Dec. 2, 1952 I. F. STEWART 2,619,869

APPARATUS PARTICULARLY ADAPTED FOR CHARGING ORIENTATED ARTICLES OF RELATIVELY GREATER LENGTH THAN WIDTH

Filed Dec. 6, 1950 3 Sheets-Sheet 1

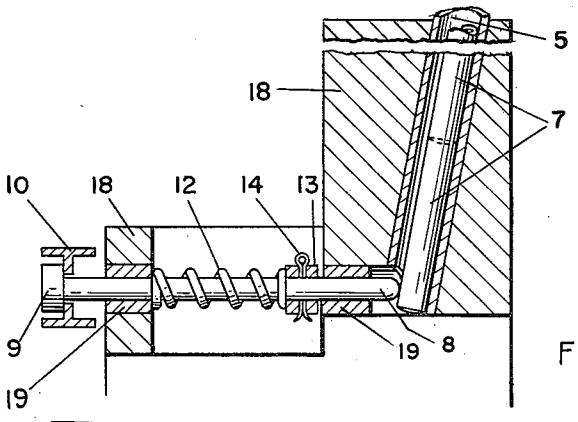
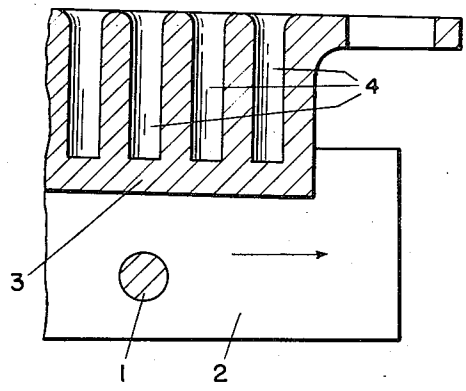



FIG. 1



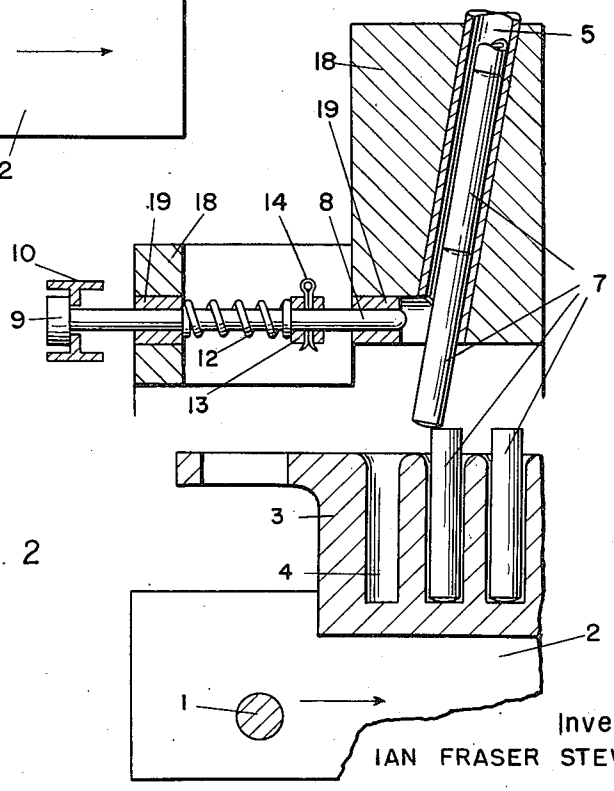




FIG. 2

Inventor
IAN FRASER STEWART

Cushman, Darby & Cushman
Attorneys

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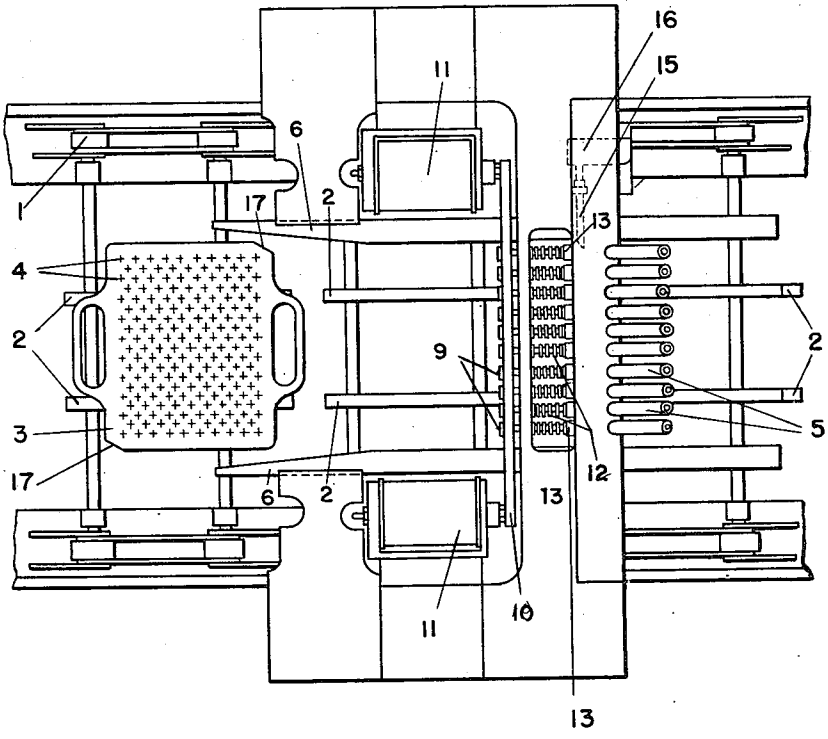



FIG. 3

Inventor
IAN FRASER STEWART

Cushman, Darby & Cushman
Attorneys

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Filed Dec. 6, 1950 3 Sheets-Sheet 3

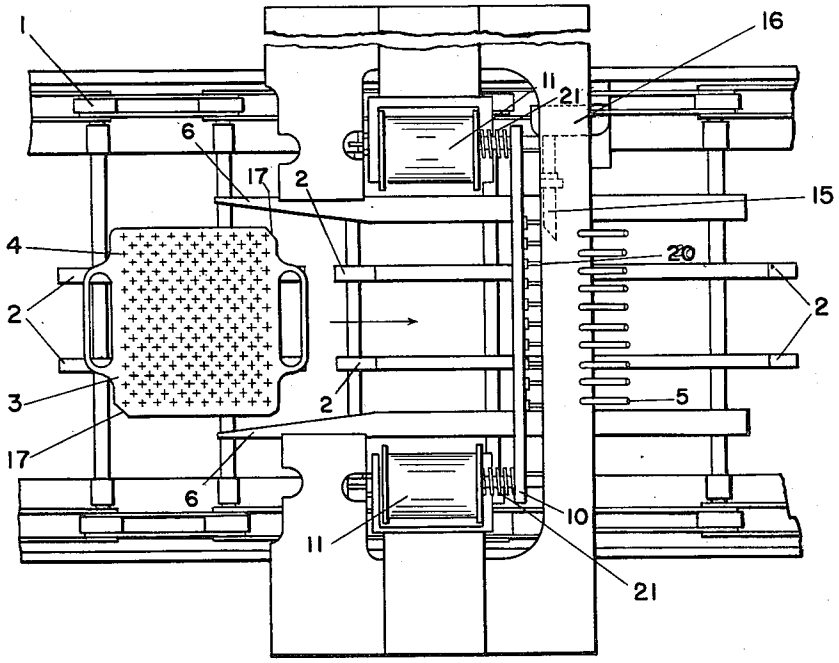



FIG. 4

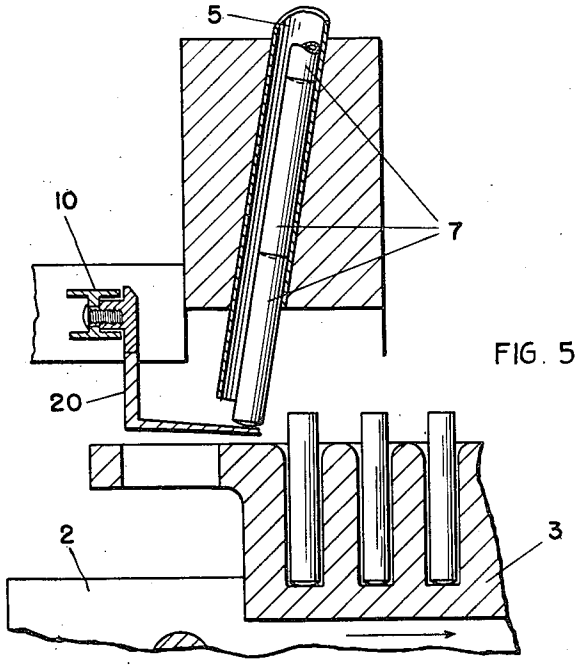



FIG. 5

Inventor
IAN FRASER STEWART

Cushman, Darby & Cushman
Attorneys

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# UNITED STATES PATENT OFFICE

2,619,869

## APPARATUS PARTICULARLY ADAPTED FOR CHARGING ORIENTATED ARTICLES OF RELATIVELY GREATER LENGTH THAN WIDTH

Ian F. Stewart, Kilwinning, Scotland, assignor to Imperial Chemical Industries Limited, a corporation of Great Britain

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In Great Britain December 30, 1949

4 Claims. (Cl. 86—46)

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The present invention is concerned with apparatus particularly adapted for charging orientated articles, of relatively greater length than width and of substantially straight longitudinal axis and having one end terminating in an edge and the other end at least substantially closed by a convex surface, into a solid carrying-plate of the kind having sockets at least the entries of which are wider than the widest part of said articles.

Said articles can be in the form of tubes, cylindrical rods, and articles of other cross sectional form, as well as articles the cross section of which varies along their length.

The invention is particularly concerned with apparatus adapted for charging empty detonator tubes into a solid detonator carrying-plate of the kind having sockets at least the entries of which are wider than the diameter of the detonators.

The aforesaid solid carrying-plates may be constructed of one or more pieces as for instance a carrying-plate provided with a false base.

British Patent No. 622,527 describes and claims inter alia a machine for charging a detonator carrying-plate with empty detonator tubes comprising in combination means for holding a removable detonator carrying-plate in position, a slidable feed plate adapted to rest on the detonator carrying-plate hold in said position and having holes which taper towards the bottom face thereof and correspond in position to those in the carrying-plate, a row of detonator tube guide-tubes positioned above the feed plate and adapted to be inclined at a variable angle to the vertical, e. g. 10° to the vertical, and means permitting the slidable feed plate and carrying-plate when their respective holes are out of alignment to move together below the row of guide-tubes, in which machine the slidable feed plate is adapted to slide laterally across the carrying-plate between two limits so that in one extreme position the holes of the plates coincide and in the other position they do not coincide and in which the row of guide-tubes when inclined at a suitable angle to the vertical is at such a distance from the slidable feed plate as to permit the detonator tubes projecting from below them to slide over those that have fallen into the holes of the feed plates on to the top of the carrying-plate.

The object of the present invention is to provide an apparatus which permits a continuous succession of said solid carrying-plates to be mechanically and preferably automatically filled with said articles and particularly a continuous succession of said solid detonator carrying-plates to be mechanically and preferably automatically filled with empty detonator tubes.

According to the present invention apparatus particularly adapted for charging orientated articles, of relatively greater length than width and

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of substantially straight longitudinal axis and having one end terminating in an edge and the other end at least substantially closed by a convex surface, into a solid carrying-plate of the kind having sockets at least the entries of which are wider than the widest part of said articles, comprises in combination at least one row of delivery pipes inclined at such an angle to the vertical that when permitted they can deliver under gravity said articles, similarly orientated for any one pipe, into the sockets of said carrying-plate when in the receiving position with respect to said delivery pipes while permitting slippage of an outgoing article over one which has already entered a socket of a carrying-plate and which have controlling means which can withhold or permit the emission of said articles from said delivery pipes, means for conveying a succession of empty carrying-plates so as to bring each of said carrying-plates in turn beneath said delivery pipes, and side guides exactly to locate each carrying-plate as it approaches said delivery pipes so that at least one approaching row of sockets of the carrying-plate as they pass below the delivery pipes can receive said articles from the said delivery pipes, the bottom ends of the delivery pipes being at such a distance from the carrying-plate on said means for conveying when in the vicinity of said delivery pipes as to permit the articles projecting from below the delivery pipes to slide over those that have fallen into the sockets of the carrying-plate and said controlling means being controlled by at least one detector responsive to a carrying-plate and positioned so as to be in the path of travel of a carrying-plate as it approaches and as it leaves the vicinity of said delivery pipes.

A carrying-plate to be filled in the apparatus according to the invention has to have the centre lines of its rows of sockets in the direction of its motion through the apparatus spaced apart at least a distance equal to the greatest width of said articles.

The said articles are preferably similarly orientated in all the delivery pipes.

For a solid detonator carrying-plate preferably only the entries of the sockets are appreciably wider than the diameter of the detonators to be inserted in said sockets.

Preferably the said delivery pipes are adapted to be inclined at a variable angle to the vertical, for example from 5° to 20° to the vertical.

The said controlling means to withhold or permit the emission of said articles from each of said delivery pipes can be for example a plunger located at the lower end portion of each delivery pipe and permanently spring loaded to press an adjacent article against the delivery pipe wall with sufficient force to hold up the column of articles above, each plunger having its

rearward extension passing through a clearance hole in a light beam and having a larger diameter end on the far side of the beam, each end of which beam being connected to the armature of an electromagnet in such a way that when the two magnets are energised they pull each end of the beam simultaneously in a direction away from the delivery pipes, thus transmitting their pull to the plungers by way of the large diameter plunger ends, and when the magnets are in due course de-energised they permit the said spring-loading to return the beam to a position in which each plunger can again press an adjacent article against the wall of its delivery pipe.

The detector responsive to a carrying-plate and positioned so as to be in the path of travel of a carrying-plate as it approaches and as it leaves the vicinity of said delivery pipes can be for example a switch operating plunger adapted to close a switch which operates the solenoids of the said electro-magnets. The said switch operating plunger can be actuated by for example having the leading edge of an oncoming solid carrying-plate bevelled and the said plunger of such shape as to be moved by the advance of the bevelled leading edge. After the said switch operating plunger has been moved by the bevelled leading edge of the solid carrying-plate a side of the carrying-plate holds the switch operating plunger in the depressed position until the edge of the carrying-plate passes beyond the switch operating plunger when the switch operating plunger is free to return to its original position and this permits the springs on the flow control plungers to force these flow control plungers back into the delivery pipes. Each flow control plunger now grips the lowermost article in each delivery pipe.

The said means for conveying a continuous succession of empty carrying-plates may be for example a chain conveyor having a succession of chairs shaped to support said carrying-plates; an endless belt having strips fixed across its width to push an endless succession of carrying-plates; a system of interacting thrusters. The said chairs and strips are so arranged that each carrying-plate is supported at a slight inclination to its direction of motion such that its leading edge will pass beneath the delivery pipes at a greater distance from them than its rear edge. This provision ensures that the bottom of the lowermost article in a delivery pipe which has been stopped by a flow control plunger on a level with the top of the rear edge of the carrying-plate which has just been filled will be at a distance above the level of the leading edge of the oncoming carrying-plate.

If desired the required number of delivery pipes can be separated into more than one set in such a way that the carrying-plates are filled in stages as they pass beneath each set of delivery pipes. The delivery pipes of any one set have to be suitably placed so that a pair of side guides can bring a carrying-plate into position for filling the rows of sockets corresponding to the delivery pipes of the particular set. Each set of delivery pipes will require its own side guides and means for controlling the emission of said articles.

One embodiment of the invention particularly suitable for the filling of empty detonator tubes into a solid detonator carrying-plate is illustrated by way of example with reference to the diagrammatic drawing accompanying the specification whereof Fig. 1 is a sectional elevation showing a detonator carrying-plate about to be charged with empty detonator tubes, Fig. 2 is a sectional elevation showing a detonator carrying-plate being charged, Fig. 3 is a plan view of the embodiment of the invention. A preferred embodiment particularly suitable for the filling of empty detonator tubes into a solid carrying-plate is illustrated by way of example with reference to the diagrammatic drawings attached hereto whereof Fig. 4 is a plan view of this preferred embodiment and Fig. 5 is a sectional elevation showing a carrying-plate which has been charged with empty detonator tubes and empty detonator tubes in a position ready for insertion into a succeeding carrying-plate (not shown). The same reference numerals refer to like parts throughout.

Referring to the drawings, Figs. 1, 2 and 3, 1 is a chain conveyor, 2 are chairs, 3 is a solid carrying-plate, 4 are sockets in the carrying-plate, 5 are delivery pipes, 6 are side guides for locating the carrying-plate 3 with respect to the pipes 5, 7 are detonator tubes, 8 are flow control plungers to control the emission of the tubes 7 from the delivery pipes 5, 9 are the larger diameter ends of the flow control plungers 8, 10 is a light beam for withdrawing the flow control plungers 8, 11 are electromagnets, 12 are compression springs, 13 are collars fixed to the flow control plungers 8 by split pins 14 to transmit the thrust of the compression springs 12 to the flow control plungers 8. 15 is a detector plunger, 16 is a switch to permit the electro-magnets 11 to be energized, 17 are diagonally positioned bevelled corners of the carrying-plate 3 to permit the carrying-plate 3 to be placed on a chair 2 so that either bevelled corner 17 can operate the detector plunger 15. 18 is part of the structure of the embodiment and 19 are bushes in which the flow-control plungers 8 slide.

An empty detonator carrying-plate 3 on the chairs 2 of the chain conveyor 1 is laterally displaced into alignment with respect to the delivery pipes 5 as it enters the space between the side guides 6. The delivery pipes 5 are kept supplied with orientated detonator tubes 7 by a mechanism (not shown). The delivery pipes 5 are inclined at an angle of 10° to the vertical. The bearing surfaces of the chairs 2 are inclined downwards at a small angle to the horizontal in the direction of motion of the chain conveyor 1 to correspondingly incline the carrying-plates 3 (as shown in Figure 1) so as to prevent an approaching carrying-plate 3 from striking the side of the lowermost detonator tubes 7 held by the control plungers 8 in the delivery pipes 5 and to be delivered into the sockets 4 of the said approaching carrying-plate 3. The bottoms of the said lowermost detonator tubes 7 have been left at the height of the receding top edge of the preceding carrying-plate 3. As the carrying-plate 3 continues its motion between the side guides 6 one of its bevelled corners 17 comes into contact with the correspondingly bevelled tip of the switch operating plunger 15, the tip of which projects through one of the side guides 6 into the space between the said side guides 6 and on a level with the bevelled corner 17 of the carrying-plate. The switch operating plunger 15 is depressed by the bevelled corner 17 as the carrying-plate 3 pushes against it. This action closes the switch 16 causing the electro-magnets 11 to be energised. At this instant the top of the carrying-plate 3 is in position beneath the delivery pipes 5 so that when the energised electro-magnets 11 withdraw the light beam 10, which bears against the larger di-

ameter ends 9 of the flow control plungers 8, against the thrust of the compression springs 12, the orientated detonator tubes 7 in the delivery pipe 5 slide downwards, the lowermost members of each column landing on the top of the carrying-plate 3 in front of the sockets 4. As the movement of the carrying-plate 3 brings the first socket 4 of each row of sockets beneath the columns of detonator tubes 7 the lowermost detonator tube of each column falls into these first sockets 4. The relative inclination of the detonator tube 7 which has just entered the socket 4 to the inclination of the detonator tube 7 above it, the latter being still partly within the delivery pipe 5, is such that the mouth of the detonator tube 7 in the socket 4 slides under the rounded bottom of the detonator tube 7 above, without tending to catch on it. When the detonator tube 7 which has entered the socket 4 has passed beyond the detonator tube above, the latter has merely to fall into the next socket 4 as this socket passes beneath the delivery pipe 5. The falling of the detonator tubes 7 into the sockets 4 continues until the side of the carrying-plate 3 which has been in contact with the switch operating plunger 15 passes beyond this plunger 15. When this occurs the switch 16 opens returning the plunger 15 to its original position, when the electro-magnets 11 cease to pull the ends of the light beam 10. The compression springs 12 are now able to force the flow control plungers 8, by pushing the collars 13 which are secured by split-pins 14 to the flow control plungers 8, against the lowermost detonator tube 7 in each delivery pipe 5 so as to prevent further emission of detonator tubes 7. The movement of the flow control plungers 8 causes the larger diameter ends 9 of the flow control plungers 8 to pull the light beam 10 away from the electro-magnets 11 which resets the electro-magnet 11 for a repetition of the aforementioned cycle of operations when another carrying-plate 3 arrives at the side guides 6.

Referring to the drawings, Figs. 4 and 5, 20 are flow control fingers to control the emission of the empty detonator tubes 7 from delivery pipies 5, and are attached to the light beam 10. 21 are compression springs.

As in the previous embodiment an empty detonator carrying-plate 3 on the chairs 2 of the chain conveyor 1 is laterally displaced into alignment with respect to the delivery pipes 5 as it enters the space between the side guides 6. The delivery pipes 5 are kept supplied with orientated detonator tubes 7 by a mechanism (not shown). The delivery pipes 5 are inclined at an angle of 10° to the vertical. The bearing surfaces of the chairs 2 are horizontal. The bottoms of the lowermost detonator tubes 7 are supported by the control fingers 20 at a height above the top surface of the detonator carrying-plate 3. As the carrying-plate 3 continues its motion between the side guides 6 one of its bevelled corners 17 comes into contact with the corresponding bevelled tip of the switch operating plunger 15, the tip of which projects through one of the side guides 6 into the space between the said side guides 6 and on a level with the bevelled corner 17 of the carrying-plate. The switch operating plunger 15 is depressed by the bevelled corner 17 as the carrying-plate 3 pushes against it. This action closes the switch 16 causing the electro-magnets 11 to be energised. At this instant the top of the carrying-plate 3 is in position beneath the delivery pipes 5 so that when the energised electro-magnets 11 withdraw the light beam 10 carrying



the control fingers 20 against the thrust of the compression springs 21, the orientated detonator tubes 7 in the delivery pipes 5 slide downwards, the lowermost members of each column landing on the top of the carrying-plate 3 in front of the sockets 4. As the movement of the carrying-plate 3 brings the sockets which are in the first row of sockets at right angles to the direction of movement of the carrying-plate 3, beneath the columns of detonator tubes 7 the lowermost detonator tube of each column falls into a socket 4. The relative inclination of the detonator tube 7 which has just entered the socket 4 to the inclination of the detonator tube 7 above it, the latter being still partly within the delivery pipe 5, is such that the mouth of the detonator tube 7 in the socket 4 slides under the rounded bottom of the detonator tube 7 above, without tending to catch on it. When the detonator tube 7 which has entered the socket 4 has passed beyond the detonator tube above, the latter has merely to fall into the next socket 4 as this socket passes beneath the delivery pipe 5. The falling of the detonator tubes 7 into the sockets 4 continues until the side of the carrying-plate 3 which has been in contact with the switch operating plunger 15 passes beyond this plunger 15. When this occurs the plunger 15 returns to its original position opening the switch 16 when the electro-magnets 11 cease to pull the ends of the light beam 10. The previous movement of the beam 10 and the compression of the compression springs 21 are such that the said compression springs 21 are now able to move the light beam 10 until the tips of the flow control fingers 20 meet the empty detonator tubes 7 in the rearmost sockets 4 of the carrying-plate 3 and to maintain this contact of the control fingers 20 with the tubes 7 as the plate 3 moves a short distance further, during which movement the lowermost detonator tube 7 within the delivery pipe 5 and momentarily resting on the rearmost tube 7 inserted into the carrying-plate 3 falls on the top surface of the control finger 20 (as shown in Fig. 5), which surface is below the top of the detonator tube 7 standing in the socket in the carrying-plate 3.

What I claim is:

1. Apparatus particularly adapted for charging oriented articles, of relatively greater length than width and of a substantially straight longitudinal axis, into a carrying-plate having at least one row of sockets to receive the articles, the combination comprising: at least one row of upstanding delivery pipes each to be filled with a column of articles and adapted and arranged to deliver the latter, by gravity, into the corresponding sockets of a carrying-plate when the latter is in a receiving position beneath said pipes, said pipes being inclined to permit slippage of an outgoing article over one which has already entered a socket upon horizontal movement of the carrying-plate; means for conveying a succession of empty plates so as to bring each of the latter in turn into receiving position beneath said pipes and with the upper surface of the plates spaced below said pipes a distance less than the length of the articles; guide means for aligning each plate with respect to said pipes as the former approaches the latter; a plunger located at the lower end portion of each of said delivery pipes and permanently spring-loaded to press an adjacent article against the wall of the said delivery pipes with sufficient force to hold up the column of articles above, each plunger having a rearward extension provided with an enlarged outer end; a

beam having a plurality of clearance holes therein of smaller dimensions than that of said plunger extension enlargements and each receiving the extension of a said plunger; an electromagnet having a movable armature connected to each end of said beam for moving the latter in a direction away from said delivery pipes in order to retract said plungers and permit emission of the articles from said pipes; and at least one detector for controlling said electromagnets, said detector being responsive to the presence of a plate and disposed in the path of travel of the latter for operating said electromagnets to permit emission of articles from said pipes when a plate is in article-receiving position therebeneath and to withhold such emission in the absence of a plate in such receiving position.

2. Apparatus particularly adapted for charging oriented articles, of relatively greater length than width and of a substantially straight longitudinal axis, into a carrying-plate having at least one row of sockets to receive the articles, the combination comprising: at least one row of upstanding delivery pipes each to be filled with a column of articles and adapted and arranged to deliver the latter, by gravity, into the corresponding sockets of a carrying-plate when the latter is in a receiving position beneath said pipes, said pipes being inclined to permit slippage of an outgoing article over one which has already entered a socket upon horizontal movement of the carrying-plate; means for conveying a succession of empty plates so as to bring each of the latter in turn into receiving position beneath said pipes and with the upper surface of the plates spaced below said pipes a distance less than the length of the articles; guide means for aligning each plate with respect to said pipes as the former approaches the latter; a movable control finger located externally to the mouth of each delivery pipe and adapted to support the lowermost article in said pipe when emission of said article is to be withheld; a movably-mounted beam supporting said fingers; spring means urging said beam in a direction to move said fingers beneath said pipes; electromagnetic means for moving said beam in a direction to move said fingers from beneath said pipes; and at least one detector for controlling said electromagnetic means, said detector being responsive to the presence of a plate and disposed in the path of travel of the latter for operating said electromagnetic means to permit the emission of articles from said pipes when a plate is in article-receiving position therebeneath and to withhold such emission in the absence of a plate in such receiving position.

3. Apparatus particularly adapted for charging oriented articles, of relatively greater length than width and of a substantially straight longitudinal axis, into a carrying-plate having at least one row of sockets to receive the articles, the combination comprising: at least one row of upstanding delivery pipes each to be filled with a column of articles and adapted and arranged to deliver the latter, by gravity, into the corresponding sockets of a carrying-plate when the latter is in a receiving position beneath said pipes, said pipes being inclined to permit slippage of an outgoing article over one which has already entered a socket upon horizontal movement of the carrying-plate; means for conveying a succession of empty plates so as to bring each of the latter in turn into receiving position beneath said pipes and with the upper surface of the plates spaced below said pipes a distance less than the length of the articles; guide means for aligning each plate with respect to said pipes as the former approaches the latter; a movable means adjacent the lower end portion of each delivery pipe and engageable with the lowermost article in said pipe to withhold its emission; spring means urging said movable means in a direction to effect said engagement with said lowermost articles; electromagnetic means connected to said movable means for moving the latter in a direction away from said pipes to permit emission of the articles from said pipes; a switch for controlling said electromagnetic means; and a plunger for operating said switch, said plunger being positioned to be engaged and moved by the engagement thereof by a leading edge of a said carrying plate and to be held in the thus-moved position by a side of the said plate until the latter passes beyond said plunger.

4. Apparatus particularly adapted for charging oriented articles, of relatively greater length than width and of a substantially straight longitudinal axis, into a carrying-plate having at least one row of sockets to receive the articles, the combination comprising: at least one row of upstanding delivery pipes each to be filled with a column of articles and adapted and arranged to deliver the latter, by gravity, into the corresponding sockets of a carrying-plate when the latter is in a receiving position beneath said pipes, said pipes being inclined to permit slippage of an outgoing article over one which has already entered a socket upon horizontal movement of the carrying-plate; means for conveying a succession of empty plates so as to bring each of the latter in turn into receiving position beneath said pipes, and with the upper surface of the plates spaced below said pipes a distance less than the length of the articles, said conveying means including an inclined support for each carrying-plate for carrying the latter at a slight inclination to its direction of movement so that the leading edge of each plate will pass beneath the delivery pipes at a greater distance therebelow than the trailing edge of each plate; controllable means for withholding the emission of the articles from said pipes; and at least one detector responsive to the presence of a plate and disposed in the path of travel of the latter for operating said controllable means to permit emission of articles from said pipes when a plate is in article-receiving position therebeneath and to withhold such emission in the absence of a plate in such receiving position.

IAN F. STEWART.

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