Jan. 3, 1956 JUAN L. PUJOL Y FONT 2,729,378

MACHINE FOR CLOSING AMPOULES

Filed June 11, 1952 3 Sheets-Sheet 1

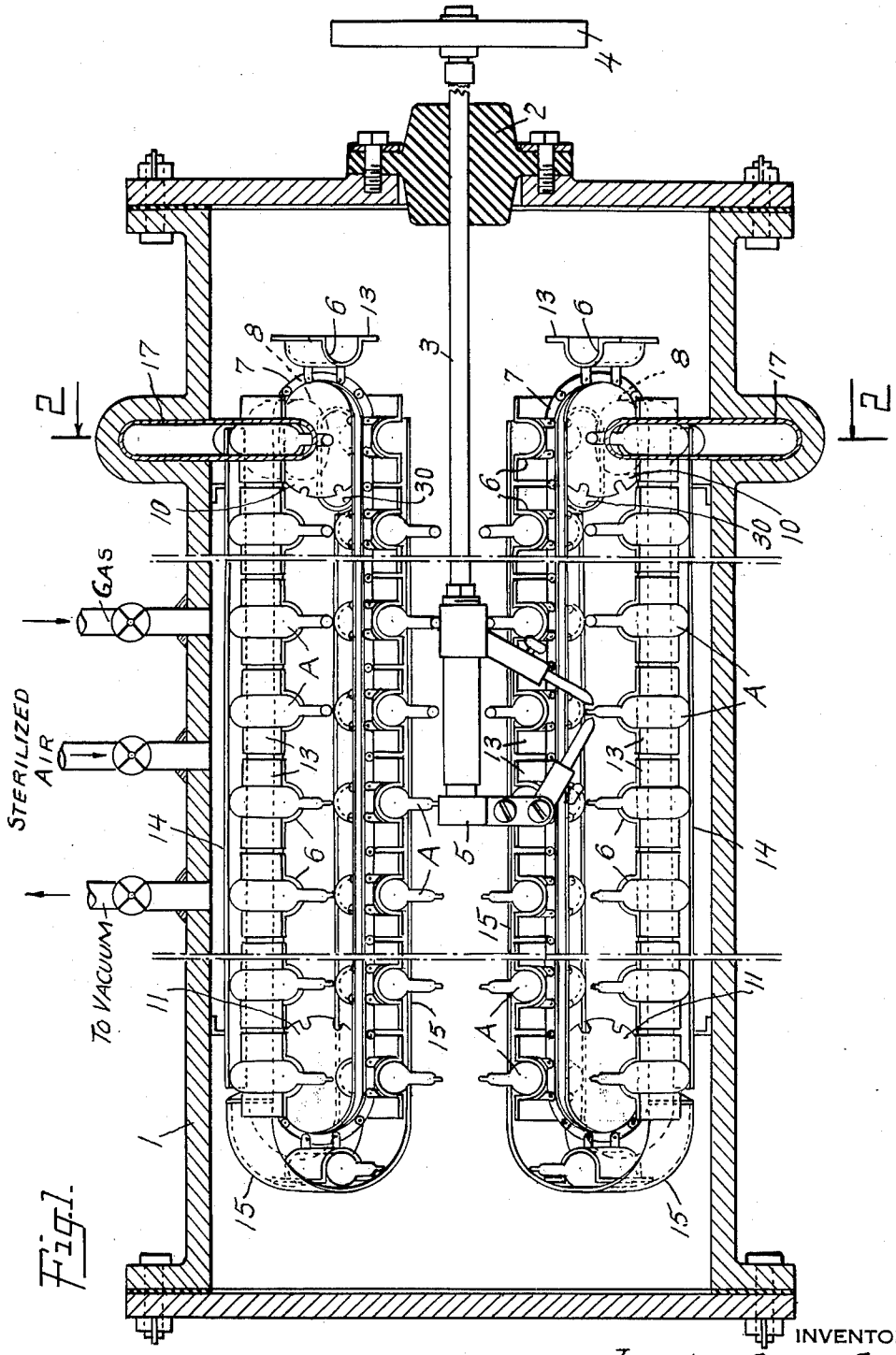


Fig. 1.

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Fig. 2.

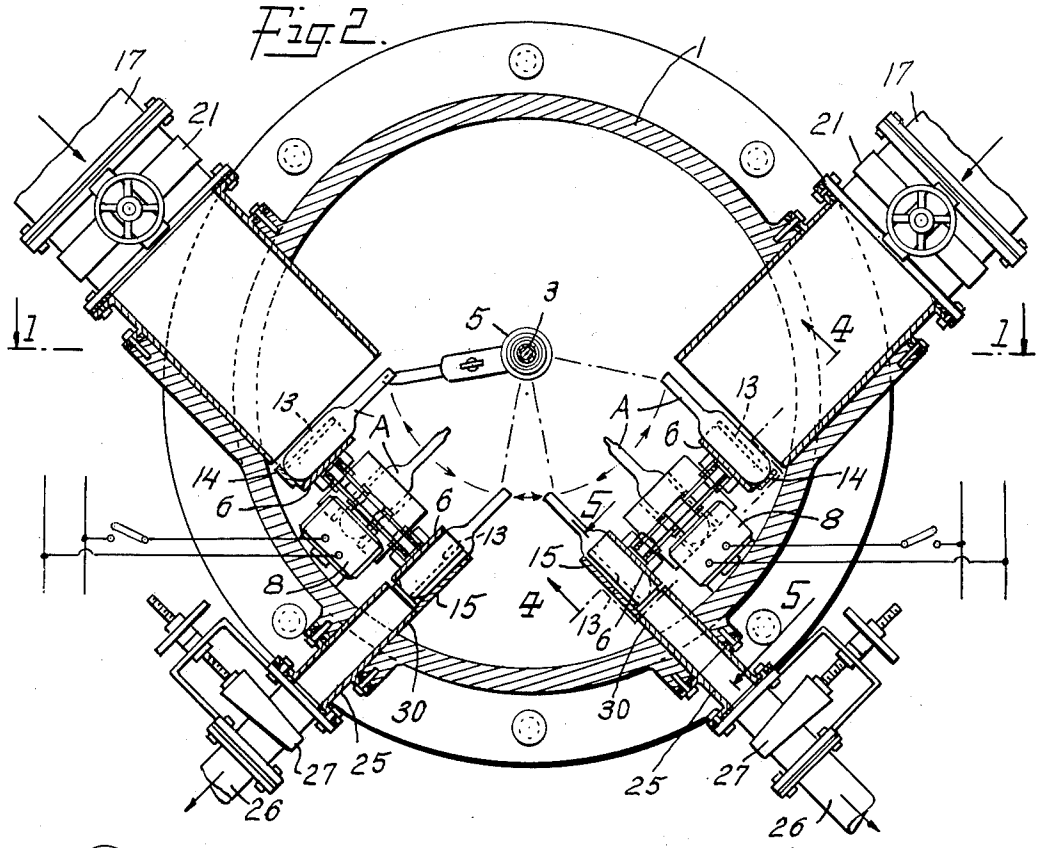


Fig. 9.

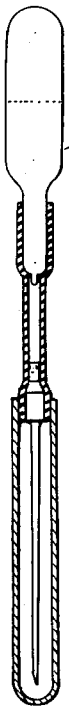


Fig. 4.

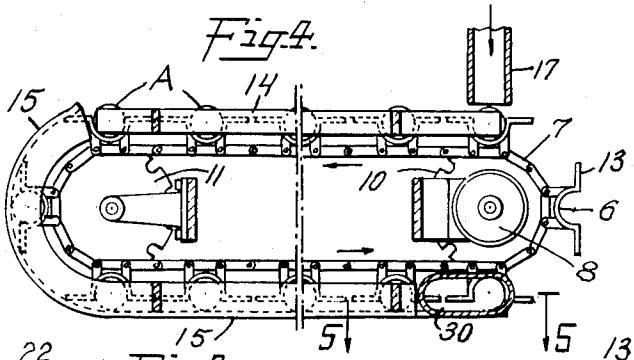


Fig. 8.

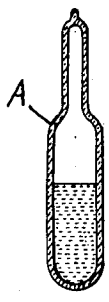


Fig. 3.

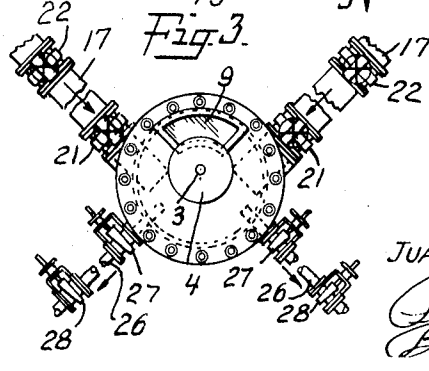
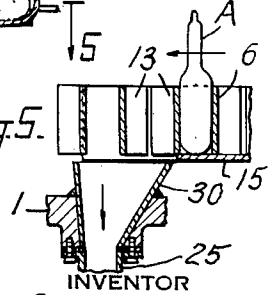


Fig. 5.



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Fig. 6.

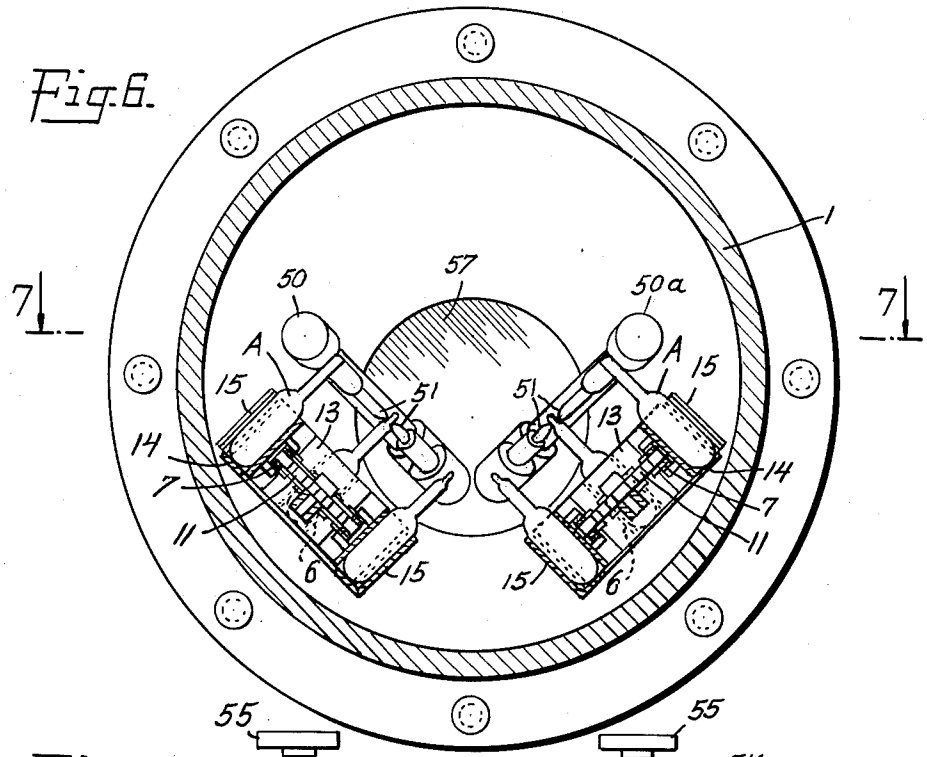
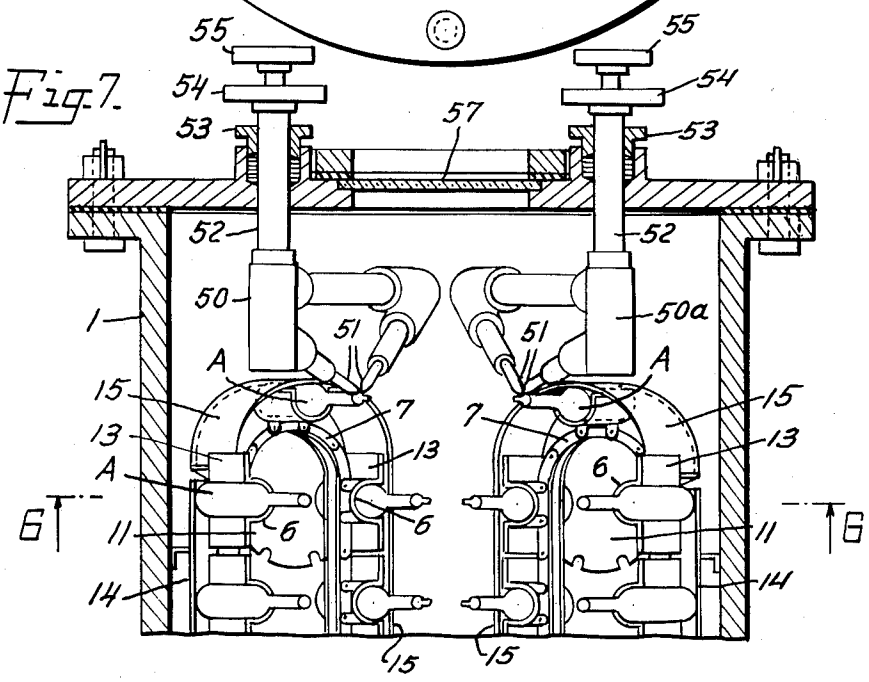


Fig. 7.



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MACHINE FOR CLOSING AMPOULES

Juan L. Pujol y Font, Cleveland, Ohio

Application June 11, 1952, Serial No. 292,850

11 Claims. (Cl. 226—82.2)

This invention relates to ampoule sealing machines and specifically to the machine illustrated in my prior Patents Nos. 2,361,413 and 2,479,024.

The primary object of my present invention is to provide the machine of the above described patents with means for feeding the ampoules to be sealed to the cylinder wherein they are sterilized, charged with gas under pressure and sealed and also for withdrawing the ampoules therefrom without requiring the discharge of the compressed gas from the cylinder and its renewal with each batch of ampoules.

By the improvements disclosed in this application the ampoules can be sealed at a much more rapid rate and a considerable saving in cost of the charging gas can be realized.

In one form of my invention hereinafter described, the sealing of the ampoules is effected as in my above described patents by manual manipulation of the sealing arc, while in the other form of the invention herein illustrated and described the arc is maintained in fixed position and the ampoules are successively moved through the zone heated by the arc at a rate such that the ampoules are sealed. In addition to the saving in time and expense the use of my improved machine expedites the packing of the ampoules and facilitates the use in connection with the ampoule-sealing machine of automatic packing machines.

Other advantages of my improved structure will appear from the following specification and the accompanying drawings; wherein

Fig. 1 is a horizontal axial section on line 1—1 of Fig. 2;

Fig. 2 is a transverse vertical section on line 2—2 of Fig. 1;

Fig. 3 is an end view of the apparatus on a reduced scale;

Fig. 4 is a detail sectional view on line 4—4 of Fig. 2;

Fig. 5 is a detail sectional view on line 5—5 of Fig. 4;

Fig. 6 is an end view of a modified form of the machine looking from the left of Fig. 1;

Fig. 7 is a horizontal sectional view on line 7—7 of Fig. 6;

Fig. 8 is a sectional view of the sealed ampoule; and

Fig. 9 is a similar view of the complete hypodermic syringe for which the ampoules are chiefly used.

Referring to the drawings, particularly Fig. 1, 1 indicates the cylinder in which the ampoules A are supported for sealing. The cylinder is similar to the cylinder employed in the machines of my above mentioned Patent No. 2,479,024 in that it is provided at one end with a rubber stuffing-box 2 attached to the end wall of the cylinder in such manner that the stuffing-box may be angularly deflected with respect to the cylinder wall and still remain gas-tight. Mounted in the stuffing-box for sliding movement is a rod 3 having a handle 4 on the outer end and a sealing unit 5 on its inner end, the sealing unit being preferably an electric arc of the character illustrated in my co-pending application. The details

of the sealing arc are not disclosed herein as they form no part of the present invention.

As in my prior patents the chamber in which the ampoules are assembled for sealing consists of a long horizontal cylinder which is gas-tight and which is supplied with pipe connections leading, respectively, to vacuum pump, a source of sterilized air or gas and a source of inert gas under pressure, as indicated in Fig. 1. In my prior apparatus stationary racks for holding the ampoules A are supported in the cylinder in such position that the operator, by turning and sliding the rod 3 carrying the sealing arc, in its stuffing-box, can bring the arc successively into position adjacent the tips of the ampoules and thereby heat-seal the ampoules which, as shown in Fig. 8, are partly filled with the medicament to be administered and contains by virtue of the inert gas under pressure supplied to the cylinder, a sufficient charge of compressed gas to eject the medicament when the seal of the compoule is broken after its assembly in the hypodermic syringe, as illustrated in Fig. 9.

In the present application I have substituted for the stationary racks of my prior patents movable ampoule holders 6 supported on chains 7 each of which chains is independently driven by an electric motor 8 as shown in Fig. 2. The motors 8 are of the type having a built-in reduction gear, not shown, so that when the motors are energized by closing their circuit, their driving shafts will rotate at comparatively slow speed so that the operator may, by observing the movement of the chains through the window 9 in the end of the cylinder above the hand wheel 4, stop the chains when they have reached the desired position.

The motors 8 are supported on opposite sides of the vertical longitudinal plane of the cylinder at points about midway between the bottom of the cylinder and the horizontal axial plane of the cylinder and are so positioned that their driving shafts upon which the sprocket wheels 10 for driving the chain 7 are mounted, extend in substantially radial directions toward the axis of the cylinder. Sprocket wheels 11 similar to the wheels 10 are supported on fixed brackets near the opposite end of the cylinder, the arrangement being such that the sprocket chains, which are endless, extend in two horizontal reaches from one sprocket wheel to the other, with the holders 6 providing spaced pockets for the ampoules which are open on their outer faces, as shown, and have laterally projecting portions 13 extending in opposite directions from the ampoule-retaining pockets into close proximity to the projecting portion 13 of the adjacent ampoule holder.

The ampoules are retained in the pockets of the carrier as it moves along the upper reach of its path of movement by means of a rail 14 against which the bottoms of the ampoules rest, as shown in Fig. 2. As the chain moves around the sprocket 11 at the far end of the cylinder and through the bottom reach of its path of travel, the ampoules are held in place by an angular rail 15 which underlies both the end of the ampoule and also the side of the ampoule.

The ampoules are supplied to the pockets of the carrier chains from magazines 17 whose lower ends are fixed in the walls of the chamber in position substantially in line with the shafts of the motors 8 and sprocket wheels 10. The magazine, as shown particularly in Figs. 1 and 2, are of such cross-sectional dimensions that the ampoules will be retained therein in a single line with their axes parallel with the axes of the pockets 6 in the chain when the motors are stopped with a pocket positioned immediately beneath the magazines.

As shown in Fig. 3, the magazines extend outwardly and upwardly from the cylinder, and are of sufficient height to hold a full charge of ampoules. That is to say,

each magazine holds sufficient ampoules to fully charge the chain which underlies its open end.

The magazines are provided with gate valves indicated at 21 which are hand operated and are so positioned with respect to the distance from the pocket 6 immediately beneath the magazine that the valve when closed will pass between two adjacent ampoules and close off the portion of the magazine above the valve from communication with the interior of the cylinder. That is to say, the distance of the valve above the bottom of the pocket on the chain is a multiple of the diameter of the ampoule so that the edge of the valve will be in line with the contacting surfaces of adjacent ampoules and pass between them without damaging either ampoule and will at the same time lift the charge of ampoules in the magazine a distance equal to the thickness of the valve plate.

The outer ends of the magazines are provided with similar gate valves 22 closing the magazines and each magazine is provided with a connection to the vacuum line and also to the line supplied with sterilized air or gas.

Immediately beneath the magazines 17 are the discharge magazines 25 each of which consists of a pipe section projecting through the wall of the magazine at a point in line with the pocket 6 of the sprocket chain which is diametrically opposite to the pocket which underlies the feed magazines. The pipes 25 are provided outside the cylinder with extensions 26, the extensions 26 being of a length to receive in axial alignment all the ampoules supported by one of the chains during the sealing operation. The pipe extensions 26 are provided at their ends adjacent the cylinder with gate valves 27 and at their far ends with similar gate valves 28.

At their ends adjacent the path of the sprocket chains the pipes 25 are flared out as shown in Figs. 4 and 5 to an elliptical cross-section 30, the axis of the ellipse being parallel with the path of movement of the chain. The angular ampoule supports 15 which lie adjacent the lower path of movement of the chains terminate adjacent the elliptical sections of the discharge magazines 25 so that the ampoules carried by the chains will, as the chain advances, over the elliptical mouth sections of the discharge magazines, begin to slide into the magazine, the inclination of the magazines being such that during the intervals, the pockets are passing over the tops of the magazines the ampoules will move into the magazines a distance at least equal to their height.

The receiving magazines 25, 26, as well as the guide rails 14 and 15 are preferably made of polished metal which offers little retarding friction to the movement of the ampoules.

In operation the two magazines 17 are filled with ampoules and in the first instance when the machine is initially loaded, both valves 21, 22 open so that the ampoules will fill the magazines all the way from the pockets on the chains beneath the magazines to the top, that is, to a point just below the valves 22. To facilitate the loading of the magazines ampoule holders generally similar to cartridge clips may be provided, the holders being so constructed that they may be released from the charge of ampoules after the latter are deposited in the magazines. Such holders, however, form no part of the present invention and other methods of quickly loading the magazine may be used instead.

After the magazines are filled to the level of the valve 22 these valves are closed and the vacuum line to the cylinder opened and the cylinder, including the magazines, exhausted of air. After being exhausted of air the cylinder is charged with sterilized air or gas which is retained in the cylinder for a sufficient time to thoroughly sterilize the cylinder and the ampoules. The cylinder is then again connected to the vacuum pump which withdraws the sterilized air after which it is charged with the inert gas under pressure which is used to eject the contents of the ampoules. Nitrogen or carbon dioxide is usually employed for the purpose.

After the cylinder is charged with the compressed gas the motors 8 are started by the attendant, the direction of rotation of the motors being such that the upper reach of the chains move from the end of the cylinder where the magazines are located toward the other end of the cylinder. As the chains move under the magazines one ampoule will drop into each pocket and will be retained therein by the guide rails 14 and 15 until all the pockets of the chains are charged with ampoules save only the pockets which are passing around the sprocket at the magazine end of the cylinder and the pockets immediately over the discharge magazines 25. The operator watches the progress of the chains through the window 9 in the end of the cylider and stops the movement of the chains when the pockets carrying the first ampoule reaches the position immediately adjacent the discharge magazines.

After the chains are charged with ampoules but before the sealing operation is started the valves 21 are closed and valves 22 are opened so that they may be recharged with ampoules to be sealed. After the initial charge the portions of the magazines between the valves 21 and the pockets of the chain will always be full of ampoules to be sealed.

In order to discharge the sealed ampoules from the chains the valves 27 adjacent the magazines are opened so that the ampoules as they are advanced by the chain during the period that the second charge of ampoules is being fed to the chain will by gravity drop into the open ends of the pipe 25 and slide down the pipe through the gate valve 27 into the extensions 26 which, as stated above, are sufficiently long to receive the entire charge of ampoules. During this discharge of the ampoules into the magazines 26 the valves 28 at the outer end of the receiving magazines 26 are closed and after the last sealed ampoule is discharged from the chains the valve 27 will also be closed to thereby prevent egress of gas from the cylinder. After the valves 27 are closed the valve 28 may be opened and the ampoules removed from the receiving magazines 26.

After the initial batch of ampoules is sealed there will be at each operation of the motors 8 a series of the sealed ampoules discharged into the receiving magazine and a series of unsealed ampoules charged from the magazine into the pockets in the chain.

In Figs. 6 and 7 I have illustrated a modification of the machine wherein the ampoules are sealed during the movement of the carrier chains so that the operation may be made substantially continuous, depending only upon the facilities for feeding the unsealed ampoules to the machine and the removal of the sealed ampoules. As here shown the sealing arc 5 and its supporting rod 3 and hand wheel 4 are dispensed with and instead two arcs 50 are supported at the opposite end of the cylinder 1 in position for the necks of the ampoules as they are carried by the chains around the sprockets 11 to pass in close proximity to the adjacent ends of the carbons 51 forming the arcs. Each arc 50 is supported on a rod 52 carried by a gas-tight stuffing-box 53 on the end wall of the cylinder 1. Each arc comprises the usual carbon-shifting mechanisms, not shown, whereby the carbons may be projected to a greater or less extent beyond their holders the proper distance apart and to maintain the arc in a fixed position as the carbons are burned away by the action of the arc. It will be understood that the two carbons are manipulated, respectively, by the hand wheels 54 and 55 supported on the outer end of the tubular rod 52 on which the arcs are mounted. A viewing window 57 is formed in the end wall of the casing so that the operator may observe the sealing operation and adjust the arcs as may be necessary from time to time to secure the proper sealing of the ampoules.

In operating the modified apparatus the magazines 17

are charged with the unsealed ampoules and the machine otherwise adjusted, as previously described. The arcs are then properly trimmed and supplied with current so that when the motor is started the ampoules will be continuously carried past the arcs which are positioned for the tips of their necks to be sufficiently heated by the arcs to be properly sealed. When sufficient ampoules have been sealed to fill the receiving magazines **26** the machine may be stopped and the sealed ampoules removed from the magazines as above described. In order, however, to speed up the operation the charging magazines **17** and the receiving magazines **26** may be readily detachable from the machine so that the magazines **17**, when empty, may be removed and previously charged magazines substituted. Likewise, the filled magazines **26** may be similarly removed and an empty magazine substituted. As illustrated, the magazines are attached to the machine by bolted joints, but quickly detachable clamping joints may readily be supplied instead. When detachable magazines are used the fixed sections **25** of the receiving magazines will be extended so as to have sufficient capacity to receive the ampoules sealed during the interval required to remove the filled receiving magazines and substitute unfilled magazines. When so restricted the operation may be carried on continuously. When detachable magazines are used, as above described, such magazines may be used in connection with a suitable packing machine for packing the filled ampoules in the boxes in which they are sold.

By arranging the cut-off valves as described, the total loss of gas at each operation is merely the amount of gas which fills the spaces in the magazines not filled with the ampoules. That is, for each charge of ampoules the amount of gas lost is merely the amount of gas corresponding to the volumetric content of the magazines in excess of the space occupied by the ampoules themselves. This is a negligible amount of gas compared with the amount required to fill the cylinder which by present practice is lost with each charge of ampoules.

The labor of handling the ampoules is also greatly reduced and the overall time required for sealing a batch of ampoules is greatly reduced.

With the apparatus shown in Figs. 6 and 7 where the sealing is carried out by the movement of the ampoules through the temperature zone created by the arc, the time of operation is further reduced and the process can in fact be made continuous.

If detachable magazines are used for delivering the ampoules to be sealed and receiving the filled ampoules, the process will be further expedited, as such magazines may be charged directly by the ampoule filling machine and may also be used to deliver the sealed ampoules to the packing machine, thus eliminating the individual handling of the ampoules entirely.

In the accompanying drawings and foregoing description I have described two forms of my improved charging apparatus, but it will be understood that the invention is not limited to the details of construction illustrated but includes all such modifications thereof as fall within the scope of the appended claims.

I claim:

1. In a machine for sealing ampoules the combination of a gas-tight chamber, a magazine for holding a supply of ampoules, means for successively feeding the ampoules from said magazine to said chamber, means for distributing said ampoules within said chamber, a heat-sealing unit in said chamber, and means controlled from without said chamber for bringing said ampoules and said heat-sealing unit in relative positions to effect the sealing of said ampoules.

2. In a machine for sealing ampoules the combination of a gas-tight chamber, means for feeding the ampoules to be sealed to said chamber, said means including a magazine for holding the ampoules to be sealed and a closure between said magazine and the interior of said casing, means for distributing said ampoules within said chamber, a heat-sealing unit in said chamber, and means controlled from without said chamber for bringing said ampoules and said heat-sealing unit in relative positions to effect the sealing of said ampoules.

3. In a machine for sealing ampoules the combination of a gas-tight chamber, means for feeding the ampoules to be sealed to said chamber, means for distributing said ampoules within said chamber, a heat-sealing unit in said chamber, and means controlled from without said chamber for bringing said ampoules and said heat-sealing unit in relative positions to effect the sealing of said ampoules, said feeding means including a magazine for holding the ampoules to be sealed and closures for said magazine whereby the interior thereof may be opened to the outside or closed to the outside and opened to the interior of said casing.

4. In a machine for sealing ampoules the combination of a gas-tight chamber, a magazine for holding a supply of ampoules, means for successively feeding the ampoules from said magazine to said chamber, means for distributing said ampoules within said chamber, a heat-sealing unit in said chamber, means controlled from without said chamber for bringing said ampoules and said heat-sealing unit in relative positions to effect the sealing of said ampoules, and means for discharging the sealed ampoules from said chamber.

5. In a machine for sealing ampoules the combination of a gas-tight chamber, means for feeding the ampoules to be sealed to said chamber, means for distributing said ampoules within said chamber, a heat-sealing unit in said chamber, means controlled from without said chamber for bringing said ampoules and said heat-sealing unit in relative positions to effect the sealing of said ampoules, and means for discharging the sealed ampoules from said chamber, said means comprising a receptacle for receiving said sealed ampoules and means for shutting off the interior of said receptacle from the interior of said chamber and for opening said receptacle to discharge the ampoules therefrom.

6. In a machine for sealing ampoules the combination of a gas-tight chamber, a magaizne for holding a supply of ampoules, means for successively feeding the ampoules from said magazine to said chamber, means controlled from without said chamber for distributing said ampoules within said chamber, a heat-sealing unit in said chamber, and means controlled from without said chamber for bringing said ampoules and said heat-sealing unit in relative positions to effect the sealing of said ampoules.

7. In a machine for sealing ampoules the combination of a gas-tight chamber, a movable carrier having spaced holders extending across said chamber, a magazine for feeding ampoules to said carrier, said magazine having a receiving opening with a gas-tight closure and a gas-tight closure between the magazine and the chamber, means for feeding ampoules to said holders at one point in the path of movement of the carrier and means for sealing said ampoules while supported by said carrier.

8. In a machine for sealing ampoules the combination of a gas-tight chamber, a movable carrier having spaced holders extending across said chamber, a magazine for feeding ampoules to said carrier, said magazine having a receiving opening with a gas-tight closure and a gas-tight closure between the magazine and the chamber, means for feeding ampoules to said holders at one point in the path of movement of the carrier, means for sealing said ampoules while supported by said carrier and means for discharging the sealed ampoules at another point in the path of movement of the carrier.

9. In a machine for sealing ampoules the combination of a gas-tight chamber, a carrier within said chamber, a magazine for feeding ampoules to said carrier, said magazine having a receiving opening with a gas-tight closure and a gas-tight closure between the magazine and the chamber, a motor for operating said carrier, means for starting and stopping said motor from without

said chamber, means for feeding ampoules to said carrier at one point in its travel, means for discharging ampoules from said carrier at another point in its travel and means for heating the open end of said ampoules to seal the same while supported by said carrier.

10. In a machine for sealing ampoules the combination of a gas-tight chamber, a carrier within said chamber, a magazine for feeding ampoules to said carrier, said magazine having a receiving opening with a gas-tight closure and a gas-tight closure between the magazine and the chamber, a motor for operating said carrier, means for starting and stopping said motor from without said chamber, an electric arc positioned adjacent the path of the open end of the ampoules during the movement of said carrier and means for trimming and adjusting said arc from without said casing.

11. In a machine for sealing ampoules the combination of a gas-tight chamber, a carrier extending across said chamber, a magazine for feeding ampoules to said

carrier, said magazine having a receiving opening with a gas-tight closure and a gas-tight closure between the magazine and the chamber, a motor for operating said carrier, means for starting and stopping said motor from without said chamber, means for feeding ampoules to said carrier at one point in its travel, means for discharging ampoules from said carrier at another point in its travel, an electric arc positioned adjacent the path of the open end of the ampoules during the movement of said carrier and means for trimming and adjusting said arc from without said chamber.

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