An improved lid lifter and drop sleeve mechanism is mounted on the bottom of a larry car and is utilized to remove a lid or cover from a coke oven charging hole and to conduct a charge of coal to the charging hole. The lid lifter and drop sleeve mechanism includes a linkage assembly which is actuated by a single operating motor to lower an electromagnet which is energized and rotated to free the cover. The operating motor is then reversed and return springs operate the linkage assembly to raise the electromagnet and cover. Actuation of a single traversing motor moves the raised electromagnet and cover away from the charging hole and positions a drop sleeve assembly in alignment with the charging hole. The linkage assembly is then actuated by the operating motor to lower a smoke or drop sleeve member into engagement with the entrance to the charging hole and a charge of coal is delivered from the larry car through the drop sleeve assembly to the coke oven. The operating motor is then actuated to enable the return springs to again operate the linkage assembly to raise the sleeve member. The traversing and operating motors are then activated in sequence to move the electromagnet back into alignment with the charging hole and return the cover.

17 Claims, 8 Drawing Figures
LID LIFTER AND DROP SLEEVE MECHANISM

BACKGROUND OF THE INVENTION

This invention relates generally to a lid lifter and drop sleeve mechanism which is utilized in connection with a larry car or other vehicle to charge a coke oven.

There are many known mechanisms for removing the lid or cover from a charging hole of a coke oven. In addition, there are many known drop or smoke sleeve mechanisms which are utilized to conduct a charge of coal to the open charging hole. One of these known mechanisms is disclosed in U.S. Pat. No. 2,981,423 and utilizes a plurality of motors to move a carriage and swing a cover away from the charging hole of a coke oven with a lowered trip rod. As the cover is swung away from the charging hole, a drop sleeve is moved into alignment with the charging hole. In addition to the motors for moving the carriage, a pair of motors are provided to raise and lower the trip rod and to raise and lower the drop sleeve. Of course, the motors for moving the carriage and the two motors for moving the drop sleeve and trip rod are subjected to relatively high temperatures and severe operating conditions and may require frequent maintenance.

SUMMARY OF THE PRESENT INVENTION

The present invention provides a new and improved lid lifter and drop sleeve mechanism which utilizes a single operating motor and return springs to raise and lower a lid lifter and to extend and retract a drop sleeve assembly. This is accomplished by utilizing the operating motor to actuate a linkage assembly to lower a lid lifter when the operating motor is actuated in a first direction from an initial condition and to extend a drop sleeve when the operating motor is actuated in a second direction from the initial condition. The return springs actuate the linkage assembly to raise the lid lifter or retract the drop sleeve.

The lid lifter includes an electromagnet which is lowered into engagement with a cover or lid for a charging hole. Once the electromagnet has magnetically gripped the cover, a motor is activated to rotate the electromagnet to loosen the cover from the entrance to the charging hole. After the cover has been loosened, the electromagnet is raised vertically upwardly to lift the cover away from the charging hole. A traversing motor is then actuated to move the drop sleeve into alignment with the open charging hole.

Accordingly, it is an object of this invention to provide a new and improved lid lifter and drop sleeve mechanism which is reliable in operation and which will require a minimum of maintenance.

Another object of this invention is to provide a new and improved lid lifter and drop sleeve mechanism having a single operating motor for lowering a lid lifter and for extending a drop sleeve assembly.

Another object of this invention is to provide a new and improved lid lifter and drop sleeve mechanism having a linkage assembly which is actuated to raise and lower a lid lifter and to extend and retract a drop sleeve assembly, and wherein a return spring arrangement actuates the linkage assembly to raise the lid lifter and retract the drop sleeve assembly.

These and other objects and features of the present invention will become more apparent upon a consideration of the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a schematic illustration depicting a larry car in association with a plurality of lid lifter and drop sleeve mechanisms constructed in accordance with the present invention;

FIG. 2 is a partially broken away side elevational view of one of the lid lifter and drop sleeve mechanisms of FIG. 1, the lid lifter and drop sleeve mechanism being shown with a magnet of a lid lifter assembly in vertical alignment with a cover for a charging hole of a coke oven;

FIG. 3 is a schematic illustration of the lid lifter and drop sleeve mechanism of FIG. 2, the lid lifter being shown in a lowered position engaging the charging hole cover;

FIG. 4 is a schematic illustration, generally similar to FIG. 3, illustrating the lid lifter assembly in a raised position to one side of the charging hole and a drop sleeve assembly in vertical alignment with the entrance to the charging hole;

FIG. 5 is a schematic illustration depicting the drop sleeve assembly in an extended condition forming a chute between a discharge opening for the larry car and the entrance to the charging hole;

FIG. 6 is a plan view, taken generally along the line 6--6 of FIG. 2;

FIG. 7 is a partially broken away fragmentary schematic illustration of a portion of a linkage assembly for raising and lowering the lid lifter assembly and extending and retracting the drop sleeve assembly;

FIG. 8 is a schematic illustration depicting hydraulic circuitry for effecting operation of the lid lifter and drop sleeve mechanism.

DESCRIPTION OF ONE PREFERRED EMBODIMENT

A larry car 10 is equipped with lid lifter and drop sleeve mechanisms 12 constructed in accordance with the present invention. The larry car 10 is shown in FIG. 1 in association with a horizontal coke oven battery having three charging holes or entrances 14 which are blocked by circular iron covers or lids 16. The lid lifter and drop sleeve mechanism 12 includes a lid lifter assembly 20 for removing the cover 16 from each of the charging holes 14 in turn and a drop sleeve assembly 22 for conducting a charge of coal from a larry car discharge opening 26 to an open charging hole.

The lid lifter assembly 20 includes an electromagnet 28 which is moved from a raised position (FIG. 2) to a lowered position (FIG. 3) and energized to magnetically grip one of the covers 16. The lid lifter assembly 20 is then raised and moved on a carriage 30 (FIG. 6) relative to the stationary larry car. This movement of the carriage 30 positions the drop sleeve assembly 22 in vertical alignment with the charging hole 14 and discharge opening 26.

The drop sleeve assembly 22 is then operated from the retracted position of FIG. 4 to the extended position of FIG. 5 to provide a chute to conduct a charge of coal to the entrance of the open charging hole 14. Once the coke oven has been charged, the drop sleeve assembly 22 is retracted and the carriage 30 is moved to align the lid lifter assembly 20 with the open charging hole. The lid lifter assembly 20 is then operated to lower the electromagnet 28 and lid 16 to the position shown in FIG. 3 to again block the opening to the charging hole 14. The electromagnet 28 is then de-energized and moved back to the raised position of
FIG. 2 to enable the larry car to move along the coke oven battery to the next charging hole.

The lid lifter assembly 20 is moved between the raised and lowered positions and the drop sleeve assembly 22 is extended and retracted upon actuation of a linkage assembly 32 (FIG. 2) which connects them with a single double acting operating motor 34. The linkage assembly 32 includes a lid lifter linkage 38 which moves the electromagnet 28 along a substantially vertical path between the raised and lowered positions. The lid lifter linkage 38 includes a pair of parallelogram type linkage arrangements 40 and 42 (see FIG. 6) adjacent to opposite sides of the carriage 30. Since the linkage arrangements 40 and 42 are of identical construction, only the linkage arrangement 40 will be fully described in order to avoid prolixity of description. However it should be understood that the linkage arrangement 42 is of the same construction and operates in the same manner as does the linkage arrangement 40.

The linkage arrangement 40 includes a pair of links 46 and 48 which are pivotally mounted on upper and lower horizontal support shafts 52 and 54. The opposite ends of the links 46 and 48 are pivotally connected at 58 and 60 with a movable platform 62 on which the electromagnet 28 is mounted.

When the single operating motor 34 is extended in a forward direction (toward the right as viewed in FIG. 2) an actuator linkage 66 swings the links 46 and 48 in a clockwise direction about the support shafts 52 and 54 to lower the support platform 62 and electromagnet 28 from the raised position of FIG. 2 to the lowered position of FIG. 3. When the lowered electromagnet 28 has been energized to magnetically grip the lid 16, a motor 70 on the platform 62 is energized to rotate a horizontally extending drive shaft 72 which is connected with a gear box 74. Rotation of the drive shaft 72 operates the gear box 74 to rotate a vertical shaft 76 and the electromagnet 28. The electromagnet 28 is advantageously provided with downwardly projecting lugs or ribs 80 (see FIG. 2) to engage suitable projections on the lid 16 to positively rotate the lid as the electromagnet 28 is rotated about its vertical central axis.

After the lid 16 has been broken loose by rotation of the electromagnet 28, the electromagnet and magnetically gripped lid 16 are raised upwardly by the interaction between a pair of return springs 86 and 88 (see FIGS. 2 and 6) and the linkage arrangements 40 and 42. The return springs 86 and 88 are stretched or elongated (see FIG. 3) when the operating motor 34 actuates the linkage 38 to lower the electromagnet 28. When the direction of operation of the motor 34 is reversed, the linkage 38 releases the return springs 86 and 88 so that their natural resilience causes them to move the lid lifter assembly 28 from the lowered position in FIG. 3 to the raised position of FIG. 2. Since the lid lifter 28 is raised by the action of the return springs 86 and 88, in the event of a malfunctioning of the motor 34, the return springs will raise the lid lifter 20 so that the larry car 10 can be moved relative to the coke ovens.

Once the electromagnet 28 has been returned to the raised position of FIG. 2 with an engaged lid 16, a traversing motor 116 (see FIG. 2) is operated to move the carriage 30 from the pickup position shown in FIG. 2 to the charging position shown in FIG. 4. When the carriage 30 is in the charging position, the drop sleeve assembly 22 is in vertical alignment with the now open charging hole 14 and the discharge opening 26 from the larry car 10. When the drop sleeve assembly 22 has been moved to this position, the operating motor 34 is actuated to operate the linkage 92 and extend the drop sleeve assembly 22 to form a chute extending from the discharge opening 26 to the charging hole 14.

To extend the sleeve assembly 22 when the carriage 30 is in the charging position of FIG. 4, the operating motor 34 actuates the sleeve linkage 92. The sleeve linkage 92 includes a pair of identical linkage arrangements 96 and 98. The linkage arrangement 96 includes a main link 102 which is pivotally mounted on the upper horizontal support shaft 52 and is connected with a movable smoke or drop sleeve 104 by a connector link 106. The opposite linkage arrangement 98 also includes a main link 110, (see FIG. 6) which is connected with the smoke sleeve 104 by a connector link 112.

Upon actuation of the operating motor 34 in the reverse or backward direction (that is toward the left as viewed in FIG. 2), the sleeve assembly 22 is extended by moving the sleeve member 104 downwardly relative to a sleeve member 114 connected to the carriage 30. Thus upon reverse actuation of the motor 34, the actuator linkage 66 pivots the main links 102 and 110 of the drop sleeve linkage 92 in a counterclockwise direction (as viewed in FIG. 4) about the support shaft 52 to move the sleeve member 104 from the retracted position of FIG. 4 to the extended position of FIG. 5. The return springs 86 and 88 are connected between the lid lifter linkage 38 and the drop sleeve linkage 92 so that the return springs 86 and 88 are both stretched or elongated upon extension of the drop sleeve assembly 22. Therefore, if the motor 34 should malfunction, the return springs 86 and 88 will move the drop sleeve 104 from the extended position of FIG. 5 back to the retracted position of FIG. 4.

When the drop sleeve assembly 22 is extended, the drop sleeve assembly provides a chute for conducting a charge of coal from the larry car outlet 26 to the charging hole 14 in the manner illustrated schematically in FIG. 5. Once the charge of coal has passed through the extended drop sleeve assembly 22 into the charging hole 14, the operating motor 34 is operated in the forward direction. This enables the return springs 86 and 88 to move the drop sleeve linkage 92 back to the unoperated position of FIG. 4 and retract the drop sleeve assembly 22.

When the coke oven has been charged and the drop sleeve assembly 22 retracted, the cover 16 must be returned to again block the entrance to the charging hole 14. Accordingly, the traversing motor 116 is then activated to move the carriage 30 from the charging position (FIG. 4) to the pickup position (FIG. 2). This moves the lid lifter 20 back into vertical alignment with the open charging hole 14. The operating motor 34 is then activated to lower the electromagnet 28 and move the cover 16 back into engagement with the entrance to the charging hole 14 (FIG. 3). Electromagnet 28 is then de-energized and moved to the raised position of FIG. 2 by the return springs 86 and 88.

The actuator linkage 66 is effective to operate the lid lifter linkage 38 when the motor 34 is operated in a forward direction and is effective to operate the drop sleeve linkage 92 when the motor 34 is operated in the
reverse direction. The actuator linkage 66 includes a pair of upright operating arms or levers 122 and 124 which are fixedly connected to the shaft 52 (see FIGS. 6 and 7). When the operating motor 34 is operated in the forward direction (toward the right as viewed in FIG. 6), a drive link 128 pivots the arm 122 and shaft 52 in a clockwise direction (as viewed in FIG. 7). As the arm 122 is pivoted, a forward or drive surface 132 presses against a surface 134 on a bifurcated end portion of the link 46 and pivots the link to lower the lid lifter assembly 20. Of course, when the direction of operation of the motor is subsequently reversed, the return spring 86 will raise the lid lifter assembly 20 in the manner previously explained.

During the clockwise rotation of the arm 122, the shaft 52 moves arm 124 in a clockwise direction away from a drive surface 140 (FIG. 7) on the main link 102 of the drop sleeve linkage 92. Since the main link 102 for the drop sleeve linkage 92 is rotatably or pivotally mounted on the shaft 52, the shaft 52 turns in a clockwise direction without effecting movement of the main link. Therefore, the drop sleeve assembly 92 remains in the retracted position of FIG. 2 as the lid lifter is lowered.

When the drop sleeve assembly 22 is to be extended, the motor 34 is operated in the reverse or backward direction (that is toward the left as viewed in FIG. 6) to pivot the linkage arms 122 and shaft 52 in a counterclockwise direction (as viewed in FIG. 7). This counterclockwise movement of the shaft 52 causes the link arm 124 to press against the drive surface 140 in the bifurcated end portion of the main link 102. Continued counterclockwise movement of the actuator arm 124 causes the main link 102 to pivot about the shaft 52 to extend the drop sleeve assembly 22. When the motor 34 returns to its centered or initial position, the return springs 86 and 88 move the link 102 in a clockwise direction (as viewed in FIG. 5) about the support shaft 52 to retract the drop sleeve assembly 22.

When the motor 34 operates the actuator linkage 66 to extend the drop sleeve assembly 22, the actuator arm 122 moves away from the drive surface 134 on the link 46 (FIG. 7). Therefore, the link 46 and lid lifter 20 remain stationary while the actuator arm 134 and support shaft 52 rotate in a counterclockwise direction (as viewed in FIG. 7). When the drop sleeve assembly 52 is being retracted under the influence of the return springs 86 and 88, the actuator arm 122 and support shaft 52 are moved in a clockwise direction (as viewed in FIG. 7) toward the link 46 to return the linkage assembly 32 to its normal or unactuated position (see FIG. 2).

The actuator linkage 66 is connected with the linkage arrangements 42 and 98 on the opposite or far side of the lid lifter and drop sleeve mechanism 12 by a horizontal cross or connector shaft assembly 148 (see FIG. 6) which is connected with the actuator link 128 and operating motor 34. The cross shaft 148 is connected by a link 152 with the linkage arrangement 98 of the drop sleeve linkage 92 in the manner previously explained in conjunction with linkages 40 and 96. Thus, the actuator linkage 66 includes a second set of operating arms 156 and 158 which are fixedly connected to the rotatable support shaft 52 in the same manner as are the actuator arms 122 and 124. The actuator arms 156 and 158 actuate the linkage arrangements 42 and 98 in the manner previously explained in connection with the actuator arms 122 and 124 and the linkage arrangements 40 and 96.

It should be noted that only a single motor 34 is utilized to operate both the lid lifter assembly 20 and the drop feed assembly 22. This motor 34 is of the piston and cylinder type and is easily maintained. However, due to the relatively severe operating conditions under which the lid lifter and drop sleeve mechanism 12 are utilized, the motor 34 may for some unforeseen reason malfunction. If this occurs, the return springs 86 and 88 will move the lid lifter 20 and drop sleeve assembly 22 to their raised and retracted conditions so that the lorry car 10 can move relative to the coke ovens.

In the illustrated embodiment of the invention, the return springs 86 and 88 extend between connections 160 and 162 (FIG. 6) to the main links 102 and 110 and connections 164 and 166 to the platform 62. Since the lid lifter linkage 38 is also connected to the platform 62, the return springs 86 and 88 are effectively connected between the lid lifter linkage 38 and drop sleeve linkage 92. Therefore, the return springs 86 and 88 are stretched whenever one of these linkages is actuated by the motor 34. It should be understood that the specific location of the connections between the linkages 38 and 92 and the return springs 86 and 88 could be varied if desired.

The single traversing motor 116 is also of the piston and cylinder type and is axially aligned with the operating motor 34. The piston rod on the traversing motor 116 is connected with the carriage 30 which is supported by wheels 170 which are disposed in rolling engagement with a pair of parallel tracks on the bottom of the lorry car 10. The cylinder end of the motor 116 is connected with the lorry car so that the carriage 30 is shifted relative to the lorry car to align either the lid lifter assembly 20 or the drop sleeve assembly 22 with a charging hole when the traversing motor 116 is operated.

A hydraulic control circuit for controlling the operation of the traversing and operating motors 116 and 34 is shown schematically in FIG. 8. When a solenoid valve 176 is actuated toward the right from the neutral position shown in FIG. 8, fluid under pressure is ported from a high pressure or fluid supply line 180 through an internal valve passage 186 to a conduit 188 leading to the head end of the piston and cylinder type motor 34. This extends the operating motor 34 toward the right as viewed in FIGS. 2 and 6 to lower the lid lifter assembly 20.

When the lid lifter assembly 20 is to be raised, it is merely necessary to operate the valve 176 to its neutral position. When the valve 176 is in neutral, the rod and head ends of the motor 134 are connected with a drain or tank conduit 192 by conduits 188 and 194 and by internal passages 196 in the valve 176. The return springs 86 and 88 are then effective to retract the motor 34 and move the lid lifter assembly 20 to the raised position of FIG. 2.

Similarly, when the drop sleeve assembly 22 is to be extended, the valve 176 is actuated toward the left of the position shown in FIG. 8 to connect the conduit 194 with the pressure supply line 180 and the conduit 188 with the drain line 192 through internal valve passages 200. Of course, this retracts the operating motor 34 from the initial or center position of FIGS. 2 and 6 to actuate the drop sleeve linkage 92 and extend the drop sleeve assembly 22. When the valve 176 is re-
for operating said first linkage to move said lid lifter means from the raised position to the lowered position upon operation of said single motor means in a first one of said two directions and for operating said second linkage to move said sleeve means from the retracted condition to the extended condition upon operation of said single motor means in a second one of said two directions.

3. An apparatus as set forth in claim 2 further including spring means for operating said first linkage to move said lid lifter means from the lowered position to the raised position upon operation of said single motor means in the second direction with said lid lifter means in the lowered position and for operating said second linkage to move said sleeve means from the extended condition to the retracted condition upon operation of said single motor means in the first direction with said sleeve means in the extended condition.

4. An apparatus as set forth in claim 3 wherein said lid lifter means includes an electromagnet and drive means for rotating said electromagnet about a vertical axis, said first linkage including means for moving said electromagnet along a vertical path upon movement of said lid lifter means between the raised and lowered positions.

5. An apparatus as set forth in claim 4 wherein said sleeve means includes a sleeve member, said second linkage including means for moving said sleeve member along a vertical path extending parallel to the axis of rotation of said electromagnet upon operation of said sleeve means between the extended and retracted conditions.

6. An apparatus as set forth in claim 5 further including second motor means for moving said lid lifter means and said sleeve means along a horizontal path between a first position in which the axis of rotation of said electromagnet extends through the entrance of the coke oven and said sleeve member is disposed to one side of the entrance to the coke oven and a second position in which said sleeve member is aligned with the entrance to the coke oven.

7. An apparatus for use in association with a vehicle to charge a coke oven, said apparatus comprising a carriage movable relative to the vehicle between a lid lifting position and a charging position, an electromagnet mounted on said carriage, said electromagnet being movable from a lowered position to a raised position to move a magnetically gripped cover vertically upwardly away from an entrance to the coke oven and toward said carriage when said carriage is in the lid lifting position and being moveable from the raised position to the lowered position to move the cover toward the entrance to the coke oven, sleeve means moveable between a retracted condition and an extended condition in which said sleeve means is effective to conduct materials to the entrance to the coke oven, linkage means for moving said lid lifter means while said sleeve means is maintained in the retracted condition and for moving said sleeve means while said lid lifter means is maintained in the raised position, and single motor means for operating said linkage means to move said lid lifter means between the raised and lowered positions with said sleeve means in the retracted condition and for operating said linkage means to extend and retract said sleeve means with said lid lifter means in the raised position.

8. An apparatus as set forth in claim 7 wherein said single motor means is operable in either one of two directions, said linkage means including a first linkage connected with said lid lifter means, a second linkage connected with said sleeve means, and actuator means
tion and for operating said linkage means to move said sleeve member between the extended and retracted positions when said carriage is in the charging position, and second motor means for moving said carriage between the lid lifting and charging positions with said sleeve member in the retracted position and with said electromagnet in the raised position magnetically gripping a cover.

8. An apparatus as set forth in claim 7 further including third motor means for rotating said electromagnet about a vertical axis when said electromagnet is in the lowered position and said carriage is in the lid lifting position to facilitate moving a cover away from the entrance to the coke oven upon movement of said electromagnet from the lowered position to the raised position.

9. An apparatus as set forth in claim 8 wherein said linkage means is operable to move said third motor means with said electromagnet upon movement of said electromagnet between the raised and lowered positions.

10. An apparatus as set forth in claim 7 wherein said first motor means includes a first piston and cylinder assembly and said second motor means includes a second piston and cylinder assembly disposed in coaxial relationship with said first piston and cylinder assembly.

11. An apparatus as set forth in claim 7 wherein said linkage means includes a first linkage connected with said electromagnet, a second linkage connected with said sleeve member, and an actuator means for effecting operation of one of said linkage at a time, said actuator means being ineffective to effect operation of said second linkage when said electromagnet is in the lowered position and being ineffective to effect operation of said first linkage when said sleeve member is in the extended position.

12. An apparatus as set forth in claim 11 wherein said first motor means includes a single piston and cylinder assembly connected with said actuator means.

13. An apparatus for use in charging a coke oven, said apparatus comprising lid lifter means movable from a lowered position to a raised position to move a cover away from an entrance to the coke oven and movable from the raised position to the lowered position to move the cover toward the entrance to the coke oven, sleeve means movable between a retracted condition and an extended condition in which said sleeve means is effective to conduct materials to the entrance to the coke oven, linkage means for moving said lid lifter means while said sleeve means is maintained in the retracted condition and for moving said sleeve means while said lid lifter means is maintained in the raised position, motor means for operating said linkage means to move said lid lifter means from the raised position to the lowered position and for operating said linkage means to extend said sleeve means, and spring means for operating said linkage means to move said lid lifter means from the lowered position to the raised position and for operating said linkage means to retract said sleeve means.

14. An apparatus as set forth in claim 13 wherein said linkage means includes a first linkage connected with said lid lifter means, and a second linkage connected with said sleeve means, said sleeve means being operatively connected with said first and second linkages and being resiliently deflected upon operation of one of said linkages relative to the other of said linkages.

15. An apparatus as set forth in claim 14 wherein said motor means includes a single piston and cylinder assembly operatively connected with said first and second linkages.

16. An apparatus as set forth in claim 14 wherein said lid lifter means includes an electromagnet, said first linkage including means for moving said electromagnet downwardly under the influence of said motor means and against the influence of said spring means upon movement of said lid lifter means from the raised position to the lowered position and for moving said electromagnet upwardly under the influence of said spring means upon movement of said lid lifter means from the lowered position to the raised position.

17. An apparatus as set forth in claim 16 wherein said sleeve means includes a sleeve member, said second linkage including means for moving said sleeve member downwardly under the influence of said motor means and against the influence of said spring means upon movement of said sleeve means from the retracted condition to the extended condition and for moving said sleeve member upwardly under the influence of said spring means upon movement of said sleeve means from the extended condition to the retracted condition.

* * * * *
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,774,787 Dated November 27, 1973

Inventor(s) Ronald R. Ledinsky

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 10, line 4 of patent claim 14, add the word "means" following the word "spring".

Signed and sealed this 23rd day of April 1974.

(SIGNATURE)
Attest:

EDWARD H. FLETCHER, JR.
Attesting Officer

G. MARSHALL DANN
Commissioner of Patents