July 17, 1934. C. S. TURNER 1,966,912

BOILER TUBE CLEANING CONSTRUCTION

Filed June 22, 1931 2 Sheets-Sheet 1

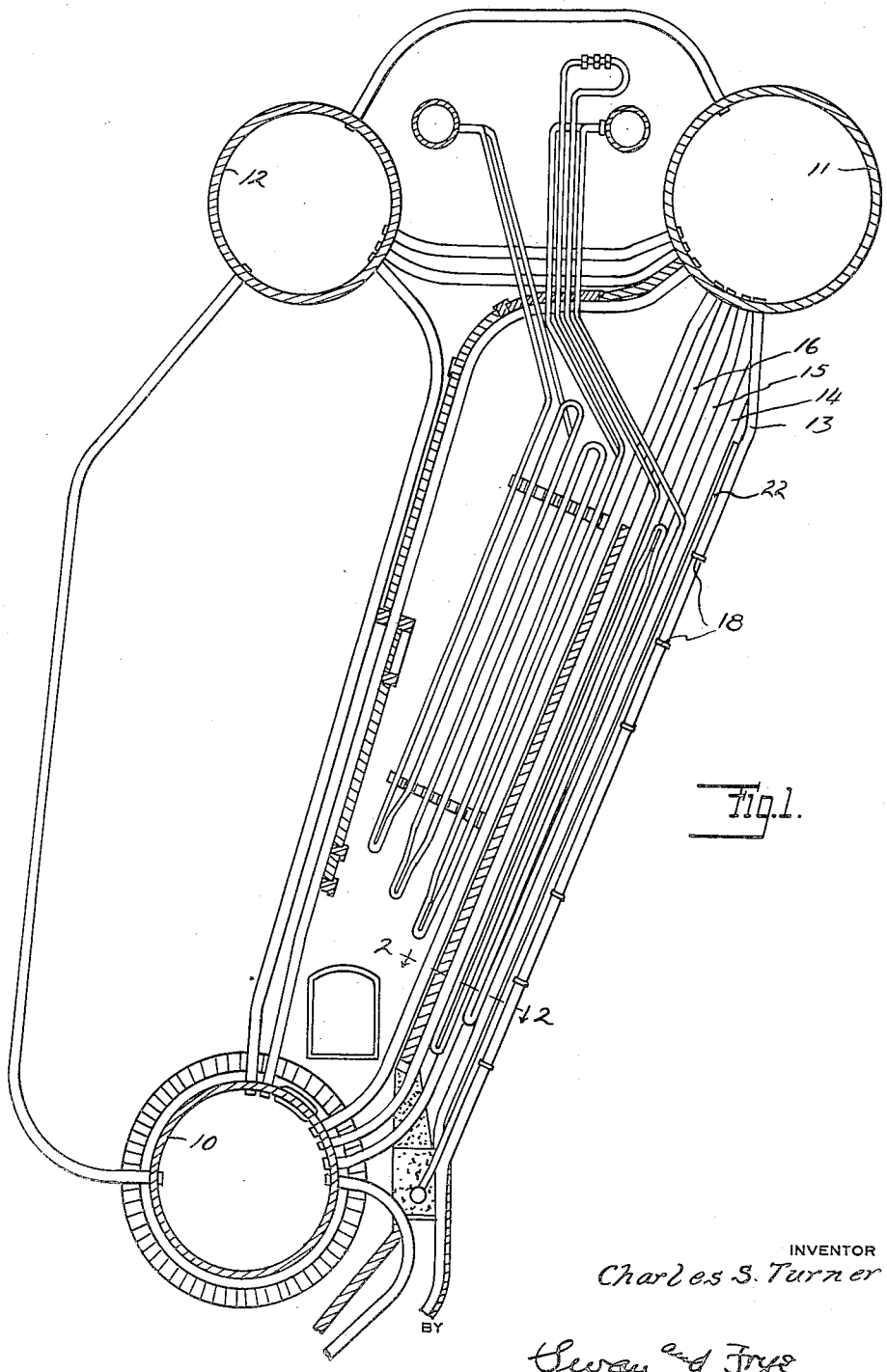


Fig. 1.

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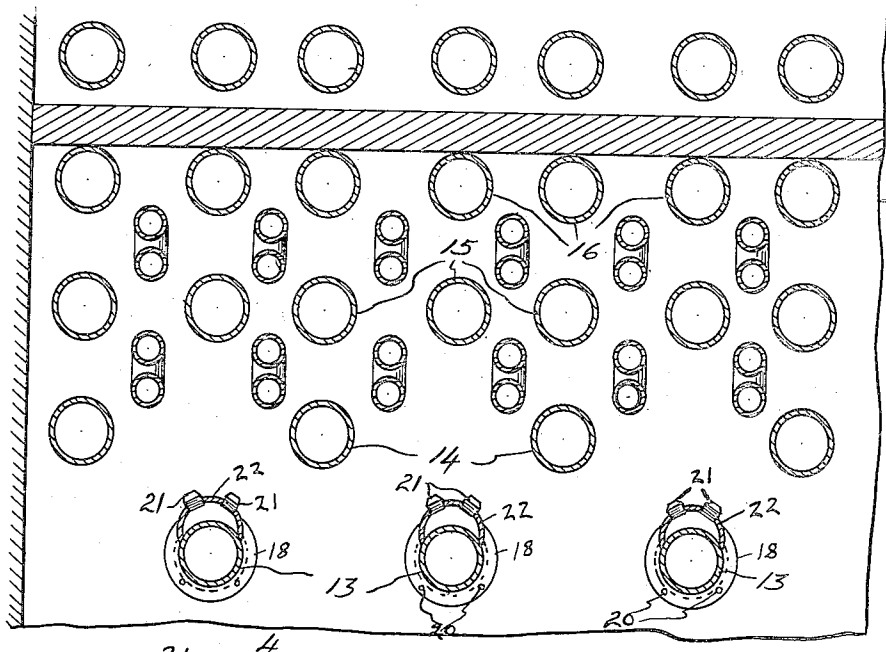


Fig. 2.

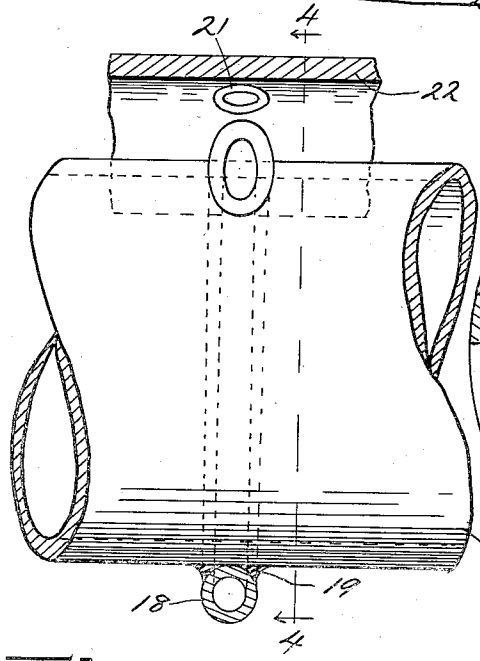


Fig. 3.

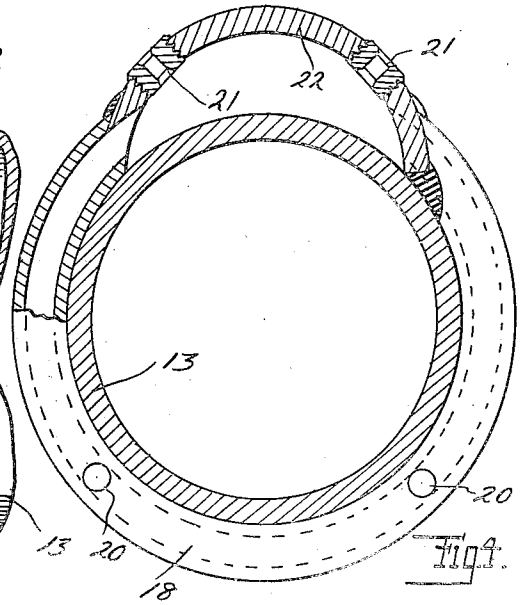


Fig. 4.

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Patented July 17, 1934 1,966,912

UNITED STATES PATENT OFFICE

1,966,912

BOILER TUBE CLEANING CONSTRUCTION

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Application June 22, 1931, Serial No. 545,885

11 Claims. (Cl. 122—392)

This invention relates to boiler tube cleaning apparatus, and particularly to a blower construction suitable for use upon the hottest tubes of a water tube boiler, to which tubes it has in the past been considered impossible to attach permanent soot blowing apparatus, because of the impossibility of preventing its burning out after only a relatively short period of service.

It is an object of this invention to provide a permanent blower tube installation, utilizable for the purpose of cleaning the hottest tubes of a boiler, yet protected against burning out at any temperature ordinarily attainable in a boiler, and irrespective of whether or not steam or other fluid be flowing through the blower tubes.

In the past the only known practical method of cleaning the front bank of tubes of a water tube boiler has been to manually insert a long pipe, termed a "lance", through the fire door the pipe having a steam or air hose attached to its end outside the furnace and an open free extremity inside the furnace from which the cleaning fluid could emerge under pressure. A workman wearing asbestos gloves manipulated the lance to direct the blast from the end of the pipe against the tubes desired to be cleaned. Satisfactory cleaning of the tubes in this manner was a practical impossibility, not only because the lance could not possibly be so manipulated as to direct the jet against all portions of the front tube bank, but because the excessve heat and consequent extreme discomfort to which the operator was exposed frequently induced him to neglect or slight the work. By means of my improved cleaning apparatus, however, it is possible to very thoroughly and completely clean the front tube bank of a boiler in far less time than it could be done with a lance, and with no discomfort or inconvenience to the operator, the only operation necessary being that of opening a valve which may be located where desired, at a convenient and comfortable distance from the region of great heat. It may therefore be noted as one of the objects of my invention that the same enables both more thorough and quicker cleansing of the hottest boiler tubes than has heretofore been possible.

A still further object of this invention lies in the integrated association of cleansing blower tubes with boiler tubes incorporated in the hottest portion of a boiler, in such manner that the heat-conductive ability of the boiler tube is sufficient to prevent burning out of the blower tubes, even when the latter are empty. Moreover these boiler tube blower units, being thus positioned upon the outermost of several spacedly arranged tube series, all soot-clearing discharge therefrom in its successive impingement against the surfaces of the banks of boiler tubes, which are located in spaced arrangement outwardly from the furnace wall, is in the direction of the flow of the furnace-generated gases as they make their way toward the rearmost bank of tubes. Thus in my improved construction none of the soot-displacing energy of the ejected stem-blast need be dissipated in the effort to make its way against such a current toward the outer rows of tubes, before beginning its soot-displacing work.

Other objects and advantages will be apparent from the following description, wherein reference is made to the accompanying drawings illustrating a preferred embodiment of my invention and wherein similar reference numerals designate similar parts throughout the several views.

In the drawings:

Figure 1 is a somewhat simplified vertical sectional view through a typical water tube boiler installation incorporating my invention.

Figure 2 is a cross-sectional view taken substantially on the line 2—2 of Figure 1 and looking in the direction of the arrows there shown.

Figure 3 is an enlarged fragmentary detail view, partly in section and partly in side elevation, of a boiler tube with which is associated one of my improved blower constructions.

Figure 4 is a transverse sectional view taken substantially on the line 4—4 of Figure 3 and looking in the direction of the arrows there shown, part of the therein shown ring nozzle being broken away.

Referring now to the drawings, reference character 10 designates the lower or mud drum of a water tube boiler, of which 11 is one of the upper steam drums. The disclosed arrangement represents what is believed to be a fairly typical boiler construction, insofar as the arrangement of the water tubes is concerned. Another upper steam drum is shown, designated 12. In such a boiler arrangement, the water tubes designated 13, 14, 15 and 16 are included in what may be termed the front bank, and are exposed to higher temperatures than any other tubes in the boiler. Since they are at all times filled with water and steam, however, they are in themselves capable of withstanding the temperatures to which they are exposed, and even of absorbing a certain number of heat units in excess of the number they are called upon to absorb and transmit to their fluid contents in performing their steam generating function. Insofar as I am aware it has not in the past been practicable to so asso-

ciate with these tubes a permanent blower system, capable of cleaning, for example, the surface of the tubes 13 nearest the source of heat, that the slightly excessive heat-conductive ability of these tubes above referred to could carry away heat absorbed by the blower tubes when cleaning fluid was not flowing through them.

I propose to associate with each of certain selected ones of the front tubes 13 a blower tube 22, which may be directly welded thereto, substantially in the form and manner shown cross sectionally in Figure 4. As there shown, the blower tube passage is of crescent contour in cross section, and lies relatively very close to the boiler tube. I have found that if burning out is to be prevented, no part of the surface of the blower tube if exposed to direct radiant heat due to being positioned on what might be termed the "windward" side of the boiler tube; that is, on the side facing the flow of furnace-generated combustion products may be further away from the interior of the boiler tube, measured through the heat-conducting metal walls, than one-and-one-quarter inches. This is much too small for an adequate flow of a soot-clearing blast, hence the necessity of placing a soot-blowing element of adequate cross-sectional size on the "leeward" or protected side of the boiler tube as regards direct impingement of the gases of full furnace temperature or of radiant heat. Jets 21 may be provided in the blower tubes, arranged at desired points, through and from which steam or other cleaning fluid may be projected against the tubes 14, 15 and 16, and against the rear surface of the tubes 13. The soot-clearing blasts thus ejected through these several nozzles or jets act clearingly upon the protected or "leeward" side of the most exposed or outermost boiler tubes 13 which the shell 22 is thus grafted upon and with direct effect upon the exposed or "windward" sides of the successively inwardly located banks of tubes, as 14, 15 and 16; as to each of these the ejected blast travels with or in the direction of, the current which the flow of soot-carrying gases of combustion is traveling, thus making its maximum soot-displacing power available against their most affected surfaces, which would not be the case if the intendedly soot-clearing jets were blown from more protected positions relatively back toward the rear of the bank of boiler tubes and in a direction just against the prevailing gaseous current in order to reach the row of tubes 13, for example, with manifestly diminished vigor, and even in such case only impinging against the protected or leeward sides of the several tubes, which need cleaning the least.

I have also found it possible to clean the front surfaces of the tubes 13, which I accomplish by means of fluid supplied through the same blower passages 22 carried upon their rear surfaces. A portion of the steam or other cleaning fluid so supplied is conducted around to the fronts of the tubes at desired points through relatively small ring-shaped nozzles, which extend circumferentially around the tubes 13, which are equipped with blower tubes as above described. The ring nozzles, which are designated 18, are so welded to the tubes 13 as to provide for maximum heat conduction between them; which may be done as shown in Figure 3, the weld being designated 19. These annular tubes or ring nozzles 18, while inadequate to convey a soot-clearing blast of steam, as the longitudinal, grafted-on units 22 do, are small enough to fall safely within the one-and-one quarter inch dimensional limits above noted, and as well to carry enough of a steam blast to supply the one or two blower nozzles 20 with which each is provided. One or both extremities of the ring nozzles are welded or otherwise secured in suitable apertures in the sides of the blower tubes, to enable the conduction of cleaning fluid from the blower tubes around to the fronts of the tubes 13. Through the nozzle apertures, as 20, in the ring nozzles steam is thus forcibly ejected against the front surface of the outermost row 13 of boiler tubes. By extending the relatively small tubes 18 circumferentially around the boiler tubes at spaced intervals, by providing for very efficient heat conduction between them, and by locating the ring nozzles entirely within the 1¼" zone above referred to, I have found that it is made possible for the boiler tubes to carry away the heat absorbed by the ring nozzles with sufficient rapidity to prevent their burning out, even during the relatively extended periods when no cleaning fluid is flowing through the blower tubes and nozzles, and when of course the danger is greatest.

From the above it will be apparent that the invention provides nozzles, such as the nozzle apertures 20, and connections, such as the tubes 18, between these nozzles and the fluid passage formed by the means 22, which means is associated with a side of the boiler tube relatively cool as compared to the side of the tube with which the nozzles are associated. Further the fluid passage 22 constitutes a part of the fluid supply connection between a source of supply of cleaning fluid, which may be located at the lower end of passage 22 as shown in Fig. 1 of the drawings, and one or more of the nozzles 20 which are spaced longitudinally of the boiler tube a substantial distance from the source of supply of the cleaning fluid.

A somewhat similar blower tube arrangement is disclosed in my copending application Serial No. 428,721, filed February 15, 1930, and the present invention therefore concerns the herein disclosed improvements thereupon, including the means for cleaning the fronts of the hottest blower tubes, as well as the other tubes of the front bank, and including the improved positioning and arrangement of the blower tubes, the ring nozzles, and the other novel features herein shown for the first time.

For the sake of convenience, the invention has been described as being embodied in a device for cleaning boilers. It will be apparent, however, that the inventive principles disclosed may be embodied in devices for cleaning apparatuses similar to boilers, and it is to be therefore understood that the term "boiler" wherever used throughout the specification and claims is to be construed as meaning a fluid heater or heat transfer apparatus of any character and that the term "boiler cleaner" is to be construed as meaning a cleaner for any such apparatus.

While it will be apparent that the illustrated embodiments of my invention herein disclosed are well calculated to adequately fulfill the objects and advantages primarily stated, it is to be understood that the invention is susceptible to variation, modification and change within the spirit and scope of the subjoined claims.

What I claim is:

1. In combination with a steam boiler having a plurality of spaced boiler tubes extending therethrough, means for cleaning the tubes, comprising a blower passage intimately associated with one of said tubes and extending longitudi-

nally of its relatively cooler side, said blower passage being of substantially crescent cross sectional contour and having nozzle apertures therein adapted to discharge cleaning fluid adjacent portions of the boiler to be cleaned, and a plurality of annular nozzle members connected to the blower passage and extending circumferentially around the supporting boiler tube to the relatively hotter side thereof said nozzle members being so arranged as to discharge cleaning fluid adjacent the hotter side of the boiler tube to clean the same.

2. In combination with a steam boiler having a plurality of spaced boiler tubes extending therethrough, means for cleaning the tubes, comprising a blower passage intimately associated with one of said tubes and extending longitudinally of its relatively cooler side, said blower passage being of substantially crescent cross section, having nozzle apertures therein adapted to discharge cleaning fluid adjacent portions of the boiler to be cleaned, and lying in its entirety relatively close to its supporting boiler tube and on its side farthest from the source of heat, and means for conducting cleansing fluid through the blower passage and from the nozzles.

3. In a boiler cleaner, the combination with a boiler tube so disposed in a boiler that the products of combustion flow around the same, of a source of supply of cleaning fluid, a cleaning fluid discharge nozzle so contacting said tube at one side thereof as to be substantially cooled thereby, said nozzle being spaced longitudinally of said tube a substantial distance from said source of supply of cleaning fluid, and a connection between said nozzle and said source of supply of cleaning fluid, said connection including means disposed exteriorly of said tube providing a fluid passage extending longitudinally of said tube, said means throughout its length so contacting a side of said tube relatively cool as compared to the side with which said nozzle is associated as to be substantially cooled by the tube.

4. In a boiler cleaner, the combination with a boiler tube so disposed in a boiler that the products of combustion flow around the same, of a source of supply of cleaning fluid, a cleaning fluid discharge nozzle integrally united with said tube at one side thereof so as to be substantially cooled thereby, said nozzle being spaced longitudinally of said tube a substantial distance from said source of supply of cleaning fluid, and a connection between said nozzle and said source of supply of cleaning fluid, said connection including means disposed exteriorly of said tube providing a fluid passage extending longitudinally of said tube, said means throughout its length so contacting a side of said tube relatively cool as compared to the side with which said nozzle is associated as to be substantially cooled by the tube.

5. In a boiler cleaner, the combination with a boiler tube so disposed in a boiler that the products of combustion flow around the same, of a source of supply of cleaning fluid, a cleaning fluid discharge nozzle so contacting said tube at one side thereof as to be substantially cooled thereby, said nozzle being spaced longitudinally of said tube a substantial distance from said source of supply of cleaning fluid, and a connection between said nozzle and said source of supply of cleaning fluid, said connection including means disposed exteriorly of said tube providing a fluid passage extending longitudinally of said tube, said means being integrally united throughout its length to a side of said tube relatively cool as compared to the side with which said nozzle is associated, so as to be substantially cooled by the tube.

6. In a boiler cleaner, the combination with a boiler tube so disposed in a boiler that the products of combustion flow around the same, of a source of supply of cleaning fluid, a cleaning fluid discharge nozzle associated with the side of said tube first contacted by the products of combustion, said nozzle being spaced longitudinally of said tube a substantial distance from said source of supply of said cleaning fluid and being united integrally with said tube so as to be substantially cooled thereby, and a connection between said nozzle and said source of supply of cleaning fluid, said connection including means disposed exteriorly of said tube providing a cleaning fluid passage extending longitudinally of said tube on the side thereof opposite to the side of said tube with which said nozzle is associated, said means being integrally united throughout its length to said tube so as to be substantially cooled by the tube.

7. In a boiler cleaner, the combination with a boiler tube so disposed in a boiler that the products of combustion flow around the same, of a plurality of fluid discharge nozzles spaced longitudinally of said tube and so contacting said tube at one side thereof as to be substantially cooled thereby, means disposed exteriorly of said tube providing a fluid passage for supplying cleaning fluid to said nozzles, said means being associated with a side of said tube relatively cool as compared to the side with which said nozzles are associated, and said means so contacting the said side of the tube as to be substantially cooled by the tube, and connections between said passage and said nozzles.

8. In a boiler cleaner, the combination with a boiler tube so disposed in a boiler that the products of combustion flow around the same, of a plurality of fluid discharge nozzles spaced longitudinally of said tube and integrally united with said tube at one side thereof so as to be substantially cooled thereby, means disposed exteriorly of said tube providing a fluid passage for supplying cleaning fluid to said nozzles, said means being associated with a side of said tube relatively cool as compared to the side with which said nozzles are associated, and said means so contacting the said side of the tube as to be substantially cooled by the tube, and connections between said passage and said nozzles.

9. In a boiler cleaner, the combination with a boiler tube so disposed in a boiler that the products of combustion flow around the same, of a plurality of fluid discharge nozzles spaced longitudinally of said tube and so contacting said tube at one side thereof as to be substantially cooled thereby, said nozzles extending radially of said tube a distance less than one and one quarter inches, means disposed exteriorly of said tube providing a fluid passage for supplying cleaning fluid to said nozzles, said means being associated with a side of said tube relatively cool as compared to the side with which said nozzles are associated and said means so contacting the said side of the tube as to be substantially cooled by the tube, and connections between said passage and said nozzles.

10. In a boiler cleaner, the combination with a boiler tube so disposed in a boiler that the products of combustion flow around the same,

of a plurality of fluid discharge nozzles spaced longitudinally of said tube and so associated with said tube at one side thereof as to be substantially cooled thereby, means disposed exteriorly of said tube providing a fluid passage for supplying cleaning fluid to said nozzles, said means being united integrally with a side of said tube relatively cool as compared to the side with which said nozzles are associated so as to be substantially cooled by the tube, and connections between said passage and said nozzles.

11. In a boiler cleaner, the combination with a boiler tube so disposed in a boiler that the products of combustion flow around the same, of a plurality of fluid discharge nozzles spaced longitudinally of said tube and disposed on the side thereof first contacted by the products of combustion, said nozzles being integrally united with said tube so as to be substantially cooled thereby, means disposed exteriorly of said tube on the side thereof opposite said nozzles providing a fluid passage for supplying cleaning fluid to said nozzles, said means being integrally united with said tube so as to be substantially cooled thereby, and connections between said passage and said nozzles integrally united with the tube.

CHARLES S. TURNER.

CERTIFICATE OF CORRECTION.

Patent No. 1,966,912. July 17, 1934.

CHARLES S. TURNER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 13, beginning with the claim number and words "2. In combination" strike out all to and including "nozzles." in line 26, comprising claim 2; and for the claim numbers "3, 4, 5, 6, 7, 8, 9, 10 and 11" read 2, 3, 4, 5, 6, 7, 8, 9 and 10 respectively; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of September, A. D. 1934.

Leslie Frazer

(Seal) Acting Commissioner of Patents.