

Sept. 25, 1928.

1,685,108

G. E. TUFFLEY

OIL BURNER FOR FURNACES

Filed July 16, 1925

2 Sheets-Sheet 1

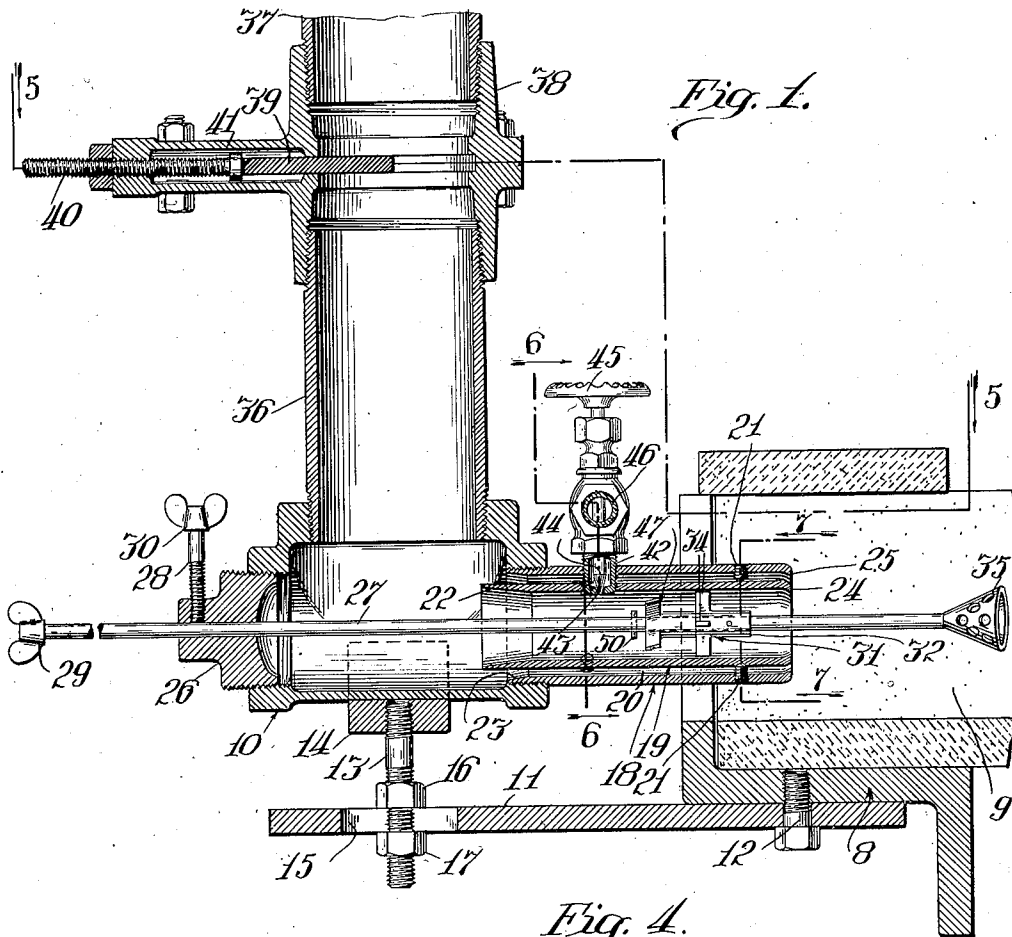


Fig. 4.

Fig. 2.

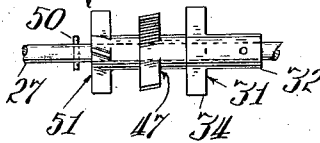
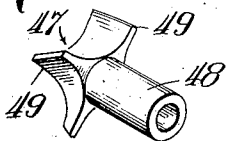
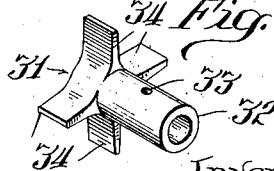


Fig. 3.



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2 Sheets-Sheet 2

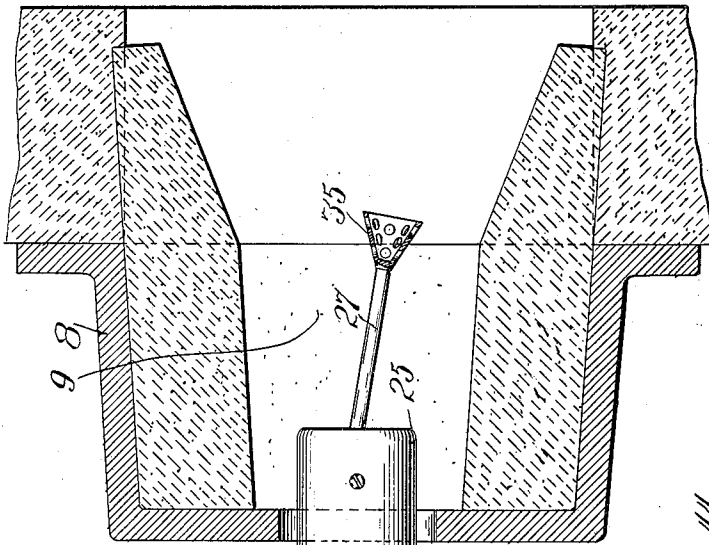
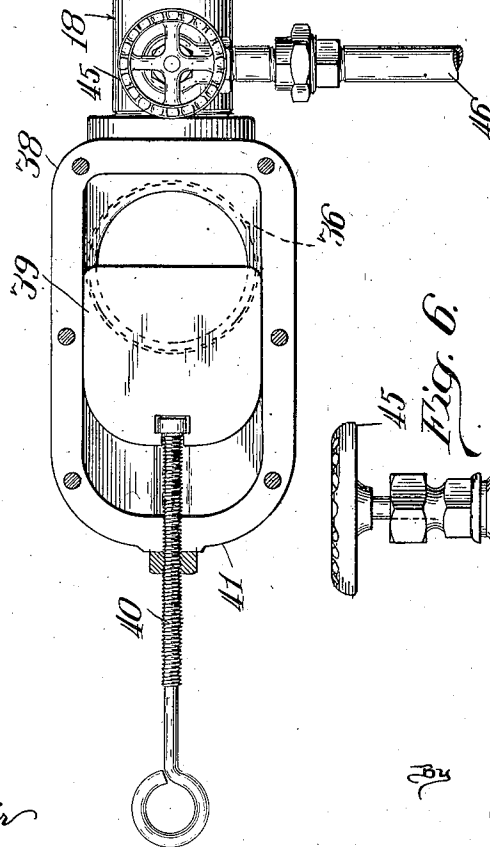


Fig. 5.



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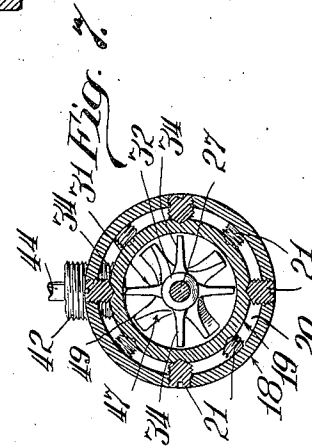


Fig. 7.

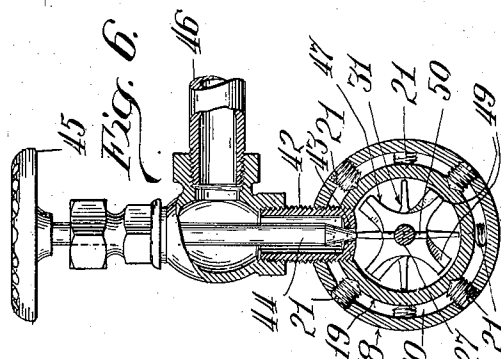


Fig. 8.

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## UNITED STATES PATENT OFFICE.

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## OIL BURNER FOR FURNACES.

Application filed July 16, 1925. Serial No. 43,930.

My invention relates to apparatus for delivering to a combustion chamber a combustible mixture composed of air and finely divided liquid fuel, such as oil, thoroughly mixed with the air, and it has for its object to provide improved means for atomizing the oil or other liquid fuel and mixing it with a stream of air, and injecting the mixture into the combustion chamber. To this end it consists of certain features of improvement which will be more particularly described hereinafter, but which generally stated principally comprise means for thoroughly breaking up the liquid fuel and causing an intimate mixture thereof with the air; means by which the delivery of the oil-laden stream of air can be adjusted to regulate the point where combustion will occur in the combustion chamber; means for preventing the choking or clogging of the burner, and means for preventing dripping or slobbering of the oil at the discharge end of the burner.

In the drawings I have illustrated my improvements as applied to a burner of the variety used generally for forge purposes, but it should be understood that they may be used in connection with the fire-box of a boiler; in furnaces for household use, and in any other situation to which they are adapted, the arrangement shown in the drawings being that which I have chosen for the purpose of illustrating the general relationship of the parts when the apparatus is used in connection with a combustion chamber or fire-box. The features that I claim as my invention will be particularly pointed out in the claims.

In the accompanying drawings,—

Fig. 1 is a longitudinal vertical section of my improved burner associated with the combustion chamber of a furnace;

Fig. 2 is a perspective view illustrating a spinner used for atomizing the oil or other liquid fuel and promoting its mixture with the air;

Fig. 3 is a perspective view illustrating a spider which serves as a supporting device for a rod which carries the spinner and also the spreader hereinafter described;

Fig. 4 is a view showing a modified arrangement designed for use with heavier oils, in which two spinners are used instead of one;

Fig. 5 is a horizontal section on line 5—5 of Fig. 1;

Fig. 6 is a vertical cross-section on line 6—6 of Fig. 1; and

Fig. 7 is a vertical cross-section on line 7—7 of Fig. 1.

Referring to the drawings,—8 indicates the wall or casing of a furnace, of which 9 is the combustion chamber or fire-box, whereof only the end portion at which fuel is admitted is shown. For convenience this will be referred to as the front of the furnace. Mounted opposite the front of the furnace is a T 10, which is preferably supported from the furnace casing 8 by means of a bar 11 secured to the furnace by a screw 12 and carrying an adjustable bolt 13 provided at its upper end with a half sleeve 14 which supports said T. The bolt 13 is adjustable not only vertically, but also longitudinally, so that the position of the T with reference to the front of the furnace may be varied as occasion may require. In the arrangement shown said bolt extends through a longitudinal slot 15 in the bar 11 and is held in place by nuts 16, 17, respectively, above and below said bar, as shown in Fig. 1.

In that end of the T that is adjacent to the front of the furnace is mounted an outer pipe 18 which extends from the T toward the combustion chamber and projects a greater or less distance thereinto, as shown in Fig. 1, and mounted inside of the pipe 18 and extending longitudinally thereof is an inner pipe 19 of somewhat less diameter, thereby providing an annular space 20 between said pipes. For holding the pipe 19 in fixed relation to the pipe 18, a number of screw plugs 21 are provided which are threaded in the pipe 18 at equi-distant points around its circumference and engage the outer surface of the pipe 19. Preferably two sets of such plugs are provided adjacent to the opposite ends of said pipes, each of said sets comprising three plugs, as best shown in Fig. 7. The inlet ends of the pipes 18, 19, which are the ends adjacent to the T 10, are reamed interiorly to present a long taper and a knife edge to the stream of air flowing into and through the pipe 19 and into the space 20 between said pipes, as best shown at 22 and 23 in Fig. 1, and the discharge ends of said pipes, which are

the ends thereof that extend into the combustion chamber, are reduced in diameter somewhat, as shown at 24, 25 in Fig. 1, to provide a nozzle effect upon the streams of air that pass through the pipe 19 and the annular space 20, respectively, by which such streams of air are deflected to some extent inwardly or toward the axes of the pipes 18, 19. The discharge ends of said pipes preferably terminate in the same transverse vertical plane, as clearly shown in Fig. 1. By this construction the pipes 18, 19 together constitute a nozzle having inner and outer coaxial passages leading from the T 10 to the combustion chamber, through which, as will hereinafter appear, air and oil are discharged into said chamber.

At the opposite end of the T 10 from the pipes 18, 19 is a screw plug 26 which is bored centrally for the passage of a rod 27 arranged coaxially with said pipes and extending through them into the combustion chamber. Said rod is longitudinally movable through the plug 26 and may also be rotated, but it may be secured in a fixed position by means of a set screw 28 carried by the plug 26, as shown in Fig. 1. Preferably the rod 27 is provided at its outer end with a wing head 29, and the set screw 28 is provided with a similar head 30, so that said elements may be conveniently turned. The rod 27 is supported in the pipe 19 so that it may rotate and also be moved longitudinally by means of a spider 31, the construction of which is best shown in Fig. 3. This spider comprises a sleeve portion 32 adapted to fit upon the rod 27, to which it may be secured by a set screw or pin passing through an opening 33 therein, said sleeve being provided, preferably at one end, with radiating arms 34. The length of said arms is such that they hold the rod 27 properly centered in the pipe 19, but do not fit said pipe closely enough to prevent longitudinal or rotary movement therein of said spider.

At its inner end the rod 27 is provided with a perforated hollow cone 35, the apex of said cone lying next to the proximate end of the rod, so that said cone tends to deflect the incoming stream of fuel outwardly and distribute it throughout the combustion chamber. That portion of the rod 27 which extends into the combustion chamber is bent or offset so that it stands at an angle to the longitudinal axis of the rod, as best shown in Fig. 5. Consequently by rotating the rod the position of the spreader cone 35 may be shifted laterally with respect to the axis of the pipe 19 to deflect the incoming fuel to different parts of the combustion chamber. Also, by moving the rod 27 endwise, the spreader cone may be moved toward or from the discharge end of the nozzle,

thereby varying its distributing effect.

Air is supplied to the interior of the T 10, and through it to the inner ends of the pipes 18, 19, by a pipe 36 which is coupled to the T in any suitable way and is adapted to be supplied with air under appropriate pressure from any suitable source, such as a supply pipe 37. A valve of any suitable description is provided, preferably in a coupling 38 that connects the pipes 36, 37, and for this purpose I prefer to use a gate valve 39 which may be adjusted by means of a screw-threaded rod 40 mounted in a lateral extension 41 of the coupling 38, as best shown in Figs. 1 and 5. By this means the volume of air supplied to the nozzle may be accurately regulated.

Liquid fuel, such as oil, is supplied to the pipe 19 at a point between its ends by a tube 42 having a discharge orifice 43 that opens into the pipe 19 directly over the rod 27. Said orifice is controlled by a needle valve 44 that is adapted to seat therein and may be adjusted by means of a wheel 45. An oil supply pipe 46 leads to the tube 42, and its discharge into the pipe 19 is controlled by the needle valve 44. Obviously the oil dripping through the orifice 43 will fall on the rod 27, and will be wiped along said rod by the air current flowing through the pipe 19. Also some of the oil will be wiped from the tube 42 at the orifice 43 by the air current and be carried along therewith through the tube 19.

Loosely mounted on the rod 27 is a spinner 47, the construction of which is best shown in Fig. 2. Said spinner comprises a sleeve 48 through which the rod 27 passes, and radiating vanes 49 set at an angle to the longitudinal axis of the sleeve 48, so that the current of air flowing through the tube 19 toward the combustion chamber will by its impingement against the vanes 49 cause the spinner to rotate. As shown in Fig. 1, the sleeve 48 bears against the adjacent face of the spider 31, which holds it against movement in one direction along the rod 27, and displacement of the spinner in the opposite direction is prevented by a cross-pin 50 carried by said rod. Consequently when the rod is adjusted longitudinally of the burner the spinner is similarly adjusted. By this construction the current of air flowing through the pipe 19 will cause the spinner 47 to rotate at a high rate of speed, so that any oil taken up by the air from the oil inlet orifice 43 will be thoroughly mixed with the air stream, and at the same time the oil carried along the rod 27 by the air current will be taken up by the spinner and thrown outward by centrifugal force so that it will be thoroughly atomized and intermixed with the air stream. The consequence is that when the air passes out of the pipe 19 it is laden with uniformly distributed

minute oil globules. In some cases where the heavier oils are used, a single spinner may be insufficient to effect the proper atomization and distribution of the oil, in which case a second spinner 51 may be provided arranged adjacent to the spinner 47, as shown in Fig. 4. Preferably where two spinners are used their vanes are set at opposite angles, so that they rotate in opposite directions.

From the foregoing description, it will be understood that the air that flows through the passage 20 that lies between the two pipes 18, 19 is not supplied with oil, as the oil is admitted only to the pipe 19. There are therefore two substantially concentric air streams flowing through the nozzle toward the combustion chamber, the inner stream being oil laden and the outer one being free from oil. At the point of discharge, however, the outer stream is directed inwardly or toward the axis of the nozzle, so that it envelops the inner stream and prevents dripping or slobbering of the oil at the nozzle. By directing the outer stream inwardly also, the streams are caused to intermix, which action is promoted by the spreader cone 35 which also aids in distributing the fuel throughout the combustion chamber. The oil that flows along the rod 27 provides for lubricating the spinner or spinners, although the greater part of it is atomized and mixed with the air flowing through the inner pipe 19, as above described.

It will be clear from the foregoing description that my improved burner comprises means for discharging an inner oil laden air stream, and an outer air stream enveloping such inner stream and mixed therewith after both streams pass out of the burner or nozzle, and that a regulable quantity of oil is supplied to the inner air stream and is atomized and thoroughly mixed therewith before the two air streams are brought together. This I believe to be new, and I also believe it to be new to provide means actuated by the inner stream for atomizing and distributing oil throughout the latter stream before the two streams come together. Other novel features are the spreader device associated with the nozzle for distributing the fuel; making said spreader adjustable laterally as well as toward and from the nozzle to regulate the distribution of the fuel, and the formation of the discharge end of the nozzle so that the outer stream is directed inwardly toward and envelops the inner stream. By reaming or tapering interiorly the inlet ends of the pipes 18, 19, the air flows freely therein without developing back pressure, and by arranging the pipes 18, 19 with respect to each other in the manner described, there

is no danger that the nozzle will choke or clog.

While I prefer to embody my invention in the form shown in the drawings, it is not restricted to such embodiment, but may be modified in various respects, as will be manifest to those skilled in the art. The claims hereinafter made are therefore to be construed accordingly.

What I claim as my invention and desire to secure by Letters Patent, is—

1. A liquid fuel burner comprising a nozzle formed of inner and outer pipes, the stationary inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying air to said passage and to the inner pipe, means for supplying oil to the inner pipe, means in said inner pipe for atomizing the fuel, an adjustable spreader located in the path of the mixture discharged from said nozzle, and means for simultaneously adjusting said fuel atomizing means and said spreader.

2. A liquid fuel burner comprising a nozzle formed of inner and outer pipes, the inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying air to said passage and to the inner pipe, means for supplying oil to the inner pipe, means in said inner pipe for atomizing the fuel, a spreader located in the path of the mixture discharged from said nozzle, and means for adjusting said spreader to different points displaced radially from the axis of said nozzle.

3. A liquid fuel burner comprising a nozzle formed of inner and outer pipes, the inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying air to said passage and to the inner pipe, means for supplying oil to the inner pipe, a rod extending through said inner pipe, a spider on said rod adapted to engage the inner wall of said inner pipe to center said rod in said pipe, rotary means in said inner pipe mounted on said rod for atomizing the fuel, a conical spreader carried by said rod, and located in the path of the mixture discharged from said nozzle, and means for adjusting the spreader laterally with respect to the nozzle.

4. A liquid fuel burner comprising a nozzle formed of inner and outer pipes, the inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying air to said passage and to the inner pipe, means for supplying oil to the inner pipe, means in said inner pipe for atomizing the fuel, a spreader located in the path of the mixture discharged from said nozzle, and means for adjusting the spreader axially toward or from the nozzle and laterally in different directions with respect to the nozzle.

5. A liquid fuel burner comprising a nozzle formed of inner and outer pipes, the inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying air to said passage and to the inner pipe, means for supplying oil to the inner pipe, a rod extending through said inner pipe, a spider on said rod adapted to engage the inner wall of said inner pipe to center said rod in said pipe, rotary means in said inner pipe mounted on said rod for atomizing the fuel, and a spreader carried by said rod, and located in the path of the mixture discharged from said nozzle, the discharge ends of said pipes being of reduced diameter forming terminal lips to direct the air currents toward the axis of said pipes.

6. A liquid fuel burner comprising a nozzle formed of inner and outer pipes, the inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying air under pressure to said passage and to the inner pipe, a rod extending through said inner pipe, a spreader carried by said rod in position to intercept the air discharged from the nozzle, said rod being adjustable longitudinally relatively to said inner pipe, and means for supplying oil to the inner pipe, said latter means being arranged to drop oil on said rod.

7. A liquid fuel burner comprising a nozzle formed of inner and outer pipes, the inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying air under pressure to said passage and to the inner pipe, a rotatable rod extending through said inner pipe, a spreader carried by said rod in offset relation to the axis thereof, and means for supplying oil to said inner pipe.

8. A liquid fuel burner comprising a nozzle formed of inner and outer pipes, the inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying air under pressure to said passage and to the inner pipe, a rotatable and longitudinally movable rod extending through said inner pipe, a spreader carried by said rod in offset relation to the axis thereof, and means for supplying oil to said inner pipe.

9. A liquid fuel burner comprising a nozzle formed of inner and outer pipes, the inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying air under pressure to said passage and to the inner pipe, a rod extending through said inner pipe, a spinner mounted on said rod and rotatable by the

force of the air current flowing through the latter pipe, and an oil supply tube extending through said outer pipe, and disposed over and arranged to drop oil on said rod in advance of the spinner.

10. A liquid fuel burner comprising a nozzle formed of inner and outer pipes, the inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying air under pressure to said passage and to the inner pipe, a rod extending through said inner pipe, a spinner mounted on said rod and rotatable by the force of the air current flowing through the latter pipe, an oil supply tube disposed over and arranged to drop oil on said rod in advance of the spinner, and a spreader carried by said rod in position to intercept the fuel mixture discharged from the nozzle.

11. A liquid fuel burner comprising a nozzle formed of inner and outer pipes, the inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying air under pressure to said passage and to the inner pipe, a rod extending through said inner pipe and adjustable longitudinally thereof, a spinner mounted on said rod and rotatable by the force of the air current flowing through the latter pipe, and an oil supply tube disposed over said rod, so that whatever oil falls through the air stream in said inner pipe drops on said rod in advance of the spinner.

12. A liquid fuel burner comprising a nozzle formed of inner and outer pipes, the inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying air under pressure to said passage and to the inner pipe, a rod extending through said inner pipe and adjustable longitudinally thereof, a spinner mounted on said rod and rotatable by the force of the air current flowing through the latter pipe, an oil supply tube disposed over and arranged to drop oil on said rod in advance of the spinner, and a spreader carried by said rod in position to intercept the fuel mixture discharged from the nozzle.

13. A liquid fuel burner comprising a nozzle formed of inner and outer pipes coaxially disposed, the inner pipe being spaced apart from the outer pipe to form a passage between said pipes, means for supplying oil to the inner pipe, means for supplying air under pressure to said passage and to the inner pipe, and two rotary vanes actuated by the flow of air through the inner pipe to revolve in opposite directions for atomizing and mixing the oil with the air in said pipe.

GEORGE E. TUFFLEY.

**CERTIFICATE OF CORRECTION.****Patent No. 1,685,108.****Granted September 25, 1928, to****GEORGE E. TUFFLEY.**

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, lines 77 and 78, claim 1, strike out the word "stationary" and insert the same before the word "inner" in line 77; 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 20th day of November, A. D. 1928.

(Seal)

**M. J. Moore,**  
**Acting Commissioner of Patents.**