

June 13, 1967

C. C. CROTHERS

3,324,904

NOZZLE CONSTRUCTION FOR FILLING MACHINES AND THE LIKE

Filed Sept. 30, 1964

2 Sheets-Sheet 1

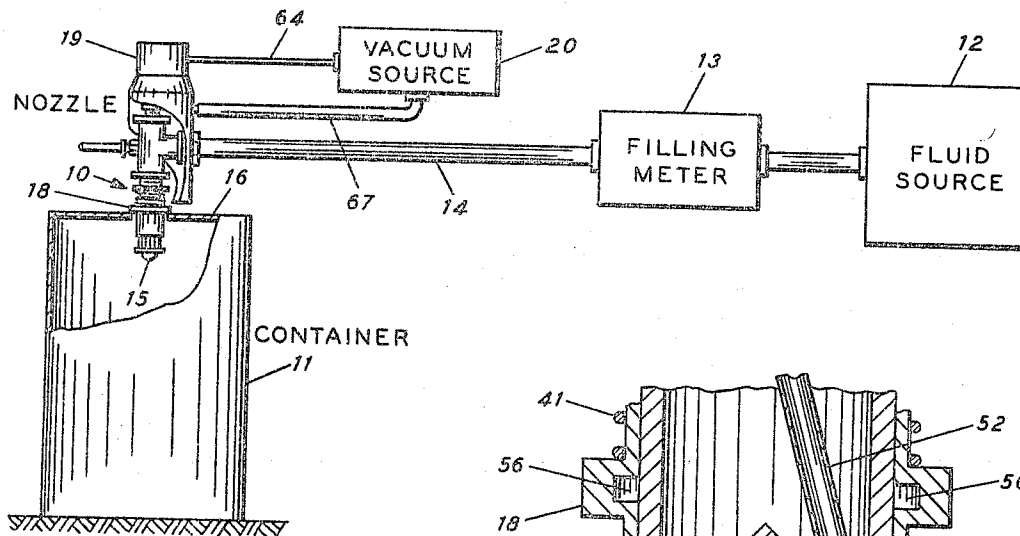


FIG. 1

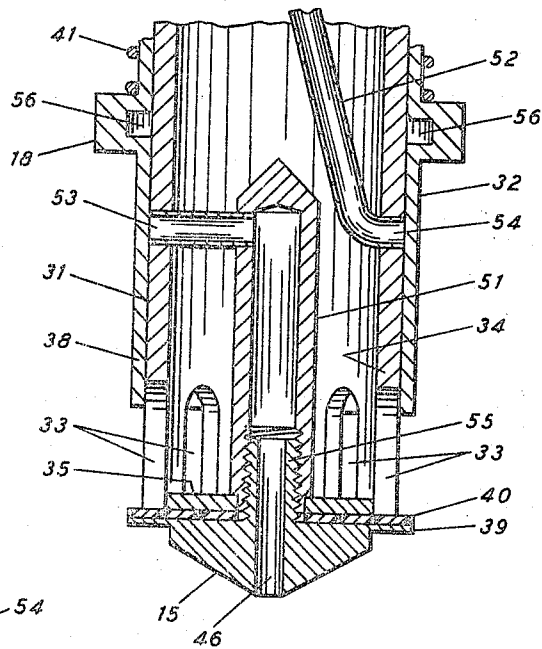


FIG. 3

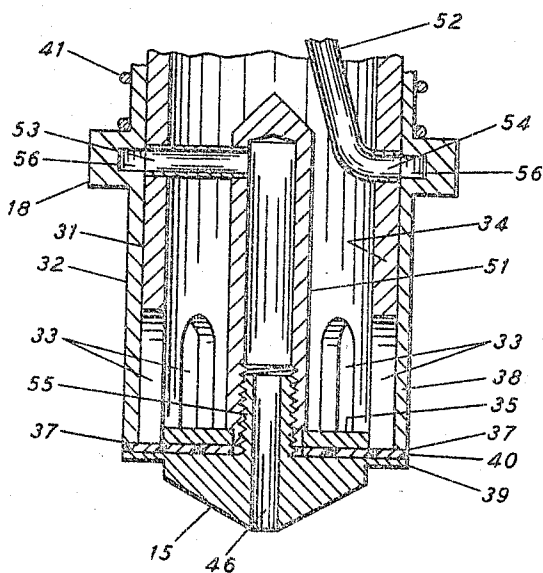


FIG. 4

INVENTOR
CLIFTON C. CROTHERS
BY *Barth L. Freeland Jr.*
George W. Watson
ATTORNEYS

June 13, 1967

C. C. CROTHERS

3,324,904

NOZZLE CONSTRUCTION FOR FILLING MACHINES AND THE LIKE

Filed Sept. 30, 1964

2 Sheets-Sheet 2

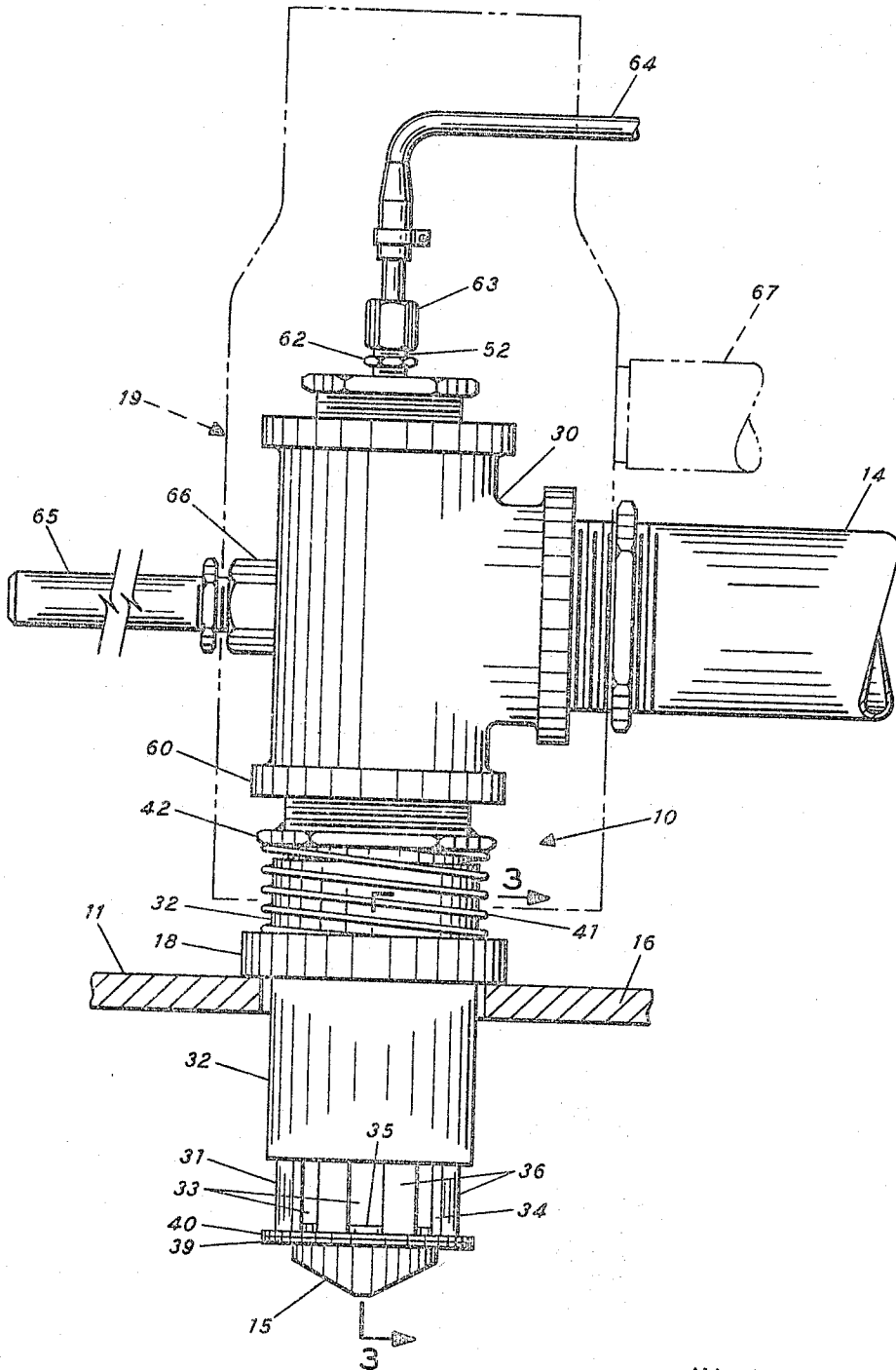


FIG. 2

INVENTOR
CLIFTON C. CROTHERS
BY *Ralph L. Treeland*
George W. Wasson
ATTORNEYS

1

3,324,904

NOZZLE CONSTRUCTION FOR FILLING MACHINES AND THE LIKE

Clifton C. Crothers, Lafayette, Calif., assignor to Chevron Research Corporation, a corporation of Delaware
Filed Sept. 30, 1964, Ser. No. 400,439
6 Claims. (Cl. 141—86)

This invention relates to nozzles, or valves, for use in conjunction with filling machines and is directed to the use of those valves in economically filling containers with toxic materials such as insecticides, fungicides, herbicides, or the like. More particularly, the invention relates to an improved filling nozzle that (1) may be opened to rapidly fill a container with toxic materials without turbulence or foaming and (2) may be closed to maintain a fixed seal between filling operations.

It is a particular object of this invention to provide an inexpensive, rugged, and dripless filling nozzle having maximum flow capacity to permit fluid to be passed rapidly into a container, minimum withdrawal capacity as a portion of the container undergoes subsurface filling, i.e., filling by a nozzle located below the fluid in the container, and minimum spillage as the nozzle is transferred from the filled container to an empty one. In carrying out this object, the filling nozzle of the present invention is constructed of spring-biased concentric telescoping cylindrical members adapted to undergo relative movement upon insertion within a bung of a container to expose a series of longitudinal slots or ports in the inner member. These slots have maximum longitudinal length to permit the fluid to pass rapidly into the container without turbulence and are spaced apart by ribs of sufficient thickness to withstand the fluid pressure during the filling operation. As the nozzle is withdrawn from the container upon completing the filling cycle, the outer member undergoes movement relative to the inner member to return to a spring-biased sealing position about the longitudinal slots in the inner member. As the slots are sealed and the nozzle transferred to an empty container a reduced atmosphere is established automatically at the tip of the nozzle by way of a vacuum source exterior of the nozzle. A vacuum line interior of the inner member serves as conduit to the tip. It is not, however, constructed of a single section, but comprises separate first and second portions connected by an annular slot in the side wall of the outer member. Consequently, by this arrangement, as the nozzle is removed from the filled container for transfer to an empty container, fluid contact is automatically established between the tip section and the vacuum source by way of these portions and the slot. But, when the nozzle is inserted within an empty container and the filling cycle is started, the suction at the tip section is automatically interrupted as the slot moves upward relative the separate portions of the vacuum line.

It has been customary in a construction of filling machines to employ check valves to control the fluid during the filling of the container. The purpose of the check valve (aside from controlling the direction of the exiting fluid) is to minimize drip between filling operations. However, experience has shown that restricting the area of the valve opening to prevent dripping has two adverse effects on filling operations, namely, (1) it unduly restricts the area of the fluid stream thereby adversely affecting the filling rate, and (2) it increases the velocity of the stream entering the container causing spattering. Additionally inasmuch as the surface tension required to retain droplets of fluid within the nozzle varies with the viscosity of the fluid, several check valves of different diameters may be needed with each filling machine.

2

Attempts have been made to physically change the check valve to increase flow rate and decrease spattering, and such improvements have usually included vacuum sources connected to the check valve to minimize drip between filling operations. However, in such cases the fluid contact between the nozzle and the vacuum source has either been maintained continuously throughout the filling and transfer cycles, or has been interrupted between filling operations by means of relatively slow, hand-operated control elements. Consequently, if a vacuum is continuously maintained, a portion of the fluid within the container may be withdrawn through the vacuum system during the filling operation. Or if the suction is periodically interrupted by the hand-operated control elements, the filling rate is adversely affected increasing operational costs.

Further objects and advantages of the present invention will become more apparent from the following detailed description of one embodiment of the invention taken in conjunction with the following drawings, in which:

FIGURE 1 is a schematic representation of the filling system using a gravity-feed nozzle in accordance with the invention;

FIGURE 2 is an elevational view, partially cut away, of the nozzle of FIGURE 1 illustrating its construction when open to fluid flow;

FIGURE 3 is a sectional view of the nozzle taken along line 3—3 of FIGURE 2; and

FIGURE 4 is an alternate sectional view of the nozzle similar to FIGURE 3 in which the nozzle is closed to fluid flow.

Referring now to the drawings and in particular to FIGURE 1, nozzle 10 constructed in accordance with the invention is illustrated as extending within container 11 for filling the latter with toxic fluids such as insecticides, fungicides, herbicides or the like. The toxic fluid is supplied to the nozzle from a source 12 through a filling meter 13 having control elements to allow an operator to control the amount of fluid passing beyond outlet pipe 14. As illustrated, to the right of the filling meter, the toxic fluid may be pressurized, while to the left of the meter the fluid flows into the container by gravity after a predetermined amount of fluid has passed beyond filling meter 13. As indicated, the tip portion or section 15 of the nozzle is located well within the container, usually located below end wall 16 by one to two inches. The nozzle will have a uniform outside diameter over most of its length but will also include an outer collar portion 18 having a diameter greater than that of the bung of the container in order to initiate opening of the nozzle as described in detail below. Furthermore, when the container is being filled with toxic materials, fumes discharged within the container can be a hazard to safety. In accordance with the invention, these fumes are exhausted by means of shroud 19 connected to vacuum source 20. The pressure above the liquid in the container is equal to the atmosphere exterior of the nozzle since there is no attempt to create a pressure-type gas seal between the nozzle and end wall 16 of the container. Since the purpose of the filling machine and nozzle is to fill a series of containers rapidly and without spillage, it is important that the nozzle maximizes flow rate of the fluid passing into each container but minimizes dripping when the nozzle is transferred from a filled to an empty container.

In accordance with the present invention, as shown in FIGURES 2 and 3, the nozzle 10 comprises a T-shaped support housing 30 connected to inner and outer telescoping members 31 and 32. Basically, the telescoping members 31 and 32 act as a valve for opening and closing the nozzle to fluid flow during the filling cycle, and have

3

an additional feature of controlling the operation of the vacuum source exterior of the nozzle. In the filling cycle, the inner and outer members 31 and 32 are arranged to move relative to one another to open circumferentially-spaced slots 33 in the inner member. The slots are located in side wall 34 above end wall 35, and each slot is separated from its neighbor by ribs 36 of sufficient width to withstand the pressure of the fluid passing from the nozzle. Each slot is normally closed to fluid flow by a fluid-tight joint 37 (FIGURE 4) formed where side wall 38 of the outer member joins enlarged boss 39. The boss 39 may be formed integrally with the inner member as by casting or can be formed integrally with tip section 15 for attachment to the inner member, as shown. To assist in forming joint 37, a washer 40 is inserted between the lower surface of the boss 39 and the lower ends of side wall 38.

Except at joint 37, the inner and outer members are not secured together. Hence as the nozzle is inserted within container 11 and collar 18 contacts end wall 16 of the container (FIGURES 1 and 2), the inner member is free to move relative to the outer member to open the slots 33 to fluid flow. Spring 41 attaches to the upper surface of collar 18 of the outer member by means of stop 42 to exert a downward force on the outer member through the collar 18, and upwardly directed force on the inner member through the stop 42. It can be observed that the rate of fluid flow through the slots is proportional to the longitudinal length of the slot parallel with the axis of symmetry of the inner member. Assuming that the relative travel length between the members will be less than the total slot length, the flow rate through the slots may thus be adjusted by changing the spring bias acting on the inner and outer members, as by altering the nozzle weight by means of a counterbalance system (not shown) attached to inlet pipe 14. Hence, to reduce turbulence for highly viscous fluids, yet ensure an adequate flow rate, the slot length may be decreased by increasing the weight of the nozzle through proper adjustment of the counterbalance system. Likewise, to assure an adequate flow rate for heavier fluids, the slot length may be increased in a similar manner, limited by the total physical length of each slot.

During the filling cycle, the vacuum source is not connected to vent port 46 in tip section 15. In FIGURE 3, there is shown the improved vacuum line in accordance with the invention to facilitate this interruption. It includes separate first and second tubular sections 51 and 52. Section 51 is L-shaped and attaches at one end to the end wall 35 of the inner member concentric to vent opening 46, and at the other end to side wall 34 of the inner member. Section 52 extends through both the inner member 31 and the support housing 30 for ultimate connection to the vacuum source 20. Its lower end attaches to the side wall 34 of the inner member at a location approximately midway between the tip section 15 and the support housing 30. As indicated, the upper end of the L-shaped section 51 and the lower end of the second section 52 do not terminate within the inner member 32, but extend through coplanar openings 53 and 54 to the exterior of the member. Consequently during the filling operation, these openings are placed in immediate contact with the inner surface of the outer member blocking fluid contact between sections 51 and 52. Thus in addition to opening the nozzle to fluid flow, the relative movement of the inner and outer members during the filling operation also prevents fluid contact between the vent opening and the vacuum source. Consequently, the fluid is not withdrawn from the container during the filling cycle even if the nozzle is operated below the surface of the fluid within the container.

In the arrangement of FIGURE 3, the lower end of the L-shaped member is secured to the end wall of the inner member by welding, and is internally threaded to accept the threaded stud 55 of the tip section 15. The

4

upper leg of the L-shaped member and the lower end of the second section 52 are attached in a similar manner to the side wall of the inner member. The locations of the attachments are shown to be diametrically opposed to each other. However, it should be understood that the location of these attachments may be varied about a circumferential path on the interior wall of the inner member as desired.

In the arrangement of FIGURE 4, slots 33 are closed to fluid flow after the nozzle has been lifted from the end wall of the container, the other member 32 undergoing downward movement relative to the inner member by means of spring 41 until the side wall 38 contacts washer 40. Openings 53 and 54 of the inner member connect respectively to the upper end of the L-shaped member 51 and the lower end of second section 52 and comprise a portion of the vacuum line connected to the vacuum source 20. When the outer member 32 contacts washer 40 to form fluid-tight joint 37 about slots 33, the openings 53 and 54 are so arranged to become aligned with slot 56 in the internal inner surface of outer member 32 to provide a connection between the adjacent ends of sections 51 and 52. Slot 56 is normally rectangular in cross section for ease of construction and usually extends the full circumference of the side wall of the outer member to provide dual paths between the severed ends of sections 51 and 52. But it is understood that a single arcuate path between these openings can be used, e.g., a slot length equal to one-half or less of the circumference of the inner member, if increased suction at the vent opening is desired.

Consequently during the transfer operation, openings 53 and 54 are placed in fluid contact by means of slot 56. Thus in addition to closing the nozzle to fluid flow, the relative downward movement of the interior and outer members during the transfer cycle also establishes a low pressure atmosphere within the vent opening. Consequently any excess fluid at the tip section 15 will not drip from the nozzle during the transfer cycle but will be withdrawn through the vent for transmission to vacuum source 20. Tip section 15 is also beveled to form an inclined surface so that the droplets may be more easily drawn into the vent.

In the present embodiment illustrated in FIGURE 2, the inner member 31 is threaded to attach to the interior of leg 60 of support housing 30. Section 52 of the vacuum line also attaches to the housing at a leg opposite to leg 60 by a bayonet connection that includes collar 62 and jam nut 63. Above the housing 30, the section 52 connects to the vacuum source by way of pliable hose 64. Surrounding the support housing is shroud 19 shown in phantom in FIGURE 2 to exhaust toxic fumes from the container during filling of the container as previously explained. Attachment is achieved by stud handle 65 threaded to weld nut 66 attached to the face of the housing. The exterior of the shroud connects by way of flexible hose 67 to the vacuum source 20.

While certain preferred embodiments of the invention have been specifically disclosed it is understood that the invention is not limited to those embodiments, as many variations will be apparent to those skilled in the art. The invention, therefore, is to be given its broadest possible interpretation in terms of the following claims.

I claim:

1. A gravity-feed, nondrip nozzle for use in subsurface filling of a series of containers with extremely dangerous fluids, comprising:

(1) a support housing connected to a source of said fluids,

(2) inner and outer telescoping cylindrical members adapted to undergo relative movement upon insertion within one of said containers, said inner member attached at one end thereof to said support housing and having a side wall and end wall remote therefrom containing at least one fluid output port and

one vent port respectively, said outer member slideably attached concentric of said inner member, and located in a normally spring-biased, sealing position about said fluid port of said inner member prior to insertion within said container,

- (3) means located within said inner member in fluid contact with said vent port of said inner member whereby reduced pressure within said means draws fluid droplets at the exterior of the nozzle into said inner member, during transference of said nozzle from container to container, said connecting means including first and second conduit sections located within said member and movable therewith and an arcuate slot formed at the interior surface of said outer member but exterior of said inner member, said first and second sections having adjacent ends adjustably terminating in contact with said slot at locations circumferentially spaced thereabout, and
- (4) means responsive to the relative movement of said inner and outer members upon insertion of the nozzle within said container during filling of said container for interrupting fluid contact between said adjacent ends of said first and second conduit sections and said arcuate slot, said adjacent ends being axially spaced from said slot in response to the relative movement of said inner and outer members, said interrupting means adapted to form a seal between said axially spaced slot and said adjacent ends.

2. In a gravity-feed system for subsurface filling of a container with extremely dangerous fluids from a source, a nondrip nozzle connected to said source comprising:

- (a) a support housing,
- (b) inner and outer cylindrical members adapted to undergo relative movement upon insertion within said container, said inner member being attached to said support housing at an end thereof and having a beveled collar portion remote from said attaching end and at least one radial fluid output port, said collar including a central vent port communicating the interior of said inner member with the exterior of said nozzle, said outer member being slideably attached concentric of said inner member in normally spring-biased sealing position about said fluid port thereof,
- (c) first and second tubular members located within said inner member having first adjacent ends terminating at locations exterior of said inner member but interior of said outer member, and second ends remote from said first ends, said first tubular member connected at said second end to said inner member to provide fluid contact with said vent opening,
- (d) a vacuum source connected to said second tubular member at said second end thereof,
- (e) said outer member including an arcuate slot formed at an interior surface connecting said first and second tubular members in fluid contact as said outer member is located in sealing contact about said fluid port of said inner member, and disconnecting said fluid contact as fluid ports are opened to passage of fluid from said source into said container.

3. In a gravity-feed system for subsurface filling of a series of containers with extremely dangerous fluids from a source thereof wherein each of said containers has an orifice formed in an end wall thereof, a nondrip nozzle connected to said source comprising:

- (a) a support housing,
- (b) inner and outer cylindrical members adapted to be inserted through said orifice into each of said container to a location below said end wall of said container,
- (c) said inner member attached to said support housing at an end thereof and having a beveled collar portion remote from said attaching end, and a series of radially located fluid ports located between said collar and said attaching end, said collar including a central vent port communicating the interior of said inner member with the exterior of said nozzle,
- (d) said outer member slideably attached concentric of said inner member in normal spring-biased sealing position about said fluid ports of said inner member and having an outer boss larger in diameter than said orifice of said container,
- (e) first and second tubular members located within said inner member having first adjacent ends terminating at radial locations circumferentially-spaced about the exterior of said inner member but interior of said outer member, said first tubular member including a second end remote from said first adjacent end and connected to said inner member concentric of said vent opening, said second tubular member including a second end remote from said first adjacent end terminating exterior of said support housing,
- (f) a vacuum source connected to said remote end of said second tubular member,
- (g) said outer member including an interior arcuate slot formed adjacent to said boss portion connecting said first and second tubular members in fluid contact with said vacuum source as said outer member is located in normal sealing contact about said fluid ports, and disconnecting said fluid contact as said fluid ports are open to passage of fluid from said source to each of said containers.
4. A nozzle as in claim 1 in which said inner telescoping cylinder member is adapted to undergo axial movement relative to said outer telescoping cylindrical member so as to open said fluid output port in said inner member to the passage of fluid from said nozzle to said container.
5. A nozzle as in claim 4 in which said outer member includes a radially extending boss adapted to contact the end wall of said container so as to initiate relative movement between said inner and outer members.
6. A nozzle as in claim 3 in which said inner cylindrical member is adapted to undergo axial movement relative to said outer cylinder member as said outer boss of said outer member contacts said end wall of said container so as to open said fluid output port in said inner member to the passage of fluid from said nozzle to said container.

References Cited

UNITED STATES PATENTS

1,136,740	4/1915	Tyson	141—117
1,837,412	12/1931	De Beck	141—117
2,665,045	1/1954	Nowakowski	141—87

H. S. BELL, Assistant Examiner.

65 LAVERNE D. GEIGER, Primary Examiner.