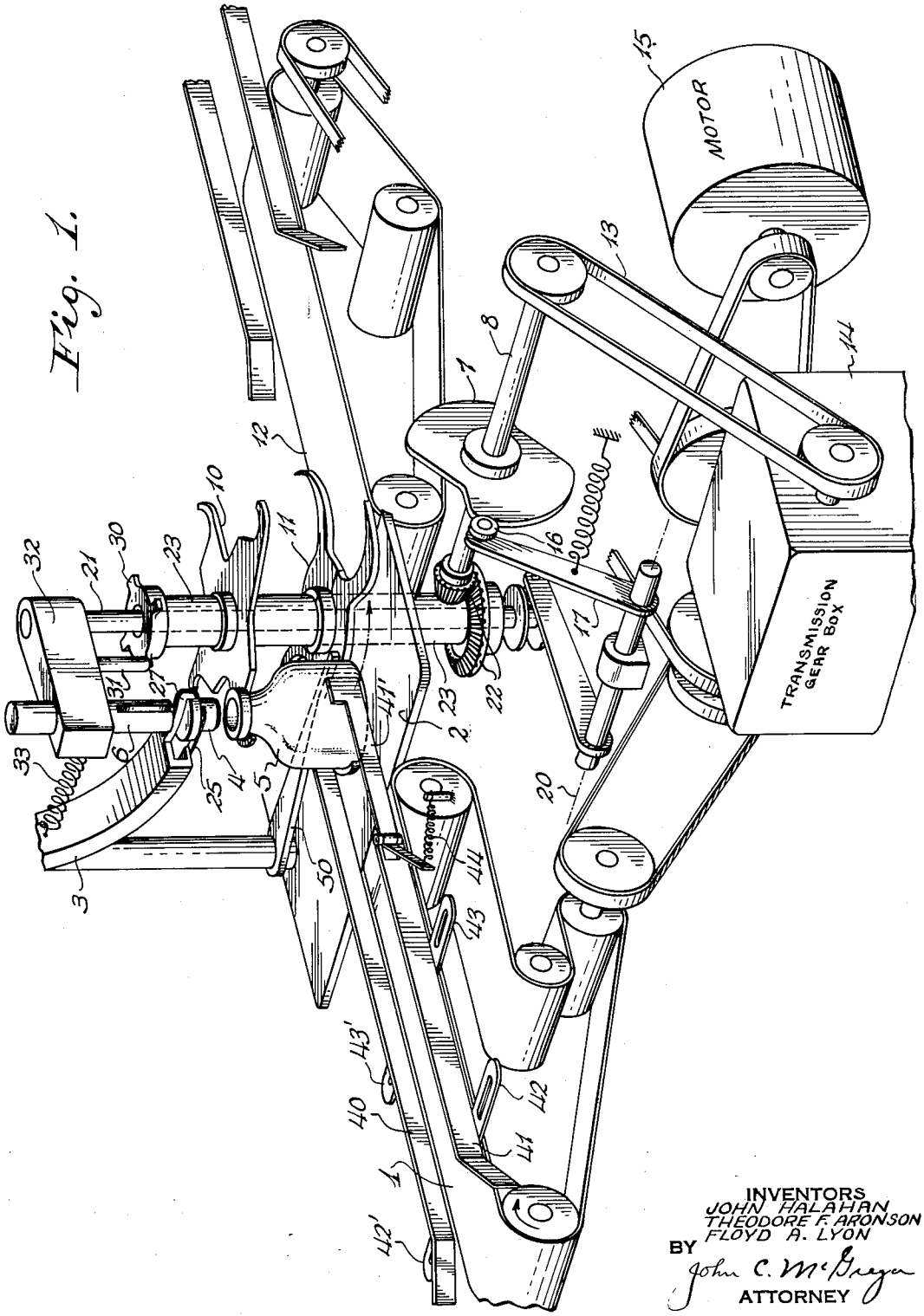
March 6, 1956 J. HALAHAN ET AL 2,737,330

BOTTLE CAPPING MACHINE

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Fig. 1.

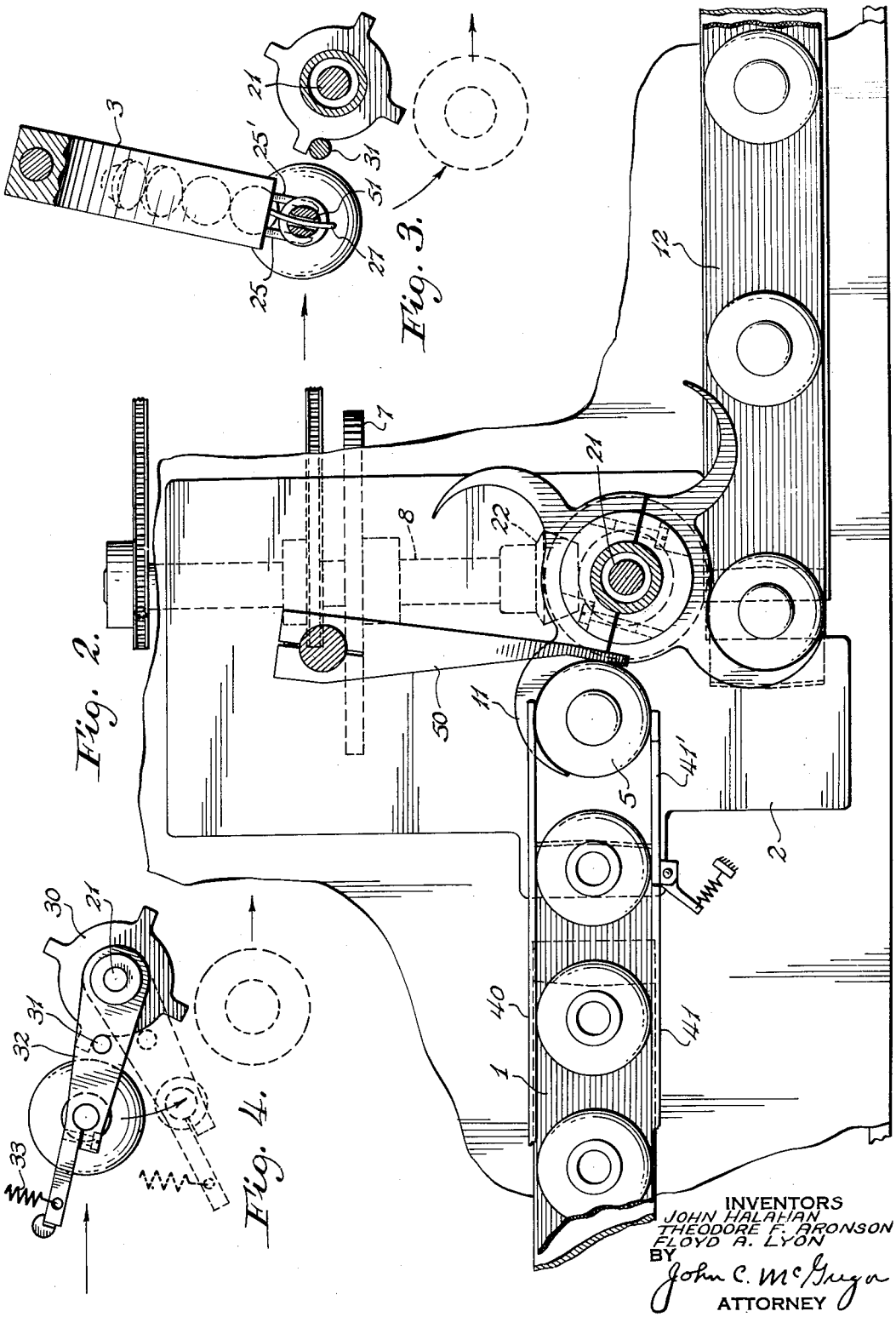


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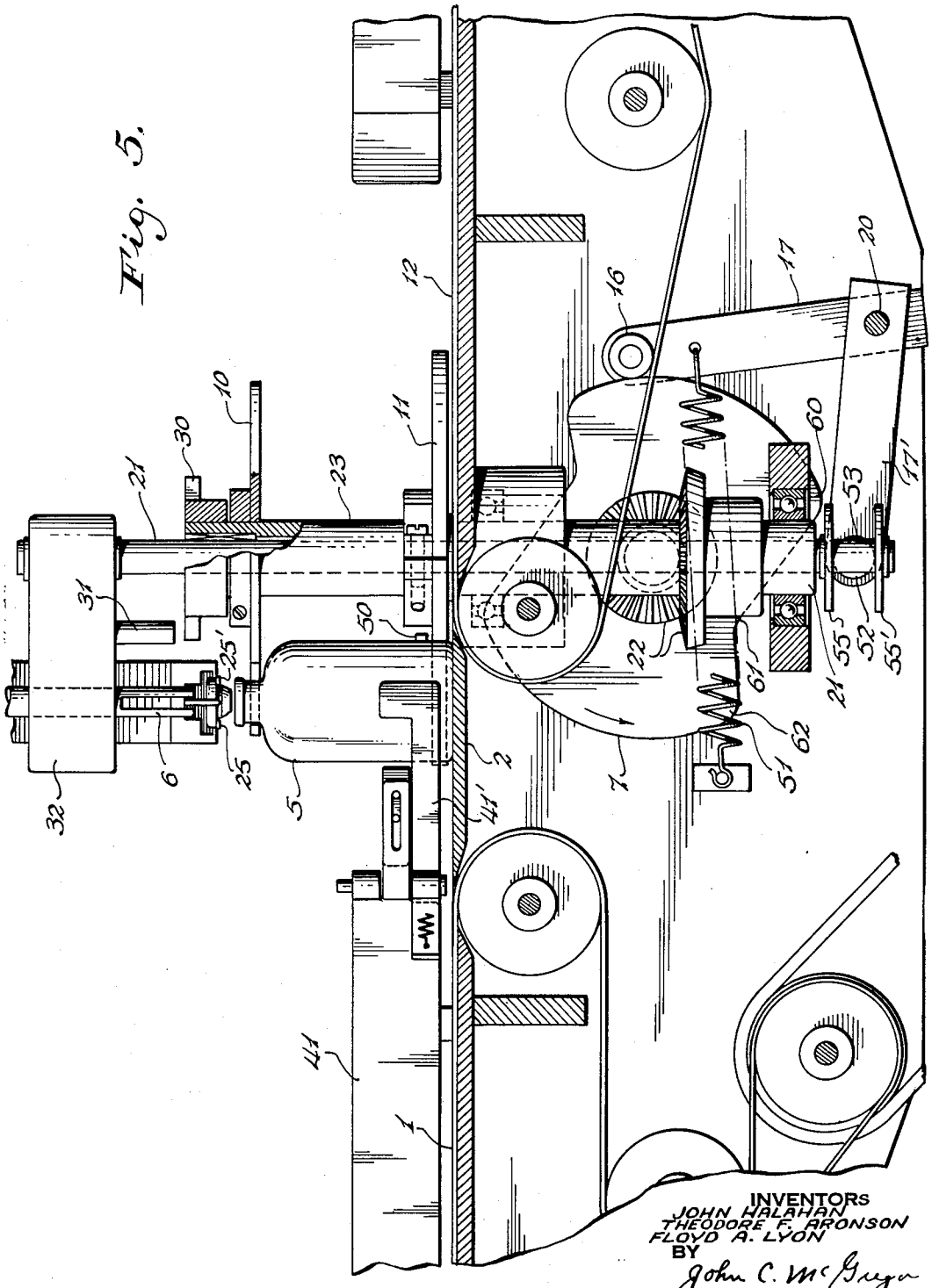


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Fig. 5.



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BOTTLE CAPPING MACHINE

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Application August 14, 1951, Serial No. 241,847

8 Claims. (Cl. 226—92)

This invention relates to container closure devices and, more particularly, to apparatus and means for inserting stoppers in bottles.

Recently there has been a need for apparatus which will be able to insert bungs or stoppers in bottles or similar containers. One of the problems in apparatus of this kind is that a considerable amount of force must be used to force the stoppers into the bottles since the tightness of the seal depends primarily upon the elasticity of the stopper. For instance, soft rubber stoppers or stoppers made of an equivalent material having a certain amount of elasticity are required. This elasticity provides a considerable resistance to the initial insertion of the stopper in the bottle neck and has an inherent tendency to pop out again after the pressure is prematurely removed. Therefore, the following specifications must be met in apparatus of this kind:

1. The bottles and stoppers must be automatically fed to the work space and accurately positioned;

2. A considerable amount of pressure must be used to insert the stopper in the bottle; and

3. The pressure must be maintained for a length of time necessary to insure that the stopper is properly and permanently seated in the bottle.

This last requirement for a continuing pressure is a considerable obstacle in achieving high speed operation and special arrangements must be made to achieve this desired result.

Accordingly a principal object of the present invention is to provide new and improved means for automatically inserting stoppers in bottles.

Another object of the present invention is to provide high speed automatic means for inserting bungs or stoppers of the resilient type into containers such as vials or bottles.

Another object is to provide new and improved means for automatic bottle stoppering which means are adjustable to accommodate different sized bottles.

Another object is to provide new and improved means for inserting resilient closing elements into bottles, including means for maintaining the pressure on said elements for a predetermined time.

The present invention achieves these objects by providing new and improved apparatus as will be described.

The invention considered generally comprises bottle feeding means which maye be a traveling belt, bottle positioning means, stopper positioning means adapted to position the stopper in a predetermined relationship with the bottles, an arm adapted to ram the stoppers in the bottles and means to maintain the ram pressure for a predetermined period. All of these means are synchronized and coordinated by a motor driven cam arrangement.

Other objects and advantages of the invention will be apparent from the following specification and figures:

Figure 1 is a functional isometric diagram of an embodiment of the invention.

Figure 2 is a horizontal view of the embodiment of Figure 1.

Figures 3 and 4 are diagrams of details of the invention.

Figure 5 is a vertical view of the embodiment of Figure 1.

Figure 1 shows one embodiment of the invention. It comprises a bottle-feeding belt 1, which feeds the bottles to be stoppered to the work platform 2 where they are properly positioned, as will be more fully described. The stoppers are fed down the hopper 3, which is a gravity-feed device, into proper position for inserting them in the bottles. The stopper 4 is shown in position to be inserted in the bottle 5.

The insertion is performed by ram action by means of ram 6, which is actuated by cam 7. After the stopper 4 has been inserted in the bottle 5, the bottle is rotated on the work table 2 by the star wheels 10 and 11 to the bottle removing belt 12.

The above is a brief outline of the operation of the system which will now be discussed in more detail. The heart of the system is the cam 7 which is mounted on the shaft 8, which in turn is motor driven by belt drive 13. The belt drive is actuated from transmission gear box 14, the power for which is supplied by the motor 15.

The cam 7 actuates the up and down motion of the ram 6 by means of cam follower 16, which is mounted on bell crank 17. The bell crank 17 is pivoted about the axis 20 so that as the cam rotates, the bell crank 17 energizes the rod 21 up and down.

The cam shaft 8 energizes and synchronizes the rotation of the star wheels 10 and 11 by means of bevel gear 22 which rotates the hollow shaft 23, upon which the star wheels are mounted. Therefore, it is seen that the up and down motion of the ram 6 and the rotation of the star wheels is coordinated and synchronized by the cam 7 which has been carefully cut for the proper operation of the system.

The stoppers slide down the hopper 3 and are positioned on two spring fingers 25 and 25′ (not shown) which suspend the stopper by its flange. The stopper is prevented from sliding off the two parallel fingers 25 and 25′ by means of the hooked finger 27. It is noted that the ram 6 is notched so as to apply pressure to the stopper 4 on both sides of the positioning finger 27. The positioning fingers 25 and 25′ may be made of flexible material such as spring steel and must have a certain amount of elasticity so that they will return to their proper position after being deformed from that position by the action of the ram 6. It is desirable that the bottle 5 and the stopper 4 be accurately positioned at the moment of the ramming so that the stopper will be accurately rammed into the neck of the bottle.

The stopper 4 is preferably of a pliable material, such as rubber or plastic, which has a certain amount of elasticity and, due to spring in the fingers 25 and 25′, there is a certain tendency of the stopper to pop out of the bottle once the ram pressure is removed. Therefore, special provisions have been taken to continue the pressure of the ram 6 on the stopper 4 while bottle 5 is commencing to rotate away from the work position. This continuing pressure is provided in the following manner. The four-toothed wheel 30 is attached to the same hollow shaft 23 as the star wheels 10 and 11 and it engages the rod 31 which is fixed to the ram head 32. Therefore, as the hollow shaft 23 rotates, the four-toothed wheel 30 causes the ram 6 to rotate a certain predetermined distance with the bottle 5. This predetermined distance is determined by the cutting of the cam 7 since, when the rod 21 starts to rise on its upward stroke, the rod 31 will become disengaged from the toothed wheel 30 and the ram head 32 will be snapped back to ramming position by the action of the spring 33. It is noted that the cam 7 is cut so that there are two work strokes per revolution of the cam. There is a one-to-two ratio in the bevel gears 22 because of the fact that the star wheels have four arms. Therefore, the cam rotates twice for each rotation of the star

wheels. This work cycle has been found satisfactory for high speed, reliable operation in a specific embodiment of the invention, although various gearing arrangements might be made to accommodate star wheels having more or less than four arms. If star wheels having a different number of arms were used, it would be necessary to cut the cam 7 so as to provide a proper work cycle.

The bottle feeding belt 1 and the bottle removing belt 12 are very similar in construction and are both actuated by belt drives from the gear transmission 14. The only significant difference between them is that the bottle removing belt 12 must travel considerably faster than the bottle feeding belt 1 in order to remove the bottles fast enough so that they will clear the rotating arms of the star wheels 10 and 11. The bottle feeding belt 1 is provided with guide rails 40 and 41 for the purpose of aligning the bottles. Stop 50 stops the bottles in proper position. The guide rails may be adjusted in width for various size bottles by means of the brackets 42, 42' and 43, 43'. The portions 41' of the guide rail 41, which guides the bottles into work position, is hinged so as to accommodate the rotation of the bottles. It is spring loaded against a stop by the spring 44 so that it will apply sufficient pressure to position the bottles accurately.

Figure 2 shows a horizontal view of the embodiment of Figure 1. The bottle 5 is shown in the ramming position where it is accurately positioned by the guide rail 41' and the arm of the star wheel 11. The adjustable arm 50 arrests the forward motion of the bottles as they are received from the feeding belt 1. The cam shaft 8 energizes the rotation of the star wheels by means of the bevel gear 22 as explained in connection with Figure 1. The small star wheel 10 for the neck of the bottle is not shown. It should be mentioned that the star wheels are split in half for the purpose of easy removal and several different size bottles may be accommodated by providing the proper size star wheels. The star wheels may be changed to accommodate the different size bottles without disturbing any other parts of the machine and without disturbing the synchronism of the various members provided by the motor driven cam 7.

Figure 2 also illustrates how the stoppered bottles are removed from the open arms of the star wheel by means of the bottle removing belt 12, which is operated sufficiently fast so that the bottles are removed without fouling the rotating star wheel arms.

Figure 3 shows a detail top view of the hopper 3 and its relation to the four-toothed wheel 30. The stoppers slide down the hopper 3 where they are positioned by the parallel horizontal fingers 25 and 25' and the overhead hooked finger 27. The shaded cross section 51 is that of the ram 6 of Figure 1 and it illustrates that the ram pressure is applied on either side of the finger 27 due to the notch in the ram 6. It has been found that, due to elasticity, the flange of the stopper is positioned upward away from the bottle somewhat so that there is not sufficient pressure between the flange of the stopper and the neck of the bottle to cause any jamming or grabbing of the fingers 25 and 25'. Figure 3 also shows the engagement of the four-toothed wheel 30 with the guide rod 31 fixed to the ram head 32. This arrangement provides that the ram head will rotate a certain predetermined distance while maintaining pressure on the stopper, as described in connection with Figure 1.

Figure 4 shows the rotation of the ram head 32 by the four-toothed wheel 30. As the star wheels and the toothed wheel 30 rotate, the wheel 30 engages the guide rod 31 which causes the ram head 32 to rotate to the position shown by the dotted lines. The angle of rotation is determined by the cutting of the cam 7, as mentioned in connection with Figure 1. When the cam 7 causes the ram rod 21 to begin its upward stroke at a predetermined position of the cam, the guide rod 31 will become disengaged from the toothed wheel 30 and the ram head 32 will be returned to the ram position by the spring 33. The feature of this rotation of the ram head is that pressure is maintained on the stopper 4 for the maximum amount of time compatible with high speed operation and high speed feeding of the stoppers. If the pressure were maintained by the ram and the bottles were stopped for this period, it would cause the entire operation to be intermittent and decrease the amount of work tremendously.

Figure 5 shows a vertical projection of the embodiment of Figure 1. Figure 5 shows the action of the cam 7, and the direction of the cam rotation is shown by the arrow. The cam follower 16 is held against the cam by a spring 51 and the motion of the cam follower is translated to the ram rod 21 by means of the bell crank 17 which is pivoted about the axis 20. The bell crank 17 is fixed to the ram rod 21 by a sliding joint 52 which transmits the vertical motion of the bell crank 17 to the ram rod 21. There is a sufficient amount of play in the sliding joint 52 to absorb any horizontal motion transmitted. The sliding joint 52 may comprise a wheel 53 which is fixed to the arm 17' and which is adapted to roll within the guide rails 55 and 55'. The guide rails may be flanges attached to the ram rod 21 so that the vertical motion will be imparted to the ram rod 21 without any binding caused by horizontal motion of the bell crank 17.

The ram is shown in the up position. As the cam rotates from the position shown, the ram rod 21 remains up until the cam follower 16 reaches the point 60 on the cam 7 at which point a sharp downward stroke of the ram occurs. The downward stroke of the ram occurs from the point 60 to the point 61 on the cam. From the point 61 to the point 62, the ram rises again. When the cam follower reaches the point 62 on the cam, the upward stroke is again completed.

Therefore, it is seen that the present invention provides means for automatically inserting stoppers into bottles or other containers. One of the features of the invention is that high speed reliable operation is obtained in a fully automatic manner. Many variations may be made on the basic invention without departing from its scope. For instance, the invention is not limited to any particular design of star wheels, any particular arrangement of gearing, or any particular arrangement of bottle feeding and bottle removing means, since many modifications and variations will occur to those desiring to practice the invention.

We claim:

1. Bottle stoppering apparatus comprising means to feed bottles to a first predetermined position, means to feed stoppers to a second predetermined position above said first predetermined position, a reciprocating ram located above said predetermined position and adapted to be driven to force one of said stoppers into one of said bottles, means to remove said sealed bottles and means connected to drive said ram to maintain the pressure of said ram for a predetermined time while said sealed bottles are being moved.

2. Bottle sealing apparatus comprising means to feed bottles to a first predetermined position, means to feed stoppers to a second predetermined position above said first predetermined position, means to insert one of said stoppers in one of said bottles comprising reciprocating ram means to apply pressure downwardly on said positioned stoppers, means to maintain said pressure for a predetermined time comprising a synchronizing cam and means to move said bottles while maintaining said pressure comprising moving means geared to said synchronizing cam.

3. Bottle stopping apparatus adapted to insert resilient stoppers into bottles comprising means to feed bottles to a first predetermined position, means to feed stoppers to a second predetermined position above said first predetermined position, a reciprocable ram means to ram stoppers into one of said bottles one at a time, rotary

bottle moving means and a motor driven cam connected to said bottle moving means and connected to reciprocate said ram to thereby synchronize the continuous operation of said ram and said rotary bottle moving means.

4. Apparatus as in claim 3 wherein said rotary bottle moving means comprises a set of rotary star wheels mounted on a hollow shaft and said ram is mounted on a rod coaxial with and inside said hollow shaft, said rod being adapted to move vertically, and said shaft being rotatable in synchronism with said motor driven cam.

5. Means for inserting stoppers in bottles comprising rotary bottle moving means comprising a pair of star wheels having arms adapted to fit said bottles, means for feeding said bottles into a position of engagement with said star wheels, means for feeding said stoppers in a predetermined position relative to said bottles, reciprocating ram means to ram said stoppers into said bottles, continuous motor driven cam means connected and adapted to drive and synchronize the operation of said ram and said star wheels, and means to maintain said ram pressure for a predetermined time including means to swing said ram with said bottle.

6. Apparatus as in claim 5 wherein said ram is mounted on a vertically reciprocating rod connected by means of a bell crank lever and cam follower to said cam and wherein said star wheels are fixed to a hollow shaft which is coaxial with said reciprocating ram rod and which is connected for rotation to said cam shaft.

7. Apparatus as in claim 6 wherein said ram is momentarily connected to said hollow shaft for rotation with said bottles to thereby obtain the optimum period of pressure.

8. Means to insert resilient stoppers into bottle type containers, means to position said containers and said stoppers relative to each other, driven ram pressure applying means to ram said stoppers in said containers with sharp impact, rotary means to move said sealed containers and means connected to said pressure applying means and said rotary means to maintain said pressure for a predetermined period of time while said containers are being moved.

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