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F. SOCCART
PISTON-ACTUATING SYSTEM

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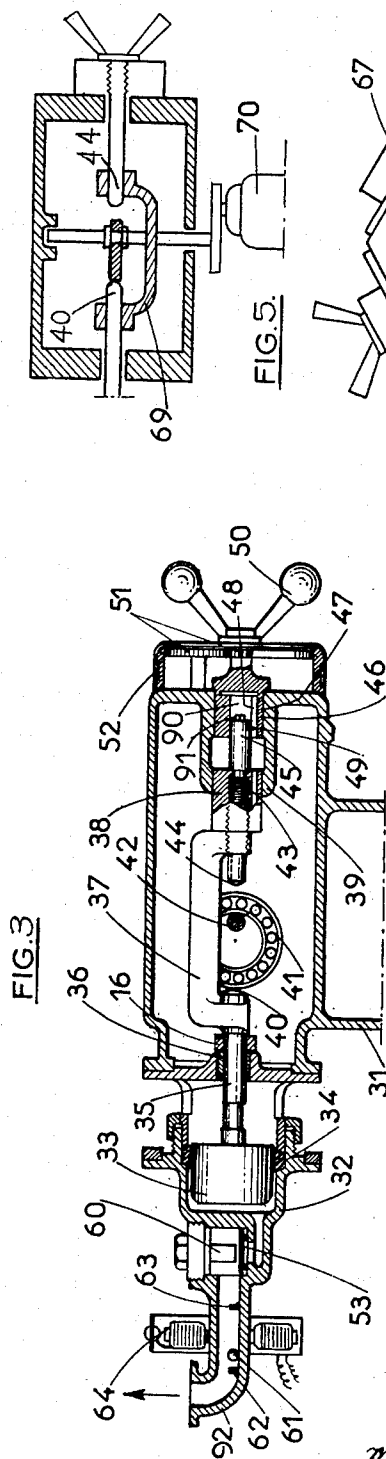


FIG. 3

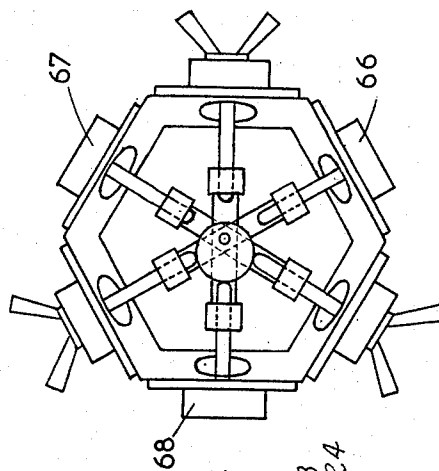


FIG. 4

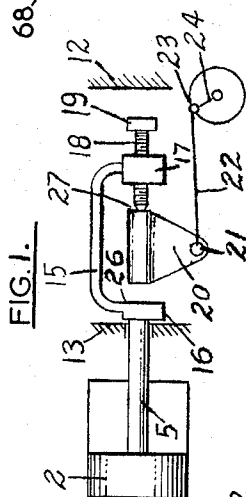


FIG. 1

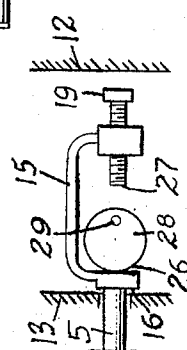


FIG. 2

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PISTON-ACTUATING SYSTEM

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6 Claims. (Cl. 74-44)

My invention relates to pumps and covers, chiefly improvements in piston pumps adapted to deliver predetermined amounts of liquid with a comparatively great accuracy in the throughput.

My invention is more particularly applicable to pumps of this type wherein the throughput may be modified and adjusted with a high accuracy, preferably during the actual operation of the pump.

My invention has for its chief object the execution of pumps of the said type which are of a comparatively simple and cheap execution while their accuracy is very high. It is applicable both to pumps with very small throughputs and to pumps with large throughputs adapted to deliver singly several cubic meters per hour.

I obtain the results referred to in accordance with the invention by producing primarily a pumping cycle in which there is provided at the end of the compression stroke an idle period of a substantial duration which has for its result to allow the complete closing of the outlet valve before the beginning of the next suction stroke; this leads to an accuracy in the throughput which is far higher than the accuracy that is obtained in prior pumps and it allows also using light valves without any springs, of a type which it was difficult to use hitherto for such purposes.

The operative circuit of the pump may furthermore and preferably incorporate also in a manner well-known per se idle periods the duration of which is substantial at the end of the suction stroke with a view to providing for a complete filling of the pump body, which cooperates also in obtaining an excellent accuracy.

My invention provides for this result by resorting to a piston sliding freely inside the pump body and including stops adapted to be actuated separately and alternately by one or more control members, the alternating actuations being separated by idle periods of substantial lengths. The shifting of the piston at both ends of the suction and delivery strokes is positively limited by stationary stops.

The actuating control member or members may be constituted in particular by one or more cams which are operative during a fraction only of their rotation or else the movable stops may be controlled by a system including a connecting rod and a crank or in any other suitable manner.

My improved arrangement is of a particularly interesting application in the case of measuring pumps, the throughput of which is to be modified and adjusted preferably during operation, independently of the adjustment of the rhythm of the movements of the piston. This adjustment may be obtained in a simple manner by adjusting the location of at least one of the stops rigid with the piston or at least one of the parts controlling said stops, this arrangement being associated with means for limiting the stroke of the piston as a function of the preceding referred to adjustment.

In these embodiments of my invention, the actuating member is adapted to act on stops rigid with the piston

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and impinging on said stops while they are still moving. This produces shocks which in the case of pumps having a small throughput are practically of a reduced magnitude, but which in the case of pumps having a large throughput may however in certain cases lead to objectionable results. According to my invention, it is possible to cut out these objectionable results by providing between the parts, which are thus brought into contact with each other, shock-absorbing means of any suitable type.

Further objects and features of my invention will appear in the reading of the following disclosure, reference being made to the accompanying drawings which illustrate, by way of example and by no means in a binding sense, various embodiments of my invention. In said drawings:

Figs. 1 and 2 shows diagrammatically two types of pumps according to my invention, illustrated by their chief component parts, said pumps having an adjustable input.

Fig. 3 is a more detailed cross-section of a pump actuated in accordance with the diagram illustrated in Fig. 2.

Figs. 4 and 5 are simplified diagrammatic showings in plan and cross-sectional views of a star-shaped arrangement of pumps.

In Fig. 1, the piston 2 carries a piston rod 5 terminating with a double bent member 15, the inner section of which 16 forms a movable stop while its outer section 17 is provided with a tapped opening inside which is threadedly engaged a screw 18 the head 19 of which forms a further movable stop, the two stops 16 and 19 adapted to impinge at the ends of the piston stroke against the cooperating stationary stops 12 and 13. Inside the bent member 15 there moves translationally a member 20 the movements of which are guided by slide-ways which are not illustrated, said member being subjected to a reciprocatory movement by a connecting rod or pitman and crank system 21, 22, 23, 24. As already mentioned, 12 and 13 designate stationary stops against which the movable stops 19 and 16 on the member 15 bear respectively at the end of the suction stroke and of the delivery stroke. It is apparent that the stroke of the piston is equal, on the one hand, to the distance separating the stops 12 and 13 minus the distance separating the movable stops 16 and 19 and on the other hand to twice the length of the crank 24 minus the clearance provided for the member 20 between the cooperating stops, respectively 26 on the inside of the bent member 15 and the end 27 of the adjustable screw, which stops face the opposite ends of said member 20. Now, by screwing more or less the screw 18 into the outer section 17 of the member 15, this reduces by a corresponding amount the clearance for the member 20 between the stops 26 and 27.

It is apparent that, if the screw 18 is sufficiently unscrewed for the distance between the stops 16 and 19 to become equal to the distance between the stops 12 and 13, the piston rod is held fast and the piston remains stationary. On the other hand, the clearance left open between the inner stops 26 and 27 for the shifting of the member 20 is equal to twice the length of the crank so that the crank may revolve freely while the member 20 reciprocates freely between the stops 26 and 27; as the screw is being screwed into the section 17, the distance between the stops 16 and 19 decreases whereby the stroke of the piston increases. At the same time the clearance provided for the member 20 between the inner stops 26 and 27 decreases and the member 20 the stroke of which is obviously constant will urge alternately towards the right hand side and towards the left hand side the stops 26 and 27 whereby the piston rod will assume a reciprocating movement.

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Now, if the screw 18 is screwed still further into the member 17, a moment comes at which the clearance provided in the member 20 between the stops 26 and 27 gives the piston its maximum stroke. It should be remarked that in this case the pump operates in the manner of a conventional pump without any idle periods at the ends of its strokes. It is obviously preferable in practice not to use the pump described under such conditions, corresponding to a zero clearance, since this cuts out immediately the advantages provided by the idle periods.

Fig. 2 illustrates a modified embodiment and more precisely a modification of Fig. 1 wherein the actuation of the pump is performed no longer through a connecting rod and crank system but through an eccentric cam 28, which takes the place of the member 20 and engages the space between the stops 26 and 27, the latter stop being constituted by the tip of the screw 18. In this case, the cam revolving round its axis 29 acts in succession on the two stops so as to give the piston a reciprocatory movement which is the same as in the preceding case. Supposing the cam is an eccentric circular cam, the stroke of the piston is equal to twice the eccentricity of the cam i.e. the distance between the centre of the cam and its rotary axis 29 minus the clearance of said cam in the space separating the stops 26 and 27, said clearance being in its turn equal to the distance between the stops 26 and 27 minus the diameter of the cam.

Fig. 3 illustrates in a more detailed manner an embodiment of a cam arrangement of the type the principle of which has been disclosed with reference to Fig. 2. In said Fig. 3, 31 designates the frame adapted to contain the mechanical control system for the piston while 32 designates the pump body carried at the end of said frame 1. Inside said pump body, is movably mounted a plunger piston 33 fluidtightness for which is obtained by means of a packing 34. The piston carries a rod 35 sliding inside a bearing 36 carrying a stop 16 for the strap 37 rigid with said rod 35 and ending with a sleeve 38, slidably engaging a bearing 39; it will be noticed that the sliding means 35 are arranged coaxially with the sliding means 38. To the front end of the strap, i.e. the end nearest the plunger piston, is secured a stop 40 adapted to cooperate with a cam 41 constituted in the particular embodiment illustrated by an eccentric ball bearing revolvably mounted with reference to the spindle 42. The actual movement of the cam is controlled by a power unit which is not illustrated, or through a suitable driving and speed reducing arrangement. The plane in which the strap 37 lies is shifted with reference to the plane of the cam 42 either towards the front of the figure or towards the rear thereof so as not to hinder the rotary movement of said cam 41 round its axis 42. Inside the sliding sleeve 38 which is tapped for this purpose, is arranged a threaded rod 43 adapted to be screwed inside said sleeve 38; the threaded rod 43 carries at its left hand end a stop 44 adapted to cooperate with the cam 41 while its right hand end forms a smooth surfaced cylinder adapted to slide inside a socket 46, which socket is revolvably carried inside a bearing 47 located beyond the bearing 39 and coaxial therewith. Said bearing 47 is however longitudinally stationary with reference to said bearing 39.

Inside the socket 46 is provided a longitudinal groove 48 engaged by a stud 49 rigid with the smooth-surfaced cylinder 45. Consequently when the socket 46 is caused to rotate, it drives through said interengaging stud 39 and groove 48 the cylinder 45 into rotation, whereby the threaded rod 43 is constrained to screw into or out of the sleeve 38 and this leads to a shifting of the unit constituted by the parts 43-44 and 45 towards the right hand side or towards the left hand side; the rotary movement of the socket 46 is obtained for instance by means of a control handle 50 rigid with said socket 46. Furthermore, a gearing 51 connects the socket 46 with a drum 52 whereby it is possible to define at any moment the

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location of the unit 43, 44, 45 inside the frame; this location defines in its turn the spacing between the stops 40 and 44 which spacing adjusts as disclosed hereinafter the stroke of the piston and consequently the throughput of the pump.

In accordance with my invention and during their reciprocatory movement, the unit including the parts 43, 44 and 45 and the sleeve 38 are shifted slidably inside the bearing 39 and inside the coaxial socket 46 and for the extreme right hand position corresponding to the end of the suction stroke, said unit abuts against the bottom 90 of the socket 46, the position of the stop formed by said bottom being adjustable at the moment of the mounting as provided for instance by a screw 91 screwed inside the rear of the cylinder 45. The latter being thus held against its stop, the strap remains stationary, the cam 41 is assumed to be in contact with the stop 44 through its part of maximum eccentricity and will engage again the stop 40 after a more or less considerable number of revolutions as defined by the adjustment of the distance separating the stops 40 and 44 which adjustment has been provided through the handle 50.

For the adjusted position corresponding to the maximum spacing between the stops 40 and 44, the cam will rotate without actuating the piston in either direction. This forms the adjustment corresponding to a zero throughput. On the other hand, for the minimum spacing between the stops 40 and 44, the cam will urge the stop 40 back as soon as it has moved away from engagement with the abutment 44. This adjustment provides a maximum stroke for the piston and consequently a maximum throughput.

The intermediate adjusted positions will produce all the intermediate throughputs between zero and a maximum.

To the front of the cylinder 32 is located the valve case provided with the input and output ports for the liquid, which ports communicate with the suction and delivery pipes located side by side as well-known in the art and of which only the delivery pipe is shown at 92 (Fig. 3).

It is possible also to describe my invention as follows, reference being made to Figs. 1 and 2 in which I may consider the arrangement as including four stops respectively at 16, 19, 13 and 12, while two thrust members 26 and 27 are carried by the piston rod to face the opposite ends of the reciprocating control member 20, the second thrust member being adjustably secured to said rod and being constituted by the tip of screw 18, which also forms advantageously the second stop 19. The control member constituted by the member 20 which assumes a reciprocating movement urges thus alternately the first and the second thrust members outwardly at the end of its stroke to make the corresponding first and second stops 16 and 19 engage correspondingly the co-operating third and fourth stops 13 and 12. Thus, the displacement of the control member 20 is equal to the distance separating the second stop 19 from the fourth stop 12 when the control member engaging the first thrust member 26 has set the first stop 16 in contact with the third stop 13 and the second thrust member 27 has been set in an extreme position for which it engages the control member on the side thereof facing away from its point of contact with the first thrust member 26.

There is also provided in accordance with my invention an arrangement inside the output pipe for checking whether the valve is in a suitable operative state. This arrangement includes chiefly a ball 61 adapted to move between two extreme stops 62 and 63. When the delivery valve operates accurately the ball is constantly held in the position illustrated i.e. in a position on the downstream end with reference to the flow of liquid.

In the case of a defective operation of the valve, the corresponding ball runs rearwardly and impinges against

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the stop 63. This movement of the ball is made apparent either by providing round it a pipe section of transparent material so as to allow direct inspection of the location of the ball or else by surrounding the delivery pipe by a magnetic or electromagnetic device 64 connected with any suitable indicating or recording means adapted to operate when the ball is shifted between its stops.

The actual measuring pump operates as follows: When the spacing between the stops 44 and 40 has been brought through action on the handle 50 to its maximum value, the rotary cam engages periodically through a sliding contact therewith said stops 40 and 44 without acting on them so that the throughput is consequently reduced to zero.

Now, if the handle 50 is operated so as to bring the unit 43-44, 45 into an intermediate position on its path such as that illustrated in the drawing for which the spacing between the stops 40 and 44 is less than in the preceding case, the cam 41 acts as it rotates during the compression stroke on the stop 40 so as to urge it back into the position illustrated. This being done, the cam continues rotating and engages after a predetermined fraction of its stroke the stop 44 so as to urge it in the opposite direction until it has returned into a position opposed to that illustrated in the drawing and for which the screw 91 on the unit 43, 44, 45, is in contact with the bottom 90 of the socket 46.

The cam continuing its rotary movement will then release the stop 44 and engages again the stop 40 which urges then towards the left hand side the piston 35 to return same into the position illustrated.

The arrangement illustrated in Figs. 4 and 5 shows an arrangement of a plurality of measuring pumps, three in the case illustrated, which are actuated by a common cam. Fig. 4 is a plan view of this arrangement and Fig. 5 an axial cross section on a larger scale.

In Fig. 4, the three pumps 66, 67, 68, are located at the three apices of an equilateral triangle, the axes of their pistons converging all at the centre of said triangle. Each pump system includes as illustrated in Fig. 5, a strap 69 of a type similar to that disclosed hereinabove but a single cam 41 acts on the stops 40 and 44 provided on each of said straps so as to serve all the three pumps.

The straps of the three pumps are shifted vertically with reference to each other so that their movements may not interfere with one another, this shifted arrangement not being illustrated; it will be readily ascertained that under such conditions the cam the rotation of which is controlled for instance by a motor 70 acts in succession on the three pumps, the movement of each pump with reference to the preceding pump being shifted by 120°. This arrangement allows on the one hand, obtaining through a single cam the control of the movement of three pumps, which is an advantage for large throughputs and on the other hand it provides for this phase shifting through 120° which, if the inputs of the different pumps and their outputs respectively are interconnected, ensures an extremely uniform flow of liquid while the total power absorbed is reduced to a minimum. The arrangement which has been described with reference to Figs. 4 and 5 allows actuating three pumps through the same cam. Now it may be of interest when it is desired to obtain large throughputs to resort to a larger number of pumps controlled by the same cam. It is then of advantage to actuate simultaneously pairs of pumps in tandem relationship in which case a hexagonal arrangement such as that described allows actuating simultaneously no longer three pumps but six pumps.

What I claim is:

1. In a system for actuating a piston, the combination of a piston rod rigid with the piston and adapted to assume therewith a reciprocatory axial movement, a first stop rigid with said rod, a second stop secured to said rod at an adjustable axial distance from the first stop, a third stationary stop cooperating with said first stop on

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the side thereof facing away from the second stop, a fourth stationary stop cooperating with the second stop on the side thereof facing away from the first stop, a thrust member integral with said piston rod, a second thrust member adjustably secured to said rod with a free space between said thrust members, means for axially adjusting the position of said thrust member on the rod between two extreme positions and simultaneously maintaining said thrust member at a predetermined invariable axial distance from said second stop, a control member engaging the space between the two thrust members and adapted to assume a reciprocating movement and to urge alternately the first and the second thrust members at the ends of its stroke in an axial direction facing away from the other thrust member to make the corresponding first and second stops engage correspondingly the cooperating stationary third and fourth stops, the displacement of the control member being equal to the distance separating the second stop from the cooperating fourth stop when the control member engaging the first thrust member has set the first stop in contact with the third stop after adjustment of the second thrust member in an extreme position for which it engages the control member on the side thereof facing away from its point of contact with the first thrust member.

2. A piston-actuating system comprising a piston, a piston rod, a first stop rigid with the piston rod, a second stop adjustably secured to said piston rod at an adjustable distance from the first stop, a third and a fourth stationary stop located on the outside of the first and second stops with reference to the second and first stops respectively and defining the stroke of the piston rod, a first and a second thrust member rigid with the first and the second stop respectively, means controlling the location of the second stop axially of the piston rod and of the thrust member rigid therewith, an actuating system including a member adapted to execute a reciprocation equal to the maximum stroke to be provided for the piston between the two thrust members and to urge during the corresponding ends of its reciprocation each thrust member in a direction facing away from the other thrust member to urge the corresponding stop of the first two stops against the corresponding stationary stop.

3. In a system for actuating a piston, the combination of a piston rod rigid with the piston and adapted to assume therewith a reciprocatory axial movement, a first stop rigid with said rod, a second stop secured to said rod at an adjustable axial distance from the first stop, a third, stationary stop cooperating with said first stop on the side thereof facing away from the second stop, a fourth, stationary stop cooperating with the second stop on the side thereof facing away from the first stop, a thrust member integral with said piston rod, a second thrust member adjustably secured to said rod with a free space between said thrust members, means for axially adjusting the position of said thrust member on the rod between two extreme positions and simultaneously maintaining said thrust member at a predetermined invariable axial distance from said second stop, an eccentric cam adapted to rotate in the space between the two thrust members to urge alternately the first and the second thrust members at the ends of its stroke in an axial direction facing away from the other thrust member to make the corresponding first and second stops engage correspondingly the cooperating stationary third and fourth stops, the displacement of the extreme points of the cam along an axial line passing through its center being equal to the distance separating the second stop from the cooperating fourth stop when the control member engaging the first thrust member has set the first stop in contact with the third stop after adjustment of the second thrust member in an extreme position for which it engages the control member on the side thereof facing away from its point of contact with the first thrust member.

4. In a system for actuating a piston, the combination of a piston rod rigid with the piston and adapted to assume therewith a reciprocatory axial movement, a first stop rigid with said rod, a second stop secured to said rod at an adjustable axial distance from the first stop, a third, stationary stop cooperating with said first stop on the side thereof facing away from the second stop, a fourth, stationary stop cooperating with the second stop on the side thereof facing away from the first stop, a thrust member integral with said piston rod, a second thrust member adjustably secured to said rod with a free space between said thrust members, means for axially adjusting the position of said thrust member on the rod between two extreme positions and simultaneously maintaining said thrust member at a predetermined invariable axial distance from said second stop, a control member slidably reciprocable in the space between the two thrust members, a crank and a pitman system controlling the reciprocation of said sliding member throughout a stroke of constant length to make said control member urge alternately the first and the second thrust members at the ends of its stroke in an axial direction facing away from the other thrust member to make the corresponding first and second stops engage correspondingly the cooperating stationary third and fourth stops, the displacement of the control member being equal to the distance separating the second stop from the cooperating fourth stop when the control member engaging the first thrust member has set the first stop in contact with the third stop after adjustment of the second thrust member in an extreme position for which it engages the control member on the side thereof facing away from its point of contact with the first thrust member.

5. In a system for actuating a piston, the combination of a piston rod rigid with the piston and adapted to assume therewith a reciprocatory axial movement, an extension of the piston rod including a laterally offset section, a first stop rigid with the piston rod, a screw coaxial with the axis of the piston rod and threadedly engaging the outer end of said extension and the first end of which facing away from the first stop forms a second stop, a third, stationary stop cooperating with said first stop on the side thereof facing away from the second stop, a fourth, stationary stop cooperating with the second stop on the side thereof facing away from the first stop, a thrust member integral with the piston rod and facing the second end of the screw, said second end forming a second thrust member, a control member engaging the space between the two thrust members and adapted to assume a reciprocating movement and to urge alternately the first and the second thrust members at the ends of its stroke in an axial direction fac-

ing away from the other thrust member to make the corresponding first and second stops engage correspondingly the cooperating stationary third and fourth stops, the displacement of the control member being equal to the distance separating the second stop from the cooperating fourth stop when the control member engaging the first thrust member has set the first stop in contact with the third stop after adjustment of the second thrust member in an extreme position for which it engages the control member on the side thereof facing away from its point of contact with the first thrust member.

6. In a system for actuating a piston, the combination of a piston rod rigid with the piston and adapted to assume therewith a reciprocatory axial movement, a first stop rigid with said rod, a second stop secured to said rod at an adjustable axial distance from the first stop, a third, stationary stop cooperating with said first stop, on the side thereof facing away from the second stop, a fourth, stationary stop cooperating with the second stop on the side thereof facing away from the first stop, a thrust member integral with said piston rod, a second thrust member adjustably secured to said rod with a free space between said thrust members, means on the outside of the fourth, stationary stop for the manual, simultaneous adjustment of the first stop and second thrust member with an unvarying spacing between the latter, a control member engaging the space between the two thrust members and adapted to assume a reciprocating movement and to urge alternately the first and the second thrust members at the ends of its stroke in an axial direction facing away from the other thrust member to make the corresponding first and second stop engage the cooperating stationary third and fourth stops, the displacement of the control member being equal to the maximum stroke to be provided for the piston.

References Cited in the file of this patent

UNITED STATES PATENTS

40	648,628	McCanna	May 1, 1900
	836,234	Zeyen	Nov. 20, 1906
	838,565	McCanna	Dec. 18, 1906
	1,008,401	Woerner	Nov. 14, 1911
	1,062,377	Woerner	May 30, 1913
45	1,099,229	Woerner	June 9, 1914
	1,494,764	Wishart	May 20, 1924
	1,595,917	Owen	Aug. 10, 1926
	1,909,955	Herbsman et al.	May 23, 1933
	2,450,248	Morgan et al.	Sept. 28, 1948

FOREIGN PATENTS

	114,741	Austria	Oct. 25, 1929
	491,060	Italy	Feb. 23, 1954