F. P. MASON.

CENTRIFUGAL CLARIFIER FOR LIQUIDS.

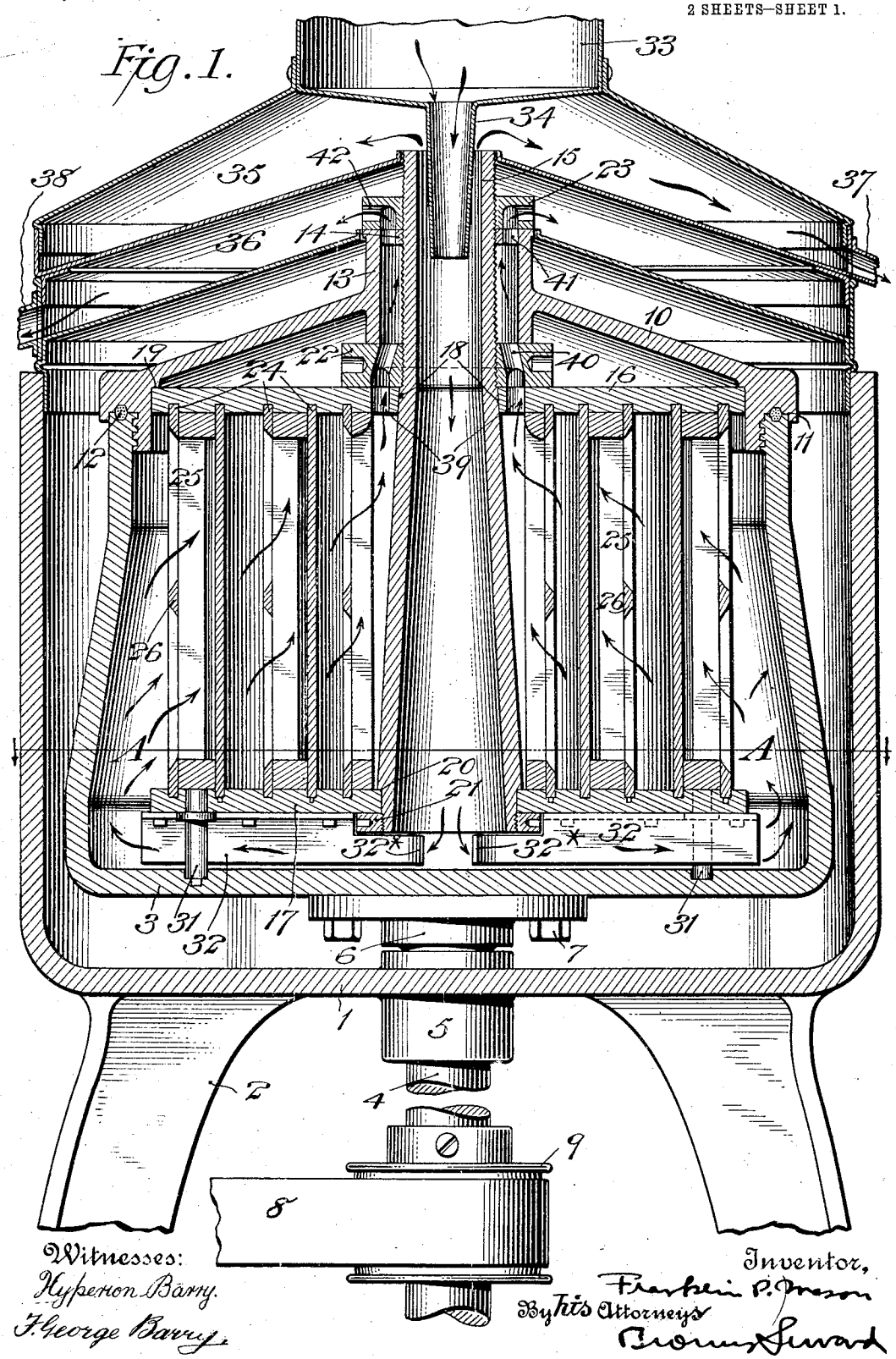
APPLICATION FILED APR. 25, 1914.

1,126,247.

Patented Jan. 26, 1915.

2 SHEETS—SHEET 1.

Fig. 1.



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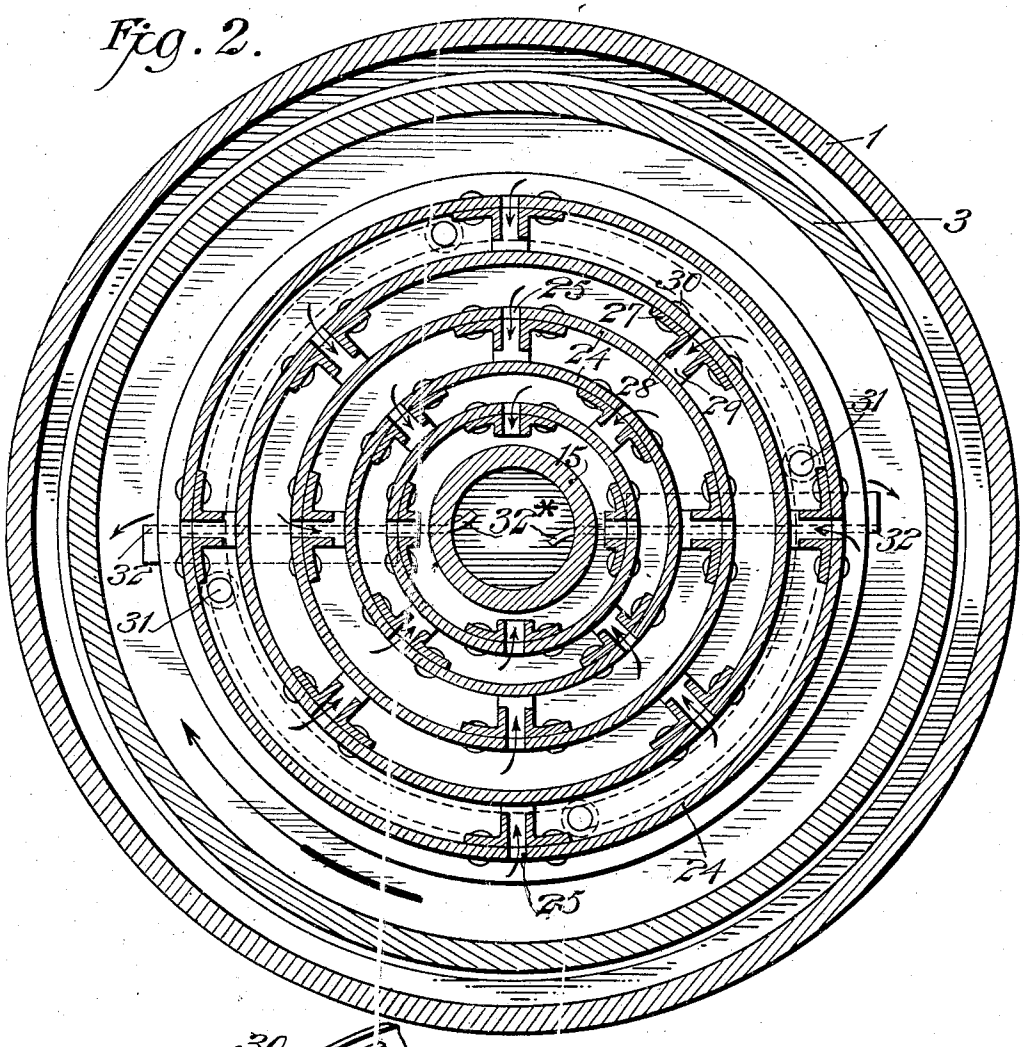
2 SHEETS—SHEET 2.

Fig. 2.



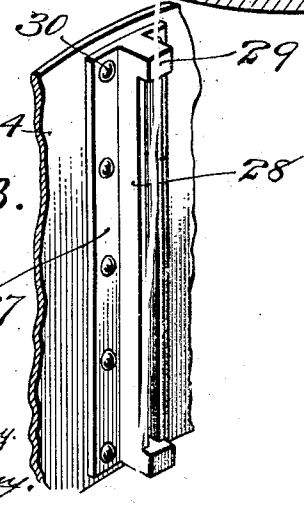
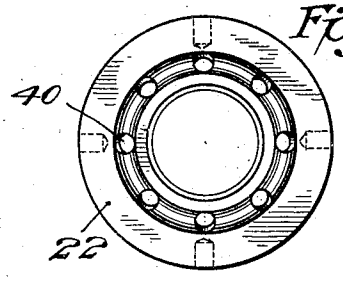


Fig. 3.

Fig. 4.



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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL CLARIFIER FOR LIQUIDS.

1,126,247. Specification of Letters Patent. Patented Jan. 26, 1915.

Application filed April 25, 1914. Serial No. 834,396.

To all whom it may concern:

Be it known that I, FRANKLIN P. MASON, a citizen of the United States, and resident of the borough of Brooklyn, in the city and State of New York, have invented a new and useful Improvement in Centrifugal Clarifiers for Liquids, of which the following is a specification.

This invention relates to centrifugal clarifiers for liquids, such, for instance, as varnish, with the object in view of providing a device of this character which is adapted to promote a step by step clarification of the liquid in such manner that as the liquid is clarified at each step it passes permanently out of contact with the foreign matter removed therefrom.

Another object is to provide means for a rapid, continuous and thorough clarification without perceptible loss of the liquid being clarified.

A further object is to provide an arrangement of this character which may be rapidly and conveniently taken apart for cleaning.

A still further object is to provide certain improvements in the form, construction and arrangement of the several parts whereby the above and other objects may be effectively carried out.

A practical embodiment of my invention is represented in the accompanying drawings, in which—

Fig. 1 represents a vertical central section through the device, Fig. 2 represents a section taken in the plane of the line A—A of Fig. 1, looking in the direction of the arrows, Fig. 3 represents a detail view of one of the slots and adjacent parts, and Fig. 4 represents a plan view of one of the perforate locking nuts.

The apparatus includes a housing denoted by 1, which is supported by suitable legs 2. The housing is shown in the present case as substantially cylindrical and of somewhat greater diameter than height. Within the housing 1 there is rotatably mounted a bowl 3, which bowl is also substantially cylindrical in form but has its upper portion slightly less in diameter than its lower portion.

The bowl 3 is arranged to be rotated at a suitable speed by means of a shaft 4 mounted in a bearing 5 in the housing 1; which shaft 4 is splined or otherwise suitably secured to a collar 6, which collar is flanged and secured by means of cap screws 7 to the under side of the bowl 3. The shaft 4 may be rotated by means of a belt 8 engaging a pulley 9 secured to the said shaft, which belt 8 is driven from any convenient source of power (not shown). The bowl 3 has a cover 10 which is screw threaded to the interior of the said bowl and is also provided with a circular recess 11 adapted to receive the upper edge of the bowl 3. A suitable packing gland 12 is provided to insure a liquid tight engagement between the cover and the bowl.

The cover 10 has a centrally disposed hollow hub 13, which provides an opening of considerable size through the said cover. This hub 13 is provided with an inwardly extending circular rib 14 which is interiorly screw threaded for engagement with the exterior screw threads on a hollow tube 15, which tube serves as an inlet to the bowl 3. This tube 15 is of sufficient length to reach nearly to the bottom of the bowl 3 and flares toward its lower portion, as clearly shown in Fig. 1.

A pair of disks 16, 17, are mounted on the tube 15, near the upper and lower portions thereof, respectively. The upper disk 16 is held against downward movement on the tube 15 by means of a beveled engagement therewith, as clearly shown at 18; while the periphery of the disk 16 has a liquid tight engagement with a shoulder 19 in the cover 10. The lower disk 17 is held against upward movement on the tube 15 by abutting a shoulder 20 thereon and it is locked against downward movement on the tube by means of a nut 21. A nut 22 serves to hold the disk 16 against upward movement on the tube 15; and another nut 23 locks the cover 10 firmly on the tube 15 with the upper and lower edges of the hub 13 abutting the nuts 22 and 23.

In the disks 16 and 17 there is mounted a series of five concentric cylinders 24, said cylinders being spaced substantially at an equal distance apart, with the innermost one near the tube 15 and the outermost one adjacent the peripheries of the disks 16, and 17. These cylinders have a tight engagement with the disks 16 and 17 by being recessed therein, as clearly shown in Fig. 1. Each of the said cylinders is provided with a plurality of openings through their walls, the said openings in the present case taking the form of vertically disposed slots 25 extend-

ing substantially throughout the height of the cylinders, but being interrupted intermediate their ends by solid portions 26 for the purpose of strength. Each of the slots is provided, on the inside of its cylinder, with a baffle box 27 which takes the form of a closed ended trough, having its sides 28 projecting inwardly from the walls of the cylinder toward the next inner cylinder, and having its ends 29 projecting so far as to abut the outer periphery of the next inner cylinder. These baffle boxes may be conveniently secured to the cylinders by means of rivets 30. In the present case, each cylinder is provided with four of the slots 25 and these are arranged in staggered relation so that the slots in alternating cylinders lie in the same planes. The disk 17 is fixed against rotation in the bowl 3 by means of pins 31, and paddles 32 are firmly secured to the under side of the disk 17, which paddles are shown as being two in number, substantially radially disposed on the disk and spaced slightly from the bottom of the bowl 3. The inner ends of the paddles are curved, as shown at 32*, Figs. 1 and 2.

A superstructure is arranged to rest upon the top of the housing 1, which superstructure comprises a feed vessel 33 having a nozzle 34 projecting downwardly into the upper end of the tube 15 and spaced from the walls of the said tube. This superstructure also has a hollow interior which is divided into a pair of outwardly sloping chambers 35, 36; the chamber 35 being the upper one and being adapted to receive any overflow of the liquid which may back up through the tube 15, which overflow may pass through the overflow outlet 37; while the lower chamber 36 is adapted to receive and discharge the clarified liquid through its discharge outlet 38, as will be subsequently fully described. Communication is open between the chamber 36 and the bowl 3 by means of apertures 39 in the disk 16, which communicate with ports 40 in the nut 22, which ports 40 are in turn open to the hollow hub 13, the ring 14 of which is perforated as at 41 for communication with ports 42 in the nut 23, which ports 42 are open to the chamber 36, as clearly shown.

In operation, the liquid flows into the feed vessel 33 and from there it passes down through the nozzle 34 into the tube 15. As the liquid is being fed, the bowl 3, and parts carried thereby, are rotated at a very high speed, *e. g.*, 6000 revolutions per minute, and the liquid, as it passes out at the lower end of the tube 15, onto the bottom of the bowl 3, is rapidly thrown toward the periphery of the said bowl, by the centrifugal force and the action of the paddles 32. As the liquid reaches the periphery of the bowl 3, it is forced upwardly by the liquid which is following, and it is guided inwardly by reason of the convergence of the walls of the bowl 3 as they approach the upper end thereof. As the liquid passes inwardly toward the center of the bowl, it comes in contact with the outermost cylinder 24, and part of it passes through the slots 25 in said outermost cylinder. It will be noted that the centrifugal force will cause the heaviest particles of the impurities contained in the liquid to adhere to the inner periphery of the bowl 3, and thus the liquid which passes into the slots 25 in the outermost cylinder is relieved of a certain percentage of its impurities and clarified to that extent. The liquid which is passed through the outermost cylinder is engaged by the baffle boxes 27 fixed to the inner periphery of the said cylinder, and whirled around at great speed. This action causes still more of the impurities to be left between the outermost cylinder and the next inner one, much of the impurities being deposited in the angles around the baffle boxes and the upper and lower portions of the cylinders. The liquid thus clarified will pass into the next cylinder, and the corresponding cycle of operations repeated until the liquid, fully clarified, passes into the space between the innermost cylinder and the outside of the tube 15. The liquid is then forced upwardly by virtue of the pressure of the liquid following and also guided in that direction by means of the convergence of the walls of the tube 15 toward the upper portion thereof; which clarified liquid will pass up through the holes 39, ports 40, hub 13, perforations 41 and ports 42, into the chamber 36, and be discharged into a convenient receptacle through the discharge outlet 38. The course of the liquid during the operation is clearly indicated by the arrows on Fig. 1.

It will be observed that during the operation of this device, the impurities removed at each stage are left behind and the clarified liquid passes away from them and permanently out of contact with them, thus obviating entirely the drawback of having the liquid intermingle throughout the clarification with the impurities which have been removed therefrom. The impurities, when once removed, are permanently left behind, clinging to various portions of the bowl and cylinders; leaving the liquid free to be further clarified by the action of the succeeding cylinders and their parts, without danger of being contaminated by any of the foreign matter or impurities previously removed.

It will be readily seen that in case the liquid is fed too fast into the tube 15, it may overflow around the outside of the nozzle 34 and be caught in receptacles placed adjacent to the overflow outlet 37. Another advantage of this device is that the liquid

does not have to, at any stage, pass through filter paper or substances of that character, and thus the loss of material by reason of adhering to or absorption by the filter paper is obviated; which loss is a very considerable one. When it is desired to cleanse the device, it will be seen that the parts may be very readily taken apart, and the cylinders and bowl quickly cleansed, by reason of the fact of the separability of the several elements composing the structure. After the cover 10 has been removed, the tube 15 and the parts carried thereby may be lifted out of the bowl 3 and plunged or immersed in a cleansing fluid for a rapid washing thereof.

I desire it to be understood that various changes may be resorted to in the form, construction and arrangement of the several parts without departing from the spirit and scope of my invention; and hence I do not intend to be limited to the details shown and described except as they may be set forth in the claims.

What I claim is:—

1. A centrifugal separator comprising a rotary bowl, a liquid inlet therefor, means for forcing the liquid from the inlet toward the periphery of the bowl, means for causing the liquid to return from the periphery of the bowl, means for clarifying the liquid during said return comprising a multiple of walls disposed within the bowl and fitted to rotate therewith and having openings therethrough, the openings in the adjacent walls being laterally staggered with respect to each other and the openings in alternate walls being substantially in line with each other, and an outlet for the clarified liquid.

2. A centrifugal separator comprising a rotary bowl, a liquid inlet therefor, means for forcing the liquid from the inlet toward the periphery of the bowl, means for causing the liquid to return from the periphery of the bowl, means for clarifying the liquid during the said return comprising a series of concentric cylinders disposed within the bowl and fitted to rotate therewith and having openings through their walls, said openings being arranged in different radial planes in adjacent cylinders and in substantially the same radial plane in alternate cylinders, and an outlet for the clarified liquid within the innermost cylinder.

3. A centrifugal separator comprising a rotary bowl, a liquid inlet therefor, means for forcing the liquid from the inlet toward the periphery of the bowl, means for causing the liquid to return from the periphery of the bowl, means for clarifying the liquid during the said return comprising a series of concentric cylinders disposed within the bowl and fitted to rotate therewith and having vertically arranged slots through their walls, the said slots being arranged in staggered relation in adjacent cylinders, and an outlet for the clarified liquid within the innermost cylinder.

4. A centrifugal separator comprising a rotary bowl, a liquid inlet therefor, means for forcing the liquid from the inlet toward the periphery of the bowl, means for causing the liquid to return from the periphery of the bowl, means for clarifying the liquid during said return comprising a multiple of walls disposed within the bowl and fitted to rotate therewith and having openings therethrough, said openings being provided with devices for actuating the liquid, and an outlet for the clarified liquid.

5. A centrifugal separator comprising a rotary bowl, a liquid inlet therefor, means for forcing the liquid from the inlet toward the periphery of the bowl, means for causing the liquid to return from the periphery of the bowl, means for clarifying the liquid during said return comprising a series of concentric cylinders disposed within the bowl and fitted to rotate therewith, said cylinders having vertically arranged slots through their walls and said slots being provided with means for actuating the liquid, and an outlet for the clarified liquid within the innermost cylinder.

6. A centrifugal separator comprising a rotary bowl, a liquid inlet therefor, means for forcing the liquid from the inlet toward the periphery of the bowl, means for causing the liquid to return from the periphery of the bowl, means for clarifying the liquid during said return comprising a series of concentric cylinders disposed within the bowl and fitted to rotate therewith, said cylinders having vertically arranged slots through their walls, the slots being arranged in staggered relation in adjacent cylinders and being provided with means for actuating the liquid, and an outlet for the clarified liquid within the innermost cylinder.

7. A centrifugal separator comprising a rotary bowl, a centrally disposed liquid inlet therefor arranged to feed to the bottom of the bowl, paddles fixed near the bottom of the bowl and arranged to rotate therewith for forcing the liquid from the inlet toward the periphery of the bowl, means for causing the liquid to return from the periphery of the bowl, means for clarifying the liquid during said return comprising a series of concentric cylinders disposed within the bowl and fitted to rotate therewith, said cylinders having openings through their walls arranged in different radial planes in adjacent cylinders, and an outlet for the clarified liquid within the innermost cylinder and surrounding the inlet.

8. A centrifugal separator comprising a rotary bowl, a centrally disposed liquid inlet therefor fitted to feed from the top to the bottom of the bowl, means for forcing

the liquid from the inlet toward the periphery of the bowl, means for causing the liquid to return from the periphery of the bowl, and means for clarifying the liquid during its said return, said last mentioned means having walls parallel to the axis of the bowl, the walls of the bowl being converged upwardly toward the walls of the said clarifying means.

9. A centrifugal separator comprising a rotary bowl, a centrally disposed liquid inlet tube therefor fitted to feed from the top to the bottom of the bowl, means for forcing the liquid from the inlet toward the periphery of the bowl, means for causing the liquid to return from the periphery of the bowl, and means for clarifying the liquid during its said return, the said last mentioned means having walls parallel to the axis of the bowl, the walls of the bowl being converged upwardly toward the walls of the said clarifying means and the walls of the inlet tube being converged upwardly away from the walls of the said clarifying means.

10. A centrifugal separator comprising a rotary bowl, a centrally open cover therefor, a liquid inlet tube secured in the opening in said cover and depending within the bowl, a series of concentric perforate cylinders supported from said tube and fitted to rotate with the bowl, and radially disposed paddles secured to the lower portion of said cylinders.

11. A centrifugal separator comprising a rotary bowl, a centrally open cover therefor, a liquid inlet tube secured in the opening in said cover and depending within the bowl, a series of concentric perforate cylinders supported from said tube and fitted to rotate with the bowl, radially disposed paddles secured to the lower portion of said cylinders, and an outlet around the inlet tube and through the cover.

12. A centrifugal separator comprising a rotary bowl, a centrally open cover therefor, a liquid inlet tube secured in the opening in said cover and depending within the bowl, a series of perforate cylinders supported from said tube and fitted to rotate with the bowl, a pair of disks secured to the tube and fitted to close the ends of the cylinders, radially disposed paddles secured to the lower disk, and an outlet surrounding the said tube and passing through the parts which secure the tube to the cover.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two witnesses, this twenty third day of April 1914.

FRANKLIN P. MASON.

Witnesses:
F. GEORGE BARRY,
C. S. SUNDGREN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."