April 16, 1935. E. W. DAVIS 1,997,860

POWER OPERATED LUBRICANT COMPRESSOR

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Fig. 1

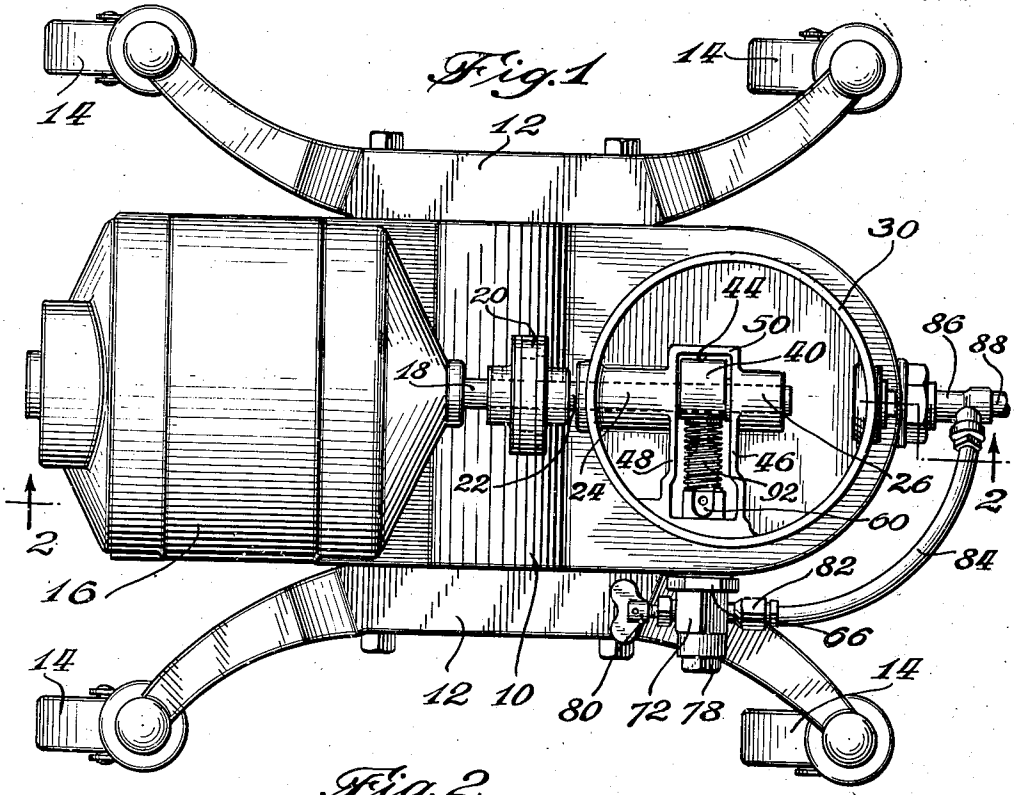
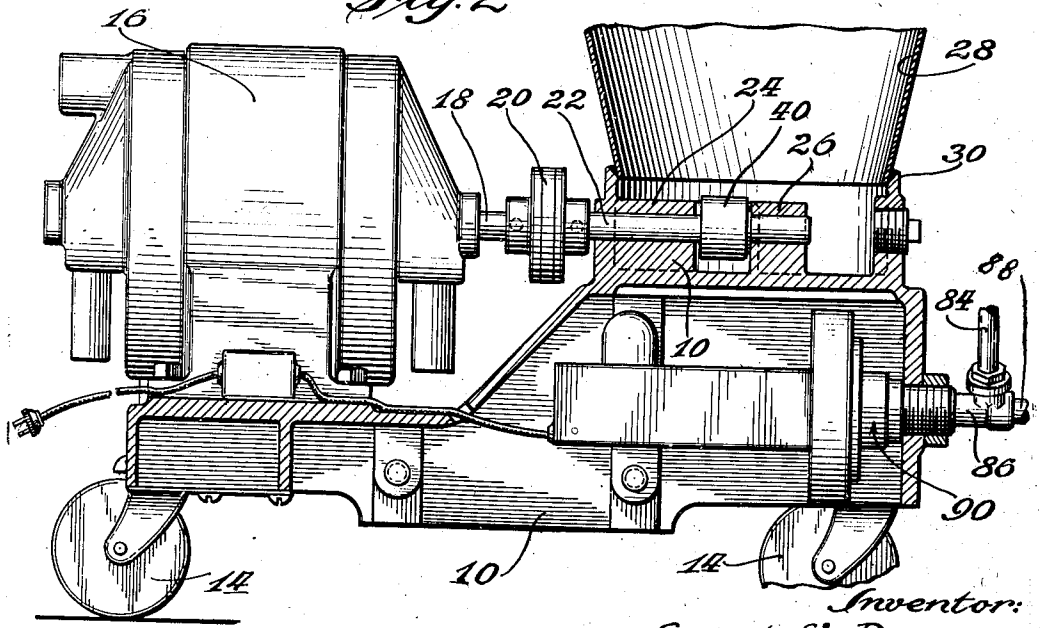


Fig. 2



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Fig. 3

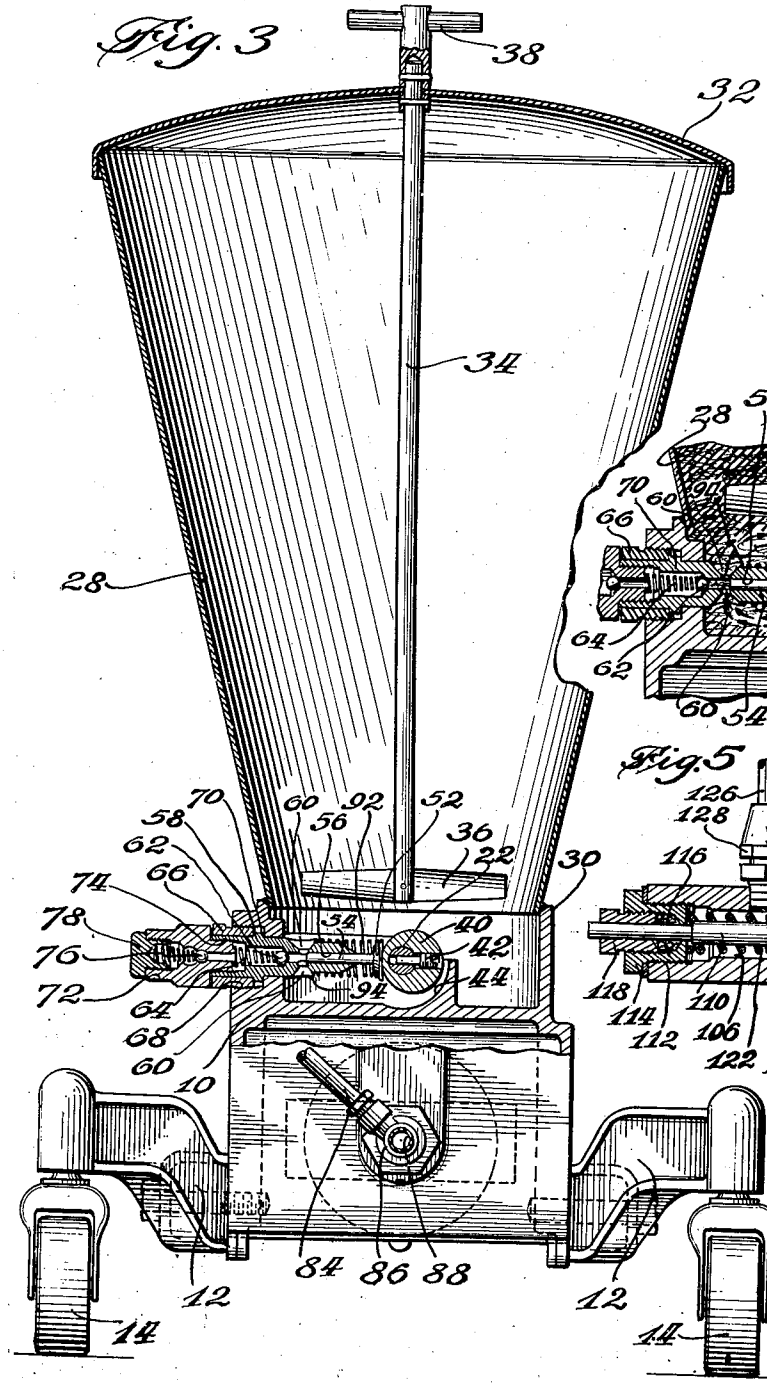


Fig. 4

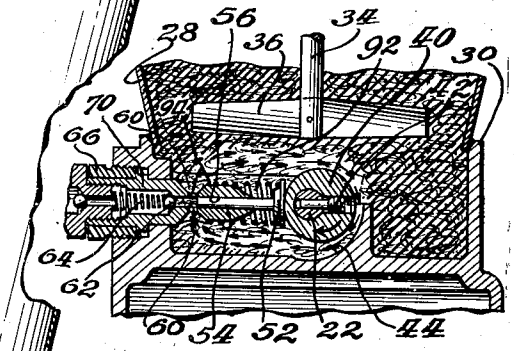
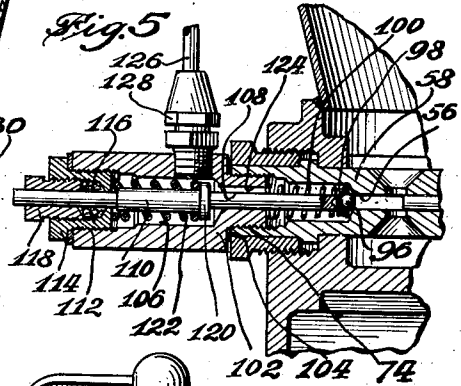


Fig. 5



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UNITED STATES PATENT OFFICE

1,997,860

POWER OPERATED LUBRICANT COMPRESSOR

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Application May 18, 1932, Serial No. 612,121

19 Claims. (Cl. 221—47.1)

My invention relates generally to lubricant compressors and more particularly to improvements in power operated lubricant compressors for supplying lubricant under high pressure.

It is an object of my invention to provide an improved lubricant compressor which is of simple construction and which will be operative to discharge heavy lubricants under high pressure.

A further object is to provide an improved lubricant compressor in which a plunger is reciprocated by a cam operating within the lubricant reservoir, the cam serving as means to aid in priming the high pressure cylinder.

A further object is to provide an improved form of outlet check valve for high pressure pumps.

A further object is to provide a lubricant compressor with a small number of parts, which has a long, useful life, which will be capable of handling various types of lubricants and which may be economically manufactured.

Other objects will appear from the following description, reference being had to the accompanying drawings, in which

Figure 1 is a plan view of the compressor with the lubricant receptacle and its connected parts removed;

Figure 2 is a central vertical sectional view thereof, taken on the line 2—2 of Figure 1;

Figure 3 is an end elevational view showing the operative parts of the compressor in vertical section;

Figure 4 is an enlarged fragmentary sectional view showing the pump plunger and cylinder and the pump operating cam; and

Figure 5 is a sectional view showing a modified form of pump outlet check valve assembly.

The compressor comprises a base casting 10 having a pair of supports 12 bolted thereto, the supports 12 being provided with suitable means at their extremities for the reception of swiveled casters 14. A motor 16 is bolted to the base casting 10 and has its armature shaft 18 connected by a flexible coupling 20 with a cam shaft 22 suitably journaled in bearings 24, 26 formed in the base casting 10. The base casting 10 has a sheet metal lubricant supply container 28 welded or otherwise secured to an upwardly extending flange 30 formed integrally with the base casting 10. The container 28 is preferably funnel-shaped and has its upper end closed by a cover 32. A stirring rod 34, having a propeller 36 secured at its lower end, is mounted for rotation relative to the cover 32 and has a handle 38 secured to its upper end.

A cam 40 is secured to the camshaft 22 by means of a set screw 42. The cam is rotatable at one end of a channel 44 formed by ribs 46, 48 and 50. The cam 40 engages a follower head 52 secured to the end of a plunger 54. The plunger 54 is reciprocable in a bore 56 formed in a cylinder 58. The plunger 54 and cylinder 58 are preferably made of extremely hard steel alloy, so that they will be capable of operation at high speed for a long period without appreciable wear.

The cylinder 58 has a pair of diametrically positioned inlet ports 60 and has its outlet port at the end of the cylinder bore 56 normally closed by a ball check valve 62 compressed against the end of the cylinder by a spring 64. The cylinder is secured in position in the base casting 10 by a bushing 66 threaded in a bore 68, the bushing engaging a flange 70 formed on the cylinder 58 and pressing the latter against the end of the bore 68. A check valve fitting 72 is threaded in an enlarged bore 74 formed in the end of the cylinder 58 and serves as a seat for the check valve spring 64. The fitting 72 is provided with a spring pressed ball check valve 76, the spring of which is supported by a plug 78. The fitting 72 is provided with a manually operable vent valve 80 and has a nipple 82 secured thereto. The nipple 82 has a conduit 84 connected thereto, the other end of the conduit being connected to a T-fitting 86. A discharge hose 88, which may be provided with the usual valved control means for making a detachable connection with the lubricant receiving fittings attached to barrels to be lubricated is connected at one branch of the T-fitting 86, the other branch communicating with a pressure-controlled switch mechanism indicated generally by the reference numeral 90. This pressure-controlled switch may be of any well known construction and is adapted to close the switch to the motor whenever the pressure in the discharge line drops below a predetermined minimum pressure, and to open the switch whenever the pressure exceeds a predetermined maximum value.

A spring 92 is compressed between a shoulder 94 formed on the cylinder 58 and the follower head 52, and normally holds the follower head in contact with the surface of the cam 40.

When the compressor is in operation, the motor rotates the cam 40 at relatively high speed. As indicated in Fig. 4, lubricant adheres to the surface of the cam 40, which rotates in the direction indicated by the arrow, and the lubricant is thus

caused to circulate in a closed path, indicated by the arrows, past the inlet ports 60 of the cylinder 58. When relatively stiff, stringy lubricant is being used, this circulation causes the lubricant to be worked up into a more plastic and fluid state, so that it will more rapidly prime the high pressure cylinder. This circulation also causes a slight heating up of the lubricant. The circulation of the heated lubricant causes the gradual softening of the lubricant lying adjacent the path of circulation so that, as lubricant is ejected by the high pressure plunger, additional lubricant will be rendered sufficiently fluid so as to be able rapidly to flow into the high pressure cylinder to prime the latter. The cam, of course, rapidly reciprocates the high pressure plunger 54 and causes ejection of the lubricant past the check valves 62 and 76 under extremely high pressure. The grease gun continues in operation until the pressure is built up to a predetermined maximum value, when the pressure-controlled switch 90 cuts out the supply of current to the motor. If and when lubricant is discharged through the discharge hose 88, causing the pressure to drop below a predetermined minimum value, the automatic pressure-controlled switch will close the circuit to the motor, whereupon the pump will immediately commence operation. It will be noted, however, that the motor is not heavily loaded upon starting. If the lubricant fails to feed to the high pressure cylinder, the propeller 36 may be manually rotated so as to force the lubricant into a position where it may be acted upon by the cam and the circulating lubricant. This will be unnecessary, however, under ordinary conditions, since the circulation of the softened and slightly heated lubricant by the cam will usually cause the lubricant continuously to feed downwardly to the high pressure pump.

If desired, the check valve construction shown in Fig. 5 may be utilized in lieu of that previously described. As shown in this figure, the cylinder 58 has the end of its bore 56 closed by a ball check valve 96. A ball retainer 98 has a central spherical portion adapted to receive the ball valve 96 and has a flange forming an abutment for a compression coil spring 100. An outlet fitting 102 is threaded in the enlarged bore 74 of the cylinder 58, a suitable gasket 104 being interposed between the fitting and the cylinder to prevent leakage of lubricant. The outlet fitting 102 is provided with a central bore 106, one end 108 of which is of reduced diameter to form a guide for a check valve stem 110, and the other end 112 of which is of enlarged diameter and threaded to receive a bushing 114. The bushing 114 forms a guide for the valve stem 110 and is recessed to receive a packing 116, the packing being held by a packing gland 118. The stem 110 has an annular flange 120 forming an abutment for one end of a relatively strong compression coil spring 122, the other end of which is seated against the inner end of the bushing 114. The stem 110 has a conical recess formed to receive the ball retainer 98 and retain the latter in a central position relative to the bore 56 of the cylinder. The fitting 102 has one or more grooves 124 cut therein to permit flow of lubricant to the bore 106 of the fitting. The discharge conduit 126 is secured in communication with the bore 106 by a suitable coupling 128.

The above described check valve construction of Fig. 5 has the great advantage that under normal conditions the lubricant pump, when operating to supply lubricant at high pressure, does not have to overcome the force of the compression spring 122, since the latter is substantially balanced by the differential pressures exerted upon the valve stem 110. When, however, the pressure in the discharge conduit is relatively low, substantially the full force of the spring 122 is exerted upon the check valve stem and the check valve 96 is therefore forced very firmly against its seat. If, for example, a particle of foreign matter becomes lodged between the check valve 96 and its seat, the pressure in the discharge line will drop, due to leakage past the check valve, thereby permitting the spring 122 to exert its full force upon the check valve, with the result that the foreign matter will be crushed between the ball and its seat. The cross sectional area of the portion of the valve stem 110 which projects through the packing gland 118, and which is exposed to atmospheric pressure, is sufficiently great that, when the compressor is operating at normal pressures, the lubricant pressure on the stem will be substantially equal to the force exerted by the spring 122. When operating under these conditions, the pressure necessary to unseat the check valve 96 need therefore be only sufficiently greater than the pressure in the discharge line to overcome the pressure of the spring 100. The use of this ball check valve construction makes it possible to operate the compressor with a minimum consumption of electric power and yet provides an outlet check valve which will seat properly under all conditions of operation. It will be understood that when the pressure in the discharge line is relatively high, the lubricant pressure on the ball check will itself exert a force upon the ball sufficient to force it tightly against its seat.

While I have shown and described a particular embodiment of my invention, it will be apparent to those skilled in the art that various modifications in design and construction may be made without departing from the spirit of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a lubricant compressor, the combination of a lubricant supply chamber, a cam associated therewith rotatable within the lubricant in said chamber, and a pump mechanism operated by said cam, said pump mechanism having a fixed inlet port adjacent said cam whereby lubricant will be forced by said cam toward said inlet port.

2. Lubricating apparatus of the class described comprising a lubricant receptacle, a motor driven cam rotatably mounted adjacent the bottom of said receptacle, the bottom of said receptacle having a channel formed therein beneath said cam and extending laterally thereof, and a high pressure lubricant pumping mechanism operated by said cam and having a fixed inlet port located adjacent said channel whereby lubricant circulated through said channel by said cam will flow past said inlet port to aid in rapid priming of said pumping mechanism.

3. In a high pressure lubricant compressor for the discharge of stiff viscous lubricants, the combination of a lubricant reservoir, a motor driven cam mounted for rotation adjacent the bottom of said reservoir, a pump cylinder removably secured at the bottom of said reservoir, said pump cylinder having an inlet port, a plunger reciprocable and rotatable in said cylinder and having a follower head engageable with said cam, a spring for holding said follower head in contact with said cam, and walls partially surrounding said cam and said cylinder to form an open channel for conducting lubricant advanced by said cam to the inlet port of said cylinder.

4. In a lubricant compressor, the combination of a high pressure reciprocating plunger pump having an inlet port, a cam directly engageable with the plunger of said pump for reciprocating the latter, and means including said cam for circulating and recirculating a quantity of lubricant greatly in excess of the volumetric capacity of said pump past the inlet port thereof.

5. In an apparatus for discharging relatively heavy greases at high pressure, the combination of a high pressure pump having an inlet port, an open channel adjacent the inlet port of said pump, and common means for operating said pump and circulating a quantity of lubricant in excess of the volumetric capacity of said pump past the inlet port thereof.

6. A lubricant compressor for the handling of relatively heavy greases comprising a high pressure pumping mechanism and power means for driving said mechanism, a cam forming a driving connection between said power means and said pump, and means forming an open channel for receiving lubricant adhering to said cam and conducting it to the inlet of said pump.

7. A high pressure grease compressor comprising a base casting having an open channel formed therein, a driving element mounted in said casting and movable above said channel, means for supplying lubricant to said channel, a high pressure pump having an inlet port and operated by said driving element, said pumping means being located adjacent said channel and having its inlet port positioned to be supplied with lubricant circulated through said channel by said driving element, whereby said pumping mechanism will be rapidly and effectively primed.

8. In a high pressure lubricant compressor, the combination of lubricant pumping means, a lubricant discharge conduit, a check valve having a seat between said pumping mechanism and said discharge conduit, and a spring pressed element having a portion thereof exposed to atmospheric pressure, said element engaging with said check valve to hold the latter against its seat.

9. In lubricating apparatus of the class described, the combination of a pumping mechanism, an outlet check valve for said mechanism, a stem having one end thereof exposed to atmospheric pressure and the other end thereof engageable with said check valve, and a relatively strong spring engageable with said stem to force the latter in a direction to engage and seat said check valve.

10. In lubricating apparatus of the class described, the combination of pumping mechanism, an outlet check valve, a relatively light spring for holding said check valve in closed position, a relatively strong spring operable upon said check valve to force it to its closed position, and means associated with said strong spring to decrease the pressure applied thereby to said check valve when the lubricant pressure on said check valve tending to close the same is increased.

11. In a lubricant compressor for discharging lubricant under high pressure, the combination of a pumping mechanism having an outlet valve seat, a valve engageable with said seat, a relatively light spring for holding said valve on its said seat, a relatively strong spring for holding said valve on its seat, and lubricant pressure operated means for reducing the effective force of said relatively strong spring.

12. In apparatus of the class described, the combination of a pumping mechanism having a discharge port, a check valve for closing said port, and means for applying a variable force to said check valve in a direction to seat the same, said force being determined by the lubricant pressure on the discharge side of said check valve.

13. In apparatus of the class described, the combination of a lubricant pumping mechanism, an outlet check valve therefor, means for applying a relatively constant resilient force to hold said check valve upon its seat, and resilient means for applying an additional force on said valve in a direction to seat the same, said last named means exerting an effective force responsive to the pressure of the lubricant on the discharge side of said check valve.

14. A high pressure lubricant compressor comprising a lubricant container, a disc cam mounted for rotation within said lubricant container, power means for rotating said cam at relatively high speed, a plunger having its end engageable with said cam, a cylinder for said plunger, said cylinder having an inlet port therein, and means including an open channel for conducting lubricant agitated by said cam to said inlet port.

15. In combination, a lubricant compressor having a unitary base casting, a motor and a lubricant container mounted thereon, a cam shaft connected to be rotated by said motor and journaled in bearings formed in said base casting, an eccentric cam secured to said shaft and positioned at the bottom of said container in contact with lubricant contained therein, a pumping mechanism positioned in the bottom of said container and having a moving part operated by said cam, said pump having a stationary inlet port, and means formed integrally with said base casting for conducting lubricant agitated upon rotation of said cam toward said inlet port.

16. In a high pressure lubricant compressor, the combination of a lubricant container, a cam mounted for rotation near the bottom of said reservoir, an open channel adjacent said cam to receive lubricant agitated and fed by said cam, and a high pressure pump having a stationary inlet port positioned to receive lubricant from said channel.

17. In a high pressure lubricant compressor, the combination of a lubricant container, a disc cam mounted for rotation near the bottom of said container, and a high pressure pump driven by said cam and having an inlet port positioned to receive lubricant displaced by said cam, and an open channel for conducting lubricant from said cam to said inlet port.

18. In high pressure greasing apparatus, the combination of a reservoir, a high pressure pump supplied therefrom and having a fixed inlet port, and a stationary cam located within said reservoir to actuate said pump and forming means to feed lubricant thereto.

19. In a high pressure grease feeding apparatus, the combination of a grease supply chamber, a pump having a stationary inlet port in communication with said chamber, a rotating cam in said chamber, said cam being arranged to drive said pump and feed lubricant from said chamber thereto, an open channel for conducting lubricant from said cam to said inlet port, and power means for rotating said cam at high speed.

ERNEST W. DAVIS.

CERTIFICATE OF CORRECTION.

Patent No. 1,997,860. April 16, 1935.

ERNEST W. DAVIS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 60, claim 18, for "stationary" read disc; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of June, A. D. 1935.

Bryan M. Battey

(Seal)

Acting Commissioner of Patents.