon to rotate therewith, a cam extension segment pivotally connected with the trailing end of said cam member, said segment, when held in outswung operative position, being adapted to extend the effective peripheral surface of said cam member, a track cam plate freely movable on and about said shaft adjacent a side of said cam member and segment, said track cam plate having inwardly offset track cam means, said track cam means having segment releasing terminal "drop-off" means presented in direction of rotation of said main cam member and segment, said segment having laterally offset traction roller means engageable by said track cam means to thereby outswing said segment to operative position, and manipulatable means to rotatively adjust said track cam plate, whereby to advance or retract said track cam means for segment release timing effect and resultant increase or decrease at will of the total length of effective cam surface, said latter means comprising a worm, worm gear teeth on the periphery of said track cam plate engaged by said worm, a rotatable worm shaft, a hand knob on said worm shaft for actuating the same and its worm, and frictional brake means cooperative with said worm shaft to retain the same, its worm and track cam plate against accidental rotative displacement.

9. The combination with a rotatable shaft of a main cam member fixed thereon to rotate therewith, a cam extension segment pivotally connected with the trailing end of said cam member, said segment, when held in outswung operative position, being adapted to extend the effective peripheral surface of said cam member, track cam plates freely movable on and about said shaft respectively adjacent opposite sides of said cam member and segment, means to couple said track cam plates together for common rotative movement, said track cam plates having inwardly offset track cams each having segment releasing terminal "drop-off" means presented in direction of rotation of said main cam member and segment, said segment having oppositely extending laterally offset traction roller means respectively engageable by said respective track cams to thereby outswing said segment to operative position, and manipulatable means to rotatively adjust said track cam plates, whereby to advance or retract said track cams for segment release timing effect and resultant increase or decrease at will of the total length of effective cam surface.

10. The combination with a rotatable shaft of a main cam member fixed thereon to rotate therewith, a cam extension segment pivotally connected with the trailing end of said cam member, said segment, when held in outswung operative position, being adapted to extend the effective peripheral surface of said cam member, track cam plates freely movable on and about said shaft respectively adjacent opposite sides of said cam member and segment, means to couple said track cam plates together for common rotative movement, said track cam plates having inwardly offset track cams each having segment releasing terminal "drop-off" means presented in direction of rotation of said main cam member and segment, said segment having oppositely extending laterally offset traction roller means respectively engageable by said respective track cams to thereby outswing said segment to operative position, and manipulatable means to rotatively adjust said track cam plates, whereby to advance or retract said track cams for segment release timing effect and resultant increase or decrease at will of the total length of effective cam surface, said latter means comprising a worm, worm gear teeth on the periphery of one of said track cam plates engaged by said worm, a rotatable worm shaft, and a hand knob on said worm shaft for actuating the same and its worm.

11. The combination with a rotatable shaft of a main cam member fixed thereon to rotate therewith, a cam extension segment pivotally connected with the trailing end of said cam member, said segment, when held in outswung operative position, being adapted to extend the effective peripheral surface of said cam member, track cam plates freely movable on and about said shaft respectively adjacent opposite sides of said cam member and segment, means to couple said track cam plates together for common rotative movement, said track cam plates having inwardly offset track cams each having segment releasing terminal "drop-off" means presented in direction of rotation of said main cam member and segment, said segment having oppositely extending laterally offset traction roller means respectively engageable by said respective track cams to thereby outswing said segment to operative

position, and manipulatable means to rotatively adjust said track cam plates, whereby to advance or retract said track cams for segment release timing effect and resultant increase or decrease at will of the total length of effective cam surface, said latter means comprising a worm, worm gear teeth on the periphery of one of said track cam plates engaged by said worm, a rotatable worm shaft, a hand knob on said worm shaft for actuating the same and its worm, and frictional brake means cooperative with said worm shaft to retain the same, its worm and said track cam plates against accidental rotative displacement.

12. In combination with mechanism to be intermittently actuated, power transmission means for driving said mechanism, a variable cam device, and means controlled by said cam device for starting and stopping said power transmission means, adjustment of said cam device being adapted to advance or retard the moment of power transmission stop, whereby to decrease or increase at will the operative phase of the intermittently actuated mechanism, said cam device comprising a cam member, a continuously driven shaft for rotating said cam member, a cam extension segment pivotally connected with the trailing end of said cam member, said segment, when held in outswung position, being adapted to extend the effective peripheral surface of said cam member, and segment supporting and releasing means adjustable about said shaft and operative to variably support said segment in outswung position, whereby to increase or decrease at will the total length of effective cam surface.

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