Sept. 11, 1951 G. A. LEE 2,567,488

RECIPROCATING PUSHER CONVEYER

Filed March 31, 1945 3 Sheets-Sheet 1

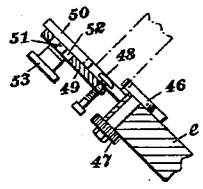


Fig.6

Fig.1

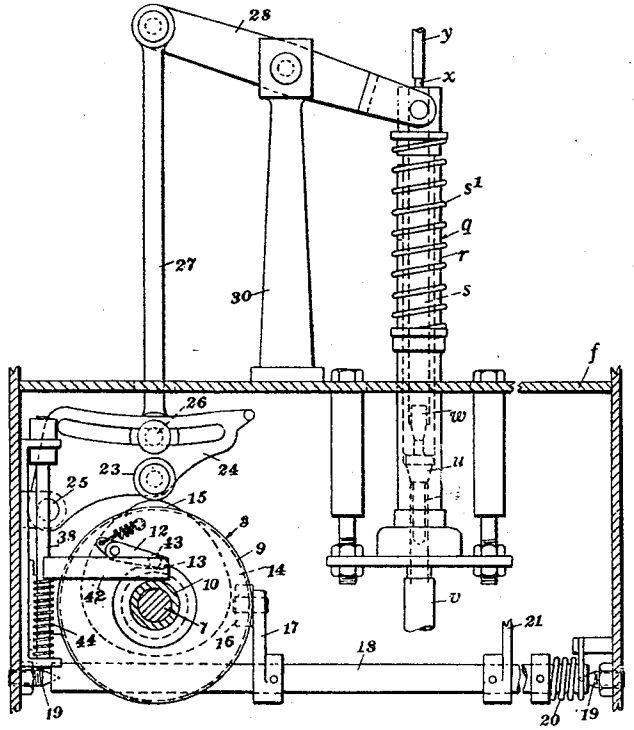


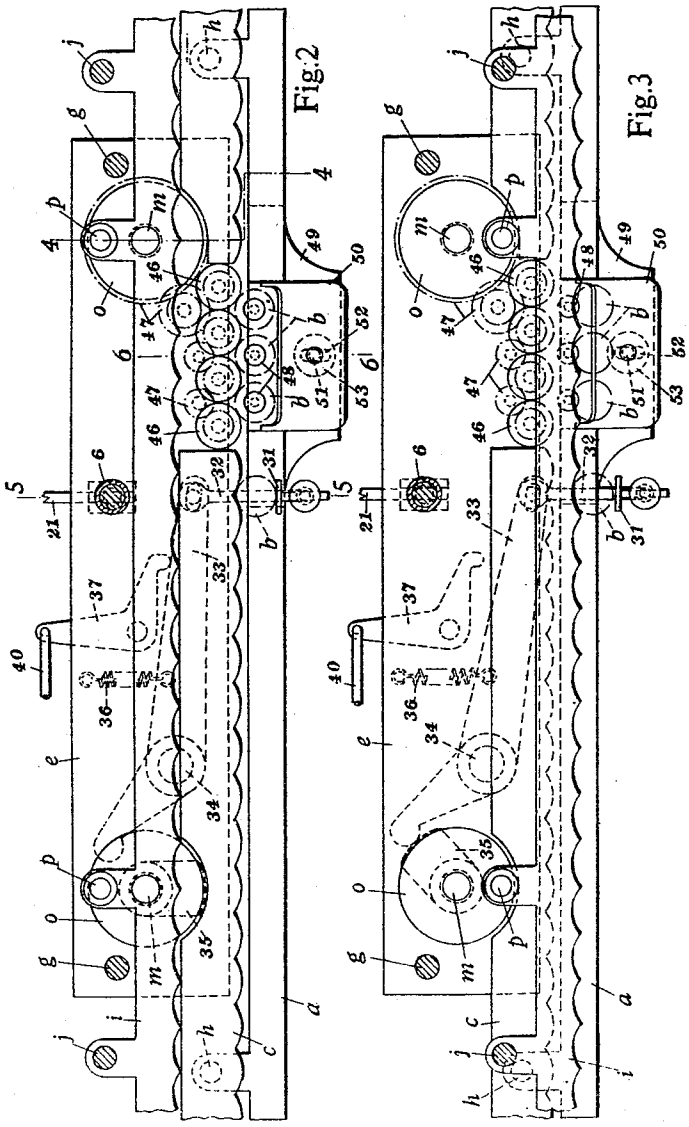
Fig.7

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RECIPROCATING PUSHER CONVEYER

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RECIPROCATING PUSHER CONVEYER

Filed March 31, 1945 3 Sheets-Sheet 3

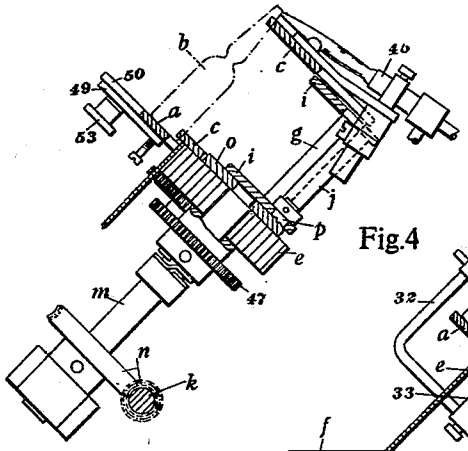


Fig.4

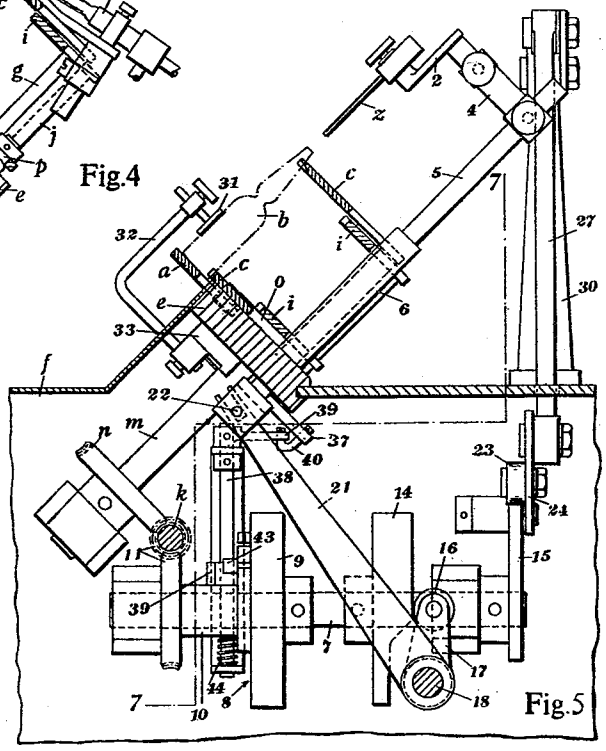


Fig.5

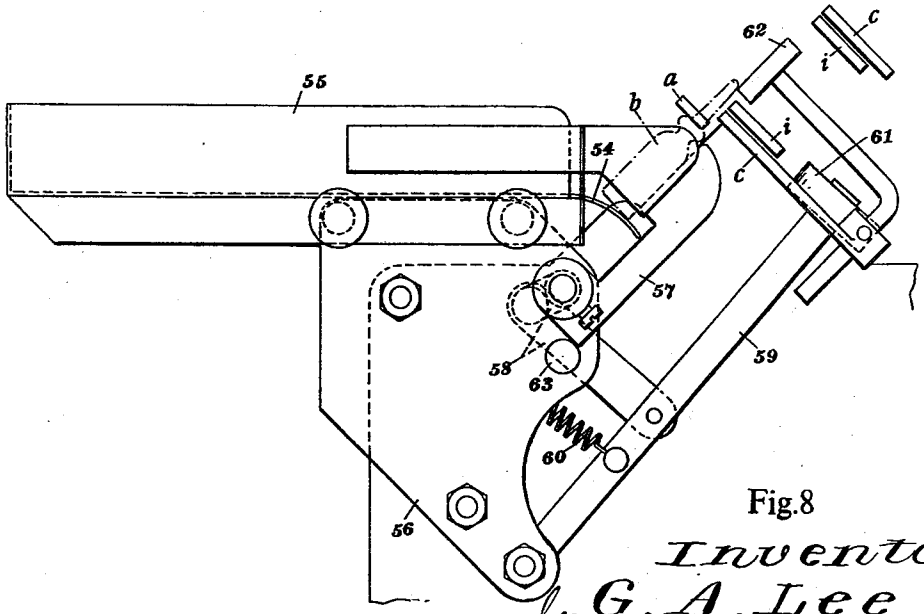


Fig.8

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UNITED STATES PATENT OFFICE

2,567,488

RECIPROCATING PUSHER CONVEYER

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In Great Britain July 15, 1943

1 Claim. (Cl. 198—224)

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This invention has for its object to provide improved machines for charging receptacles with liquid or solid substances. The invention is more particularly concerned with machines for charging receptacles in the form of ampoules with liquid drugs or like substances, but it may be applied to machines for charging other receptacles with liquid, or with granular, powdered, or other solid substances.

In the accompanying sheets of explanatory drawings:

Figure 1 is a front elevation (with the ends broken away and some of the parts omitted) of a machine constructed in accordance with the invention for charging ampoules with a medicinal liquid.

Figure 2 is a sectional plan taken on the lines 2—2 of Figure 1.

Figure 3 is a similar view to Figure 2 illustrating the machine in a different position.

Figures 4 and 5 are cross sections taken respectively on the lines 4—4 and 5—5 of Figure 2.

Figure 6 is a fragmentary sectional view taken on the line 6—6 of Figure 2.

Figure 7 is a section taken on the line 7—7 of Figure 5.

Figure 8 is a view of the discharge end of the machine with some of the parts omitted.

In carrying the invention into effect as shown, I employ a narrow horizontal support *a* on which the lower ends of the ampoules as *b* to be charged can rest, and which has the form of a straight metal or other bar or bars of any convenient length or lengths. As viewed in an endwise direction the support is suitably tilted so that the ampoules *b* can be supported thereon with their axes inclined to the vertical as shown in Figures 4, 5 and 8. At one side of the support *a* is arranged a track along which the ampoules *b* can be moved. This track comprises a pair of horizontal bars *c* arranged parallel with each other and with the support *a*. One of the track bars *c* is situated adjacent to the support *a* so as to form a lateral abutment for the lower portions of the ampoules *b* and the other of the track bars is arranged at a position such that the necks of the ampoules can rest against it. It will be seen that the bases of the ampoules *b* rest on the support *a*, and their sides lean against the front edges of the track bars *c*, these edges being situated in an inclined plane, and being corrugated so as to form depressions for retaining a succession of ampoules at a convenient distance apart. The track bars *c* and the support *a* are carried through the medium of a horizontal base

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piece *e* on the upper side of a casing *f* to be hereinafter referred to, the lower track bar being secured to the upper side of the base piece, the upper track bar being secured to the upper ends of posts *g* on the base piece, and the support being connected to the lower track bar at positions indicated by *h* in Figures 2 and 3.

For propelling the ampoules *b* along the track bars *c* I employ a pair of parallel bars *i* which are interconnected by rods *j* and which are corrugated along their front edges to form spaced depressions for engagement with the ampoules, one of these bars being situated immediately above the lower track bar and the other immediately below the upper track bar.

Any convenient actuating mechanism having a pair of spaced connections with one of the propelling bars *i* is employed for imparting a compound reciprocatory motion to the propelling bars, such motion consisting of a forward lateral movement of the propelling bars whereby the ampoules *b* are carried out of the adjacent depressions in the track bars *c*, a longitudinal movement of the propelling bars whereby the ampoules are carried along the support *a*, a retractive lateral movement of the propelling bars whereby the ampoules are allowed to occupy the next depressions in the track bars, and finally an idle return longitudinal movement whereby the propelling bars are returned to their initial positions. In the examples shown the actuating mechanism for imparting the above described compound reciprocatory motion to the propelling bars *i* comprises a driving shaft *k* (Figures 4 and 5) which is adapted to receive motion from any convenient source, such as an electrical motor (not shown), and is arranged in the casing *f*, a pair of driven shafts *m* connected by worm gearing as *n* to the driving shaft and extending at their upper ends through the base piece *e*, and discs *o* secured to the upper ends of the driven shafts and connected by crank pins *p* to the lower propelling bar. Rotation of the driven shafts *m* causes the crank pins *p* to move around the axes of these shafts, and as the lower propelling bar *i* is connected to the upper propelling bar and to both of the crank pins, it follows that the movements of the crank pins cause the required compound reciprocatory motion of the propelling bars relative to the fixed support *a* and track bars *c*. The ampoules *b* are fed successively by an attendant or automatically to the receiving end of the support *a*. The forward lateral movement of the propelling bars *i* causes the ampoules *b* to be carried out of the

adjacent depressions in the track bars *c*, the ensuing longitudinal and retractive lateral movements of the propelling bars cause the ampoules to be moved along the support *a* and allows them to occupy the next depressions in the track bars, and the following idle movement of the propelling bars causes them to be returned to their initial positions preparatory to their next action on the ampoules. Consequently, by the action of the propelling bars *i*, the ampoules *b* are caused to travel intermittently along the track bars *c* until they reach the discharge end where they are collected.

For charging each ampoule *b* in turn with the required quantity of liquid, I employ any convenient reciprocatory pump *q* (Figure 7) adapted to be actuated intermittently in synchronism with the propelling movements above described. In the example shown the pump comprises a vertical tubular body part *r* carried by and extending through the upper side of the casing *f*, and a hollow plunger *s* slidable in and extending from the upper end of the body part, the plunger being loaded by a spring s^1 which tends to move the plunger in the outward direction. The lower end of the body part *r* is provided with an axial inlet passage *t* which at its inner end forms a seating for a non-return valve *u*, and at its outer end is adapted for connection by a flexible or other pipe *v* to any convenient source of the liquid with which the ampoules *b* are to be charged. Moreover, the lower end of the hollow plunger *s* serves as a seating for another non-return valve *w*, and the upper end of the plunger is provided with a liquid outlet *x*. The non-return valves *u*, *w*, are arranged so that liquid can be drawn into the body part *r* through the inlet passage *t* by upward movement of the plunger *s*, and discharged from the body part through the outlet *x* by downward movement of the plunger. The pump outlet *x* is connected by a flexible pipe *y* to a reciprocatory hollow needle or tube *z* (Figures 1 and 5) which is adapted to enter in turn the necks of the ampoules *b*, and which is also adapted to be actuated intermittently in synchronism with the movements of the propelling bars *i*. The needle *z* is adjustably carried by a crank 2 on one end of a telescopically adjustable arm 4 which at its other end is adjustably secured on an axially slidable rod 5, the latter being arranged to pass through the base piece *e* abovementioned, and being slidably supported by a tubular guide 6 on this base piece.

Motion in the proper sequence is imparted to the pump plunger *s* and to the needle *z* from a shaft 7 which is arranged within the casing *f* at right angles to the driving shaft *k*, and which can receive rotary motion from the driving shaft through the medium of a disconnectible clutch 8 (Figures 5 and 7). This clutch comprises a disc 9 secured on the shaft 7, a sleeve 10 freely mounted on this shaft and connected by worm gearing 11 to the driving shaft *k*, and a spring loaded pawl 12 mounted on one side of the disc and engageable with a notch 13, in an adjacent flanged end of the sleeve, the arrangement being such that when the pawl is in engagement with the notch the driving shaft serves to impart motion to the shaft carrying the disc and sleeve. Also secured on the shaft 7 at any convenient distance apart are a pair of cams 14, 15. The cam 14 is a face cam and co-operates with a roller 16 on the outer end of a short lever 17 which at its other end is secured on an oscillatory shaft 18, the latter being supported within the casing *f* (in a position beneath and at right angles to the shaft 7) by end pivots 19, and being loaded by a spring 20 which serves to hold the roller on the lever in contact with the cam face. Also secured on the oscillatory shaft 18 is one end of another and relatively long lever 21 which at its other end is slotted and engages a laterally projecting pin 22 on the lower end of the slidable rod 5. The periphery of the other cam 15 co-operates with a roller 23 on a slotted lever 24 which is pivoted at 25 to the casing *f*, and which engages a roller or other lateral projection 26 on one end of a link 27, the other end of the link being connected to the outer end of the pump plunger *s* by another lever 28 which at a position between its ends is carried by a post 30 on the upper side of the casing *f*. During rotation of the shaft 7, the slidable rod 5 is moved by the cam 14 in the direction for retracting the needle *z*, and by the spring 20 in the direction for advancing the needle. Also the pump plunger *s* is moved by the cam 15 in the direction for discharging liquid from the pump *q* through the needle *z*, and by the spring s^1 in the direction for charging the pump with liquid from the source of supply. Moreover, the arrangement is such that discharge of liquid through the needle *z* occurs each time the needle is advanced into the neck of an ampoule *b*.

To prevent discharge of the pump *q* in the event of an ampoule *b* not being in position to receive the charge, I arrange adjacent to the ampoule-charging position a pad or pressure piece 31 adapted to control the clutch 8 from which motion is imparted from the driving shaft *k* to the shaft 7. The pad or pressure piece 31 is adjustably mounted on one end of a cranked rod 32 which is slidably supported by the casing *f* so that the pad or pressure piece can be moved by the rod towards and away from the front side of an ampoule *b* occupying its charging position on the support *a*. The other end of the rod 32 has a pin-and-slot connection with one arm of a double-armed lever 33 which is pivoted at 34 to the base piece *e*, and the other arm of the lever is adapted at its outer end to co-operate with a cam 35 on one of the shafts *m* abovementioned. The lever 33 is loaded by a spring 36 which serves by its action on the lever to move the pad or pressure piece 31 in one direction, movement of the pad or pressure piece in the opposite direction being effected by the action on the lever of the cam 35. Prior to each actuation of the pump *q*, the pad or pressure piece 31 is advanced towards the ampoule-charging position under the action of the spring 36. If an ampoule *b* is in the charging position it arrests the pad or pressure piece 31 and is held firmly against the track bars *c* by the force of the spring 36 until the ampoule is charged, whereupon the ampoule is released by retraction of the pad or pressure piece under the action of the cam 35. But if an ampoule *b* is not in the charging position, the pad or pressure piece 31 can continue its advance and thereby allow the lever 33 to operate a trip device for temporarily disconnecting the clutch 8, and so preventing actuation of the pump *q* and needle *z* until the next cycle, or until an ampoule comes into position for charging, it being understood that the pad or pressure piece is advanced and retracted in each of the successive cycles. The trip device above-mentioned comprises a bell crank lever 37 pivoted to the base piece *e* and adapted at one end to co-operate with the lever 33, an oscillatory spindle 38 mounted in the casing *f* and having a radial

arm 39 which is connected to the other end of the bell crank lever by a link 40, and another radial arm 42 mounted on the spindle and adapted to be moved thereby into and out of the path of a lateral projection 43 on the pawl 12 of the clutch 8, the spindle being loaded by a helical torsion spring 44 which tends to retain the spindle in a position in which the last-mentioned arm is out of the path of the pawl projection. When an ampoule is not in the charging position the pad or pressure piece 31 allows its actuating lever 33 to impart movement to the bell crank lever 37. This causes the spindle 38 to be moved angularly against the action of the spring 44 into a position in which the arm 42 lies in the path of the pawl projection 43. By contact of its projection 43 with the arm 42 the pawl 12 is disengaged from the notch 13 in the clutch sleeve 10, and the clutch 8 is put out of action until the pawl re-engages the notch. This re-engagement is effected automatically by the spring loading of the pawl 12 after a complete revolution of the sleeve 10 provided that the trip device above described is not in the meantime again operated.

After being charged each ampoule *b* is carried forward by the propelling bars *i* along the track bars *c* to a sealing region in which the neck of the ampoule is sealed by fusion. Adjacent to this region I provide a series of (e. g. three) gas burners 45 which in the example shown are mounted on the upper track bar *c*. Preferably the air required for admixture with the gas at the burners 45 is provided at constant pressure by an air pump (not shown) driven by any convenient part of the machine. While in the sealing region each ampoule *b* is rotated about its principal axis. To enable this to be effected I gap the lower track bar *c* in the sealing region, and provide in the gap a series of rollers 46. These rollers 46 are mounted on the base piece *e* and are arranged so that each ampoule *b* rests partly on the periphery of each of an adjacent pair of the rollers while occupying a sealing position in front of each burner 45. The rollers 46 are rotated in the same direction through gearing 47 by any convenient part of the machine, such as one of the driven shafts *m*, and by their rotation serve to rotate the ampoules *b* in the sealing region. Further, I preferably gap the support *a* at this region, and provide in the gap a series of pivot-like or rounded supports 48 are adjustably mounted on a can rest, thus facilitating rotation of the ampoules by the rollers 46. The pivot-like or rounded supports 48 are adjustably mounted on a plate 49 which is secured to the underside of and bridges the gap in the support *a*. To facilitate movement of the ampoules *b* between the support *a* and the pivot-like or rounded supports 48, I mount on the plate 49 another plate 50 which extends into the outer side of the gap in the support *a*, and on which the lower ends of the ampoules can rest during their movements to and from the sealing positions, the upper surface of the latter plate being flush with the upper surface of the said support. Preferably and as shown the plate 50 is adjustably secured to the plate 49 by, for example, a screw 51 secured at one end to the plate 50 and passing through a slot 52 in the plate 49, the other end of the screw being provided with a securing nut 53. This enables the extent to which the plate 50 projects into the gap in the support *a* to be varied as required.

After fusion of their necks the charged ampoules *b* are carried along the track bars *c* to a discharge position where they leave the adjacent end of the support *a* and slide on to a ledge 54 (Figure 8) which forms an extension of the base of a receiving tray 55, this ledge being situated at a convenient distance below the support.

Adjacent to the ledge 54 there is pivoted on a fixed bracket 56 one end of a lever 57 having its pivot axis situated below the ledge. The lever 57 is shaped and arranged so that when an ampoule reaches the discharge position along the track bars *c* it can slide along one side of the lever on to the ledge 54, and can rest against this side of the lever whilst on the ledge. Preferably and as shown the ledge 54 is of arcuate form, having its centre of curvature at about the pivot axis of the lever 57. The lever 57 is connected by a link or links 58 to another lever 59 which is also pivoted at one end on the bracket 56, this lever being loaded by a spring 60 or a weight. The other end of the lever 59 has mounted on it a roller 61 through which this lever can be actuated by the lower impelling bar *i* while the latter is making the idle part of its movement prior to the next advance of the ampoules *b* along the track bars *c*.

When an ampoule *b* reaches its discharge position (where it is supported in part by the track bars *c* and in part by a V-shaped piece 62 situated between the track bars) it slides downwardly on to the ledge 54. The lower propelling bar *i* then strikes the roller 61 on the lever 59 and causes the latter to actuate the lever 57 which moves the ampoule along the ledge and in so doing lifts it from its inclined position to a vertical position. By this action the ampoule is transferred from the ledge 54 to the tray 55. On release of the lever 59 by the lower propelling bar *i*, both this lever and the lever 57 return to their initial positions under the action of the spring 60 or weight associated with the lever 59, these positions being determined by contact of the lever 57 with a stop 63 on the bracket 56.

If desired I may employ two ampoule-receiving trays situated side by side and mounted on a slide enabling either to be brought opposite the track-discharge position, so that while one is being loaded the other can be emptied by an attendant. Alternatively, instead of discharging the ampoules on to a tray, they may be discharged on to a table, or on to a moving conveyor.

In the foregoing I have described an application of my invention to a machine for charging ampoules, but I desire it to be understood that the invention may be applied to machines for other analogous uses. Thus, for example, it may be applied to a machine for charging larger receptacles with liquids, or with granular, powdered or like solid substances. In this case the character of the charging means would be appropriately modified, and the fusion sealing means would be dispensed with or replaced by any other convenient means for closing the receptacles, but in all cases essentially the same means are employed for traversing the receptacles through one or more operational stages.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

A machine for charging small receptacles with liquid or solid substances, having in combination a horizontal support on which the receptacles can rest in inclined positions, stationary track bars arranged parallel with each other to form spaced abutments against which the receptacles on the support can lean, and which are formed

with spaced depressions for locating the receptacles, interconnected propelling bars which are arranged in parallel relationship with each other and with the track bars, and by which the receptacles can be moved intermittently along the support, the propelling bars being situated adjacent to the track bars, and being formed with spaced depressions for accommodating the receptacles during their movement by the propelling bars along the support, actuating mechanism having a pair of spaced connections with one of the propelling bars for imparting to the latter a compound reciprocatory motion consisting of a forward lateral movement for carrying the receptacles away from the depressions in the track bars, a longitudinal movement for moving the receptacles along the support, a retractive lateral movement for allowing the receptacles to occupy the next depressions in the track bars, and an idle return longitudinal movement, a stationary ledge on to which the charged receptacles are movable in succession from the support by the propelling bars, a transfer lever for transferring the receptacles from the ledge to a receiving position, and an actuating lever connected to the transfer lever, the actuating lever being operable by one of the propelling bars.

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