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K. C. S. AASTED

CASTING APPARATUS FOR USE IN MACHINES FOR CASTING CHOCOLATE AND THE LIKE

Filed Aug. 10, 1940

Serial No.
352,165

4 Sheets-Sheet 1

Fig. 2.

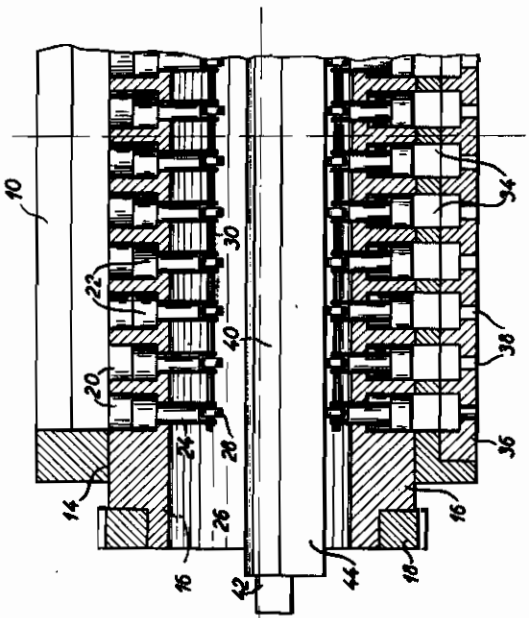

Fig. 3.

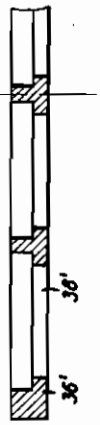

Fig. 1.

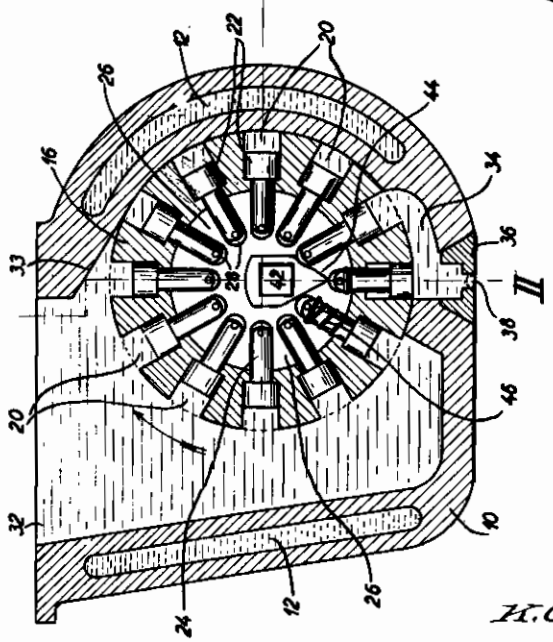

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Fig. 5.

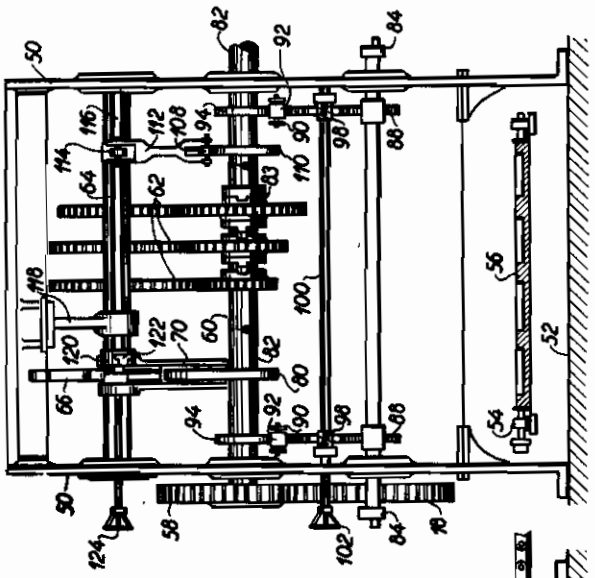

Fig. 4.

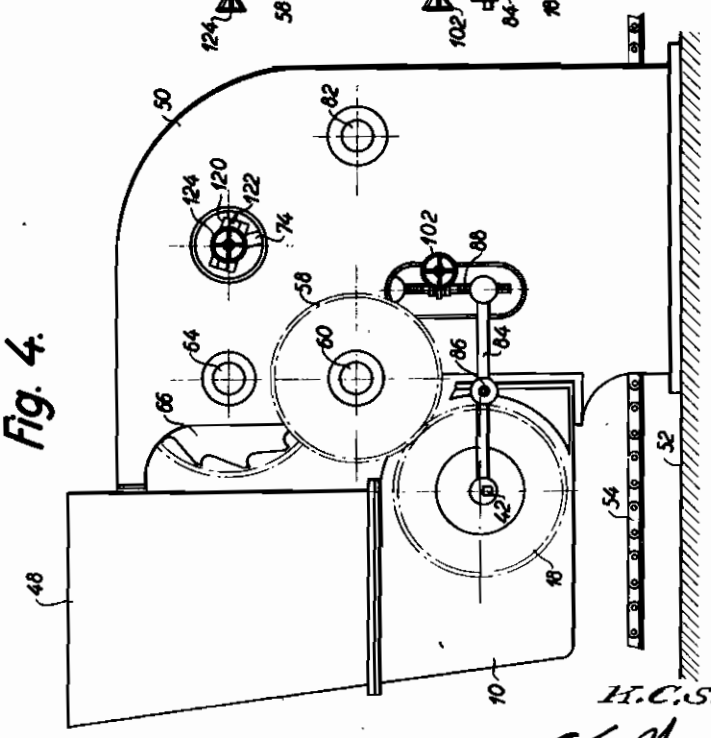

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Fig. 10.

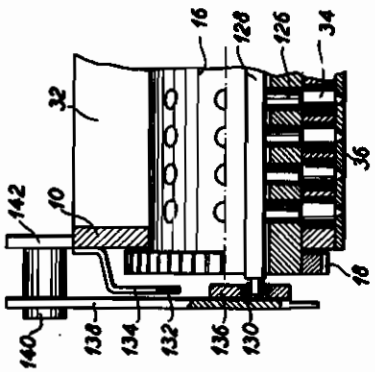


Fig. 9.

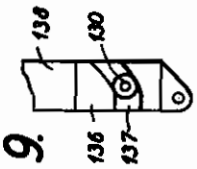


Fig. 8.

Fig. 6.

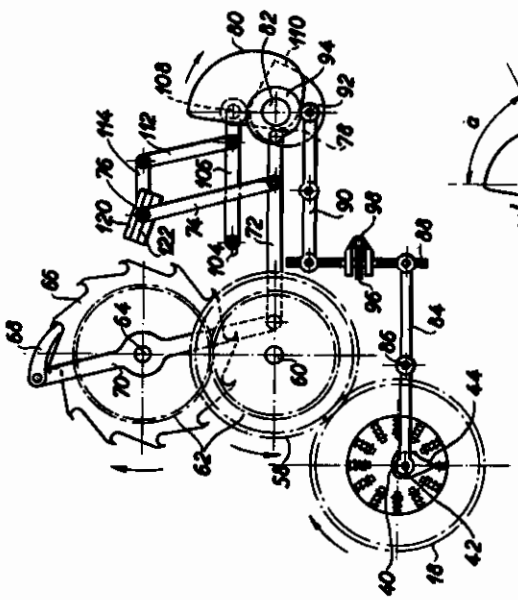
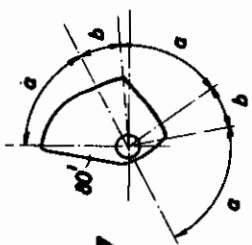


Fig. 7.



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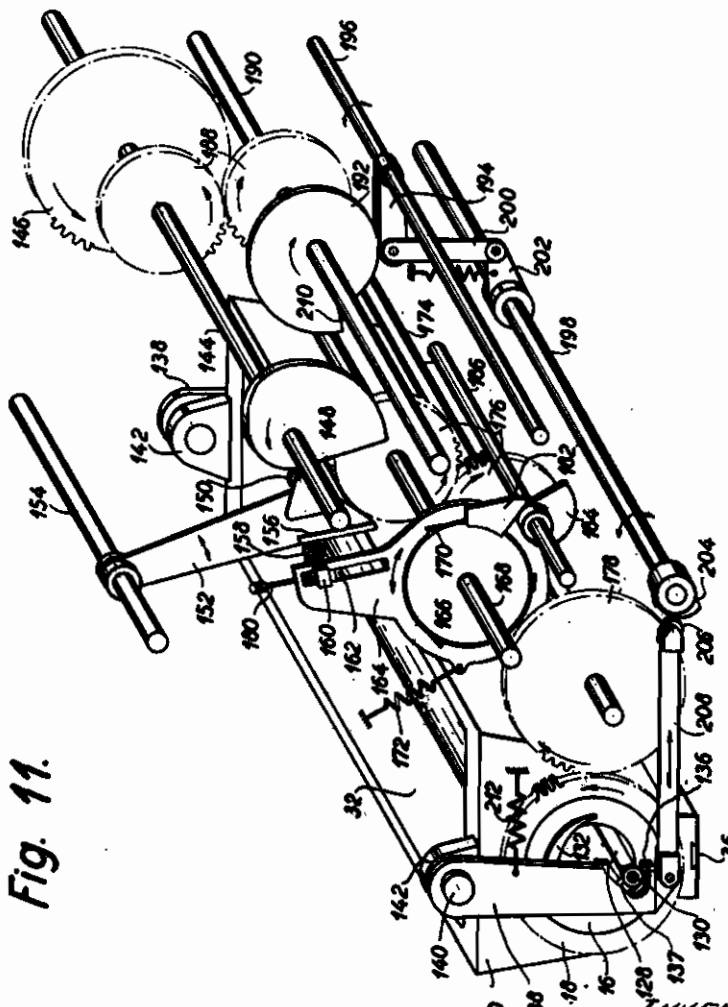

Fig. 11.

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ALIEN PROPERTY CUSTODIAN

CASTING APPARATUS FOR USE IN MACHINES FOR CASTING CHOCOLATE AND THE LIKE

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Application filed August 10, 1940

My invention relates to a casting apparatus for use in machines for casting chocolate and the like.

In a known type of such machines the casting is performed by means of a reciprocating piston working in a stationary cylinder by applying a slide which is controlled exactly in relation to the mould cavities in a row of mould plates which by means of a conveyor belt are moved at a constant speed past the casting head and through a refrigerating chamber of a material extension. Here the difficulty is encountered that in machines in which the conveyor runs at a considerable speed owing to the capacity, a very short time is available only for the casting in each mould cavity, especially when these are arranged in close proximity. On this account it has been proposed to lengthen the time available for the casting by giving the casting head an oscillatory movement, thereby following the conveyor during the casting process. Hereby, however, simultaneously the time period for the suction stroke of the pistons is shortened so that the advantage of such means is limited.

The main object of the present invention is to avoid this drawback and to provide a casting apparatus which is able to operate at a considerable speed and by which the discharge from the apparatus can be exactly timed in accordance with the speed of the conveyor and the arrangement of the mould cavities in the mould plates.

A further object is to provide an apparatus of the kind in question in which the discharge jets can be suddenly broken so that moistening of the mould plates and the conveyor by afterdripping or so-called "talling" is obviated.

A still further object is to provide an apparatus of the kind mentioned which can readily be adjusted to cast chocolate bodies of various weight and configuration in in accordance with the kind of mould plates arranged on the conveyor.

According to the invention a rotary pump is applied instead of the reciprocating pumps hitherto used. For the object in question it is preferably to use a special embodiment of such pump, as will be described later on.

The invention is illustrated by way of examples in the accompanying drawings, wherein

Fig. 1 shows a casting pump according to my invention in cross-section,

Fig. 2 shows partly a longitudinal section of the same along the line II—II in Fig. 1,

Fig. 3 shows an altered embodiment for an insertion piece shown at the bottom of Fig. 2,

Fig. 4 is, on a reduced scale, a side elevation of a casting apparatus with a pump as shown in Figs. 1 and 2,

Fig. 5 is an end view of the same,

Fig. 6 shows, partly schematically, the drive mechanism of the apparatus of Figs. 4 and 5,

Figs. 7 and 8 show altered embodiments of certain cam discs shown in Fig. 6, used in connection with an altered mode of operation of the apparatus,

Fig. 9 shows part of an arm used in connection with a slightly altered embodiment of the casting pump, as seen from the inner side of the arm,

Fig. 10 shows a longitudinal section of part of said embodiment, the upper part of the rotary body of the pump being not cut through,

Fig. 11 is a perspective view of the pump according to the last named embodiment and, partly schematically, the corresponding drive mechanism.

The pump, shown in Figs. 1 and 2, consists of a casing 10, in the walls of which are found recesses 12 for containing a heating medium serving to keep the mass, e. g. chocolate, contained in the casing in a liquid state. In bores 14 in the end walls of the casing 10 is arranged an annular body 16 which can be driven by a gear wheel 18. At the circumference of the body 16 is found a number of axially spaced rows of radially arranged cylinder bores 20, each occupying a piston 22. The piston rods 24 of these pistons project into the free central space 26 of the body 16, each carrying a roller 28 at the free end. The rollers of all pistons in an axial row may have a common pivot pin 30, as shown in Fig. 2.

One side of the casing 10 forms a tight seal against the annular body 16, see Fig. 1, while at the other side the casing forms a chamber 32 extending along a considerable part of the circumference of the body 16, said chamber serving to occupy the chocolate. The transition to the tightly sealing part of the casing 10 is formed by an inclined face 33 which adjoins the circumference of the body 16 tangentially to prevent jamming of solid particles in the chocolate. At the bottom the last named part of the casing forms, for each circumferential row of cylinder bores 20, a cavity 34 which extends over the open ends of two successive cylinder bores 20, as it appears from Fig. 1. The cavities 34 are closed below by an insertion piece 36 secured removably to the bottom of the casing 10. According to Fig. 2, this piece 36 is so formed that each cavity 34 has its own outlet 38. In the altered embodiment of the insertion piece 36', shown in Fig. 3, the cavities 34 are united in groups to a single

outlet 38' which thus is common for more axially successive cylinder bores 20.

For moving the pistons 22 a beam 40 is arranged in axial direction in the central space 26 of the body 16, said beam being supported in a floating manner at its ends on square studs 42, as will be explained later on. On one side of the beam 40 is formed a cam 44, by which the pistons 22 are displaced to the top position as they are moved past the cavities 34, the pistons being normally held in the bottom position by springs 46, one of which only is shown in Fig. 1.

Suitably the cam 44 is so formed that a piston 22 is moved from the bottom position when the free end of the appertaining cylinder bore 20 in its whole width has connection with the appertaining cavity 34 and that this piston is moved from the bottom position to the top position during the time, in which the free end of the cylinder with its whole area has connection with the cavity 34 during the rotation of the body 16. Furthermore the cam 44 is so shaped that the pistons driven by it are moved at a constant speed when the body is turned at a constant speed.

By the pump described a uniform output of the chocolate through the outlets 38 will take place when the body 16 is rotated, and when the body is turned stepwise the required casting in portions of the chocolate will be obtained. For this procedure the length of each step is of no consequence and the pump according to my invention thus has the advantage that the quantity of chocolate to be cast can be determined in a simple manner, viz. solely by the angle of rotation of each casting.

As it appears from Fig. 4 over the casing 10 is arranged a hopper 48 so that the casting apparatus may contain a great quantity of chocolate. The casing 10 is supported by brackets 50 in relation to a stationary frame 52, past which is moved the conveyor belt 54 of the apparatus, carrying mould plates 56 containing mould cavities, vide Fig. 5. In the brackets 50 the drive mechanism of the apparatus is mounted.

The gear wheel 18 arranged on the end of the body 18 intermeshes with a gear wheel 58 at the end of a shaft 60 journalled in the brackets 50. By means of a number of gears 62 with different gearings this shaft is driven from a shaft 64 carrying a pawl wheel 66. As schematically shown in Fig. 6 the pawl wheel 66 is driven by a pawl 68 pivoted on a lever 70 swingable on the shaft 64. This lever is pivotally connected to a push rod 72 the position of which furthermore is determined by it being hinged to a link 74 which at the present may be regarded as swingable on a stationary pin 76. At its free end the push rod 72 carries a roller 78 running on the circumference of a cam disc 80 fixed to a shaft 82. This shaft runs synchronously with the conveyor 54.

It is evident, that when the shaft 82 is driven in the direction indicated by an arrow the cam disc 80 will move the pawl 68 to and fro through the intermedium of the push rod 72 and the lever 70 so that the pawl as a one-way drive will move the pawl wheel 66 step by step whereby in turn the body 16, Figs. 1 and 2, is moved stepwise. If, as shown in Fig. 5, by a clutch 83 is interposed a gear 62 with the gearing ratio 1:1, the body 16 will be advanced one pitch for each movement of the pawl wheel 66. By each casting operation thus a single axial row of the pistons 22 will be active.

As it appears from Figs. 4–6 the beam 40 at its end studs 42 is suspended in two-armed levers 84 swingable on stationary pivots 86. Through the intermedium of suitable joints and nuts these levers by means of screw spindles 88 are connected with another set two-armed levers 90 which with rollers 92 rest on cam discs 94 on the shaft 82. The beam 40 with the cam 44 thus is supported by a link system 84, 88, 90 in such manner that the level of the beam is determined by the cam discs 94.

These latter are so shaped that the beam 40 and thus the cam 44 suddenly will be lifted, that is to say retracted in relation to the pistons 22 with which the cam co-act, at the end of each casting period, the object of this being to obtain a rapid interruption of the casting process. Hereby the speed of the jets passing through the outlets will decrease to zero at the end of the casting period and when the jets are broken at the mouths of the outlets, the surface of the chocolate will be retracted and form a concave surface, as it is indicated in Fig. 1, and thus a perfect and exact breaking of the jet is secured and afterdripping is obviated.

After the sudden lifting the beam 40 must be returned to its original position, which in accordance with the shape of the cam discs 94 is brought about by a slow lowering during the succeeding delivery stroke of the pistons 22 in the next row.

The screw spindles 88 have right hand threads on one half part and left hand threads on the other half part and at the middle they carry worm wheels 96 adjustable by worms 98 on a common shaft 100 by means of a hand wheel 102 arranged at the end of the shaft, vide especially Fig. 5. Hereby it is possible to adjust the level of the beam 40 and the cam 44 and thus the stroke of the pistons and the quantity of chocolate at each casting operation.

As it is necessary to retain a constant relation between the rotary velocity of the shaft 82 and the feed velocity of the conveyor 54 and, on the other hand, it is desired that the length of the casting period can be varied without altering the shape of the cam disc 80, according to my invention special means are provided, by which the end of the push rod 72, co-operating with the cam disc 80, can be swung to and fro in the plane of the cam disc in rhythmus with the reciprocating movement of the pawl 68 so that the action of the cam disc is accelerated or retarded. These means comprise an arm 106 swingable on a stationary pivot 104, said arm resting against a cam disc 110 on the shaft 82 by means of a roller 108.

By a link 112 the arm 106 is connected to an arm 114 which oscillates a shaft 116 which, as shown in Fig. 5, is journalled in the right bracket 50 and a bearing 118. At its left hand end the shaft 118 carries a cross-piece 120 with a longitudinal undercut notch 122 in which the pin 78 can be secured in arbitrary positions by means of a hand wheel 124.

When the roller 108 runs on the rotating cam disc 110 the arm 114 and thus the shaft 118 and the cross-piece 120 are swung to and fro. If the pin 76 is located co-axially to the shaft 116, this is of no influence on the co-operation between the roller 78 and the cam disc 80 and the drive mechanism functions as previously described. If, on the contrary, the pin 76 is adjusted excentrically in relation to the shaft 118, the push rod 72 will be swung to and fro about its left hand end and thus the roller 78 will run more rapidly or slowly

along the curved part of the cam disc 80 so that the time for the active advancing movement of the pawl wheel 66 is shortened or lengthened, respectively, whereby the length of the casting period of the pump is subjected to a corresponding variation.

When the drive mechanism is arranged as described, one casting will occur for each mould plate 56 on the conveyor 54. This is suitable for casting relative great chocolate cakes in which the mould cavities occupy the greater part of the width of the mould plates 56. In casting smaller chocolate pieces, in order to obtain the greatest possible capacity of the apparatus, it is necessary to arrange more mould cavities crosswise on each mould plate. If the earlier presupposed condition is retained, viz. that the shaft 82 is to be rotated by one revolution for each advancing of the conveyor by one mould plate width, on each revolution of the shaft 82 will fall a number of, say three, separate casting periods. This can be obtained by substituting the cam discs 80' and 94' shown in Figs. 7 and 8, respectively, for the cam discs 80 and 94.

On the first mentioned disc 80' the former uniformly increasing part is substituted by three parts *a* with increasing radius vector and two parts *b* with constant radius vector. On the last mentioned disc 94' three projections *c* are found insead of a single one.

By the alteration described the quantity of chocolate for each casting period will be reduced to one third. However, this can be remedied, if required, by interposing other gears 62. If for instance a gear with a gearing ratio of 1:3 is interposed so that the rotary speed of the pump is increased relative to the rotary speed of the pawl wheel 66 the previous quantity for each casting operation will again be reached.

From the above stated it will appear that the apparatus can be suited to any number of mould cavities crosswise to the mould plates, it means in the direction of movement of the conveyor. By application of different insertion pieces 36, furthermore, an adaption can be obtained to different numbers of mould cavities longitudinally to the mould plates. Thus the insertion piece 36 shown in Fig. 2 is suited for twelve cavities lengthwise while the insertion piece 36' of Fig. 3 is suited for four such cavities, which corresponds to the division of the mould plate 56 shown in Fig. 5.

The altered embodiment of the pump, shown in Fig. 10, differs from that described above therein, that the pistons are formed as plungers 126, the inner ends of which are secured to a beam 128 arranged in axial direction in the central space in the body 16. This body, as hitherto, is driven by means of the gear wheel 18. The ends of the beam 128 is formed as pivots carrying rotatable rollers 130. The operative movement of the plungers 126 is produced by cams co-operating with the rollers 130. Each roller 130 is moved in the inward direction during the rotation of the body 16 by the inner edge face of a cam 132 at the end of an arm 134 secured to the end of the casing 10.

When the plungers 126 are to perform their discharge stroke the roller 130 is moved in the outward direction by a curved notch 137 in a cam-piece 136 secured to the inner side of an arm 138 pivoted on a stud 140 secured to a bracket 142 on the casing 10. The shape of the notch 137 is best seen in Fig. 9. When the arms 138 are held stationary and the body 16 is rotated, the plungers 126 will be driven to and fro in their corresponding cylinder bores in a similar manner as described in connection with the first embodiment, the suction stroke taking place when the free ends of the cylinder bores have connection to the chamber 32 containing the chocolate, the discharge stroke occurring when the free ends of the cylinder bores are connected to the cavities 34 as previously explained.

The drive mechanism shown in Fig. 11 contains a driving shaft 144 moved synchronously with the conveyor of the casting machine by means of a gear wheel 146. The shaft 144 is journalled in a suitable manner not shown in Fig. 11. The same applies to the other shafts shown in the same figure and mentioned later on.

To the shaft 144 is secured a cam 148 co-operating with a roller 150 on an arm 152 swingable on a shaft 154. To the arm 152 is secured a ledge 156 co-acting with a roller 158. This latter roller is carried by a slide 160 displaceable in a slot 162 in a coupling member 164 co-operating with another coupling member 166 secured to a shaft 168, by means of spring pressed rollers 170 and inclined faces forming a one-way clutch in the well known manner. By means of a spring, schematically shown at 172, the member 164 is swung in the clockwise direction, by which movement the clutch is inactive. The shaft 168 is in driving connection with an other shaft 174 by gears 176. The shaft 174 carries a gear wheel 178 which intermeshes with the gear wheel 18 at the end of the annular body 18.

The transmission described for driving the pump is constructed with the object in view of making it possible to drive the pump with a great variety of velocities relative to the velocity of the conveyor. This is obtained mainly by the arm 152 interposed between the cam 148 and the clutch member 164. When the slide 160 occupies the position shown in the slot 162 the distance from the contact point of the roller 158 to the axis of the shaft 154 is comparatively short and the distance from the said point to the axis of the shaft 168 is comparatively long and thus a certain angle of oscillation of the arm 152 produced by the cam 148 will produce a comparatively small angle of oscillation of the coupling member 164. If now, by means of a screw spindle 180, the slide 160 is moved to the inner end of the slot 162, the same angle of oscillation of the arm 152 will produce a comparatively great angle of oscillation of the member 164. The rotation of the annular body 16 at each step of movement thereof will be proportional to the extent of each oscillatory movement of the coupling member 164.

If a still smaller rotation of the annular body 16 is required for each oscillatory movement of the coupling member 184, the movement of the latter in the clockwise direction may be restricted by means of a projection 182 on the member 164 co-acting with a cam 184 on a controlling shaft 186. When this shaft is adjusted in the clockwise direction, the cam 184 will abut on the projection 182 and turn the member 184 in the anti-clockwise direction so that the roller 158 will be lifted from the ledge 156. Accordingly a part only of the oscillatory movement of the arm 152 will be transmitted to the member 164 with the result, that the latter will perform a small oscillatory movement only.

The purpose of making the arms 138 swingable is to produce a small retractive movement of the plungers at the end of the discharge stroke as mentioned in connection with the embodiment first described.

It will be seen that if the roller 130 shown in Fig. 11 comes to rest at the end of a discharge stroke in the position shown in relation to the cam-piece 136, a small swinging movement of the arm 138 in the anti-clockwise direction will produce the retractive plunger movement aimed at. This movement, which ought to be rapid, is produced by the following mechanism.

The shaft 144, by means of gears 188, is in driving connection with a shaft 190 carrying a cam 192. This cam co-acts with a roller, not shown, at the end of an arm 184 secured to a shaft 198. The oscillatory movement of the arm 194 is transmitted to a shaft 198 by means of a link 200 and an arm 202. On the shaft 198 is secured a cam 204 co-operating with a roller 206 at one end of a push rod 208, the other end of which is pivoted to the arm 138.

Now the phases of the movements of the two shafts 144 and 180 are so timed that when the pump is at the end of a delivery stroke, the roller on the arm 104 runs down a substantial radial edge 210 on the cam 192. This will produce a sudden anti-clockwise movement of the shaft 198 with the result, that the roller 206 rapidly will run down the cam 204 and that the arm 138 will be swung rapidly in the anti-clockwise direction by means of a spring, as schematically shown at 212, thereby producing the small retraction of the plungers mentioned above. When the uniformly increasing part of the cam 192, thereafter, is active, the shaft 198 will be swung slowly in the opposite direction with the result, that the arm 138 is swung slowly back to its initial position thereby producing a small increase in the delivery stroke of the plungers active at this time over that determined solely by the rotation of the pump, this being of no practical importance to the operation of the pump.

It will be understood that similar means as those shown at the front end of the pump for moving the arm 138 will also be present at the back end for moving the arm at that end, even if they are not shown. If desired, also the pump body 16 may be driven at both ends by means similar to those shown at one end thereof.

My invention is not restricted to the special embodiments shown and described, which are to be regarded as examples only, as the same may be altered in various ways without departing from the spirit of the invention.

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