No. 615,997. Patented Dec. 13, 1898.

V. B. LEWES.

PROCESS OF AND APPARATUS FOR PRODUCING GAS.

(Application filed Dec. 31, 1897.)

(No Model.)

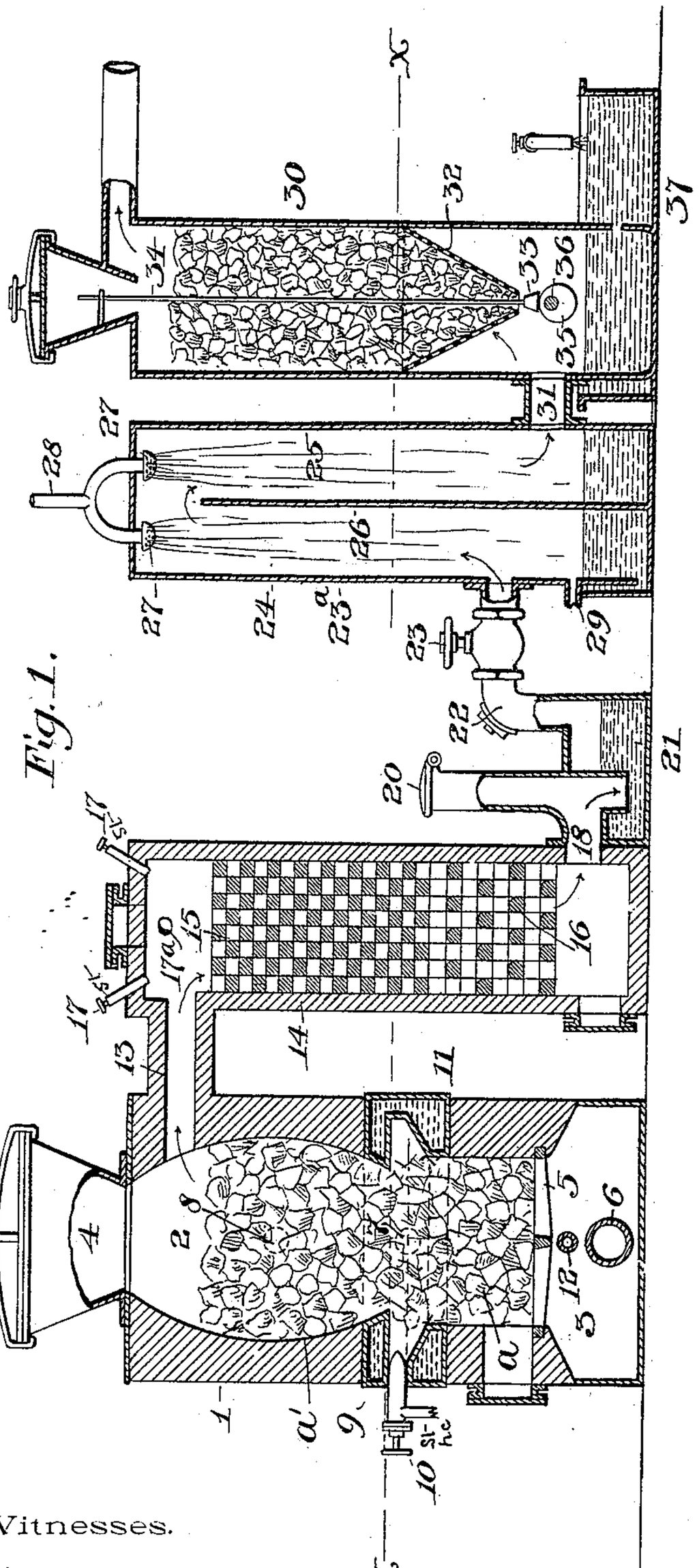

Fig. 1.

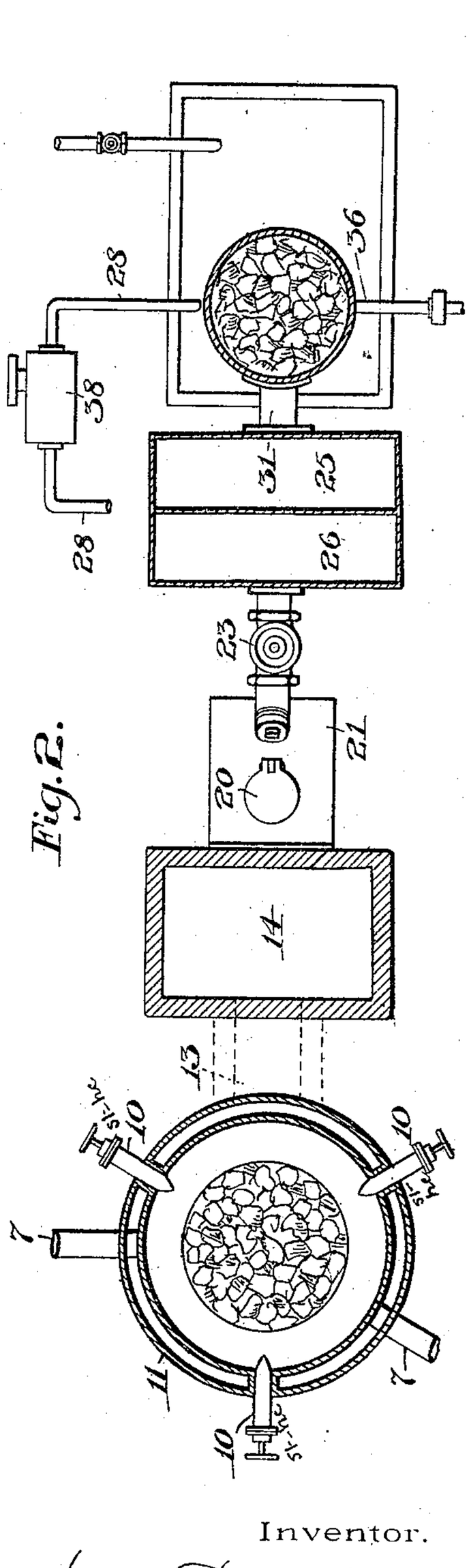

Fig. 2.

Witnesses.

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PROCESS OF AND APPARATUS FOR PRODUCING GAS.

SPECIFICATION forming part of Letters Patent No. 615,997, dated December 13, 1898.

Application filed December 31, 1897. Serial No. 665,224. (No model.)

To all whom it may concern:

Be it known that I, VIVIAN BYAM LEWES, a subject of the Queen of Great Britain and Ireland, residing at Greenwich, London, in the county of Kent, England, have invented certain new and useful Improvements in Processes of and Apparatus for Producing Gas, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

It is well known that if acetylene in quantities below ten per cent. be mixed with hydrogen, carbon monoxid, or water-gas the mixture burns with a practically non-luminous flame, and I have made a long series of experiments in order to ascertain the cause of this phenomenon and the means by which it may be overcome. I find that if acetylene be mixed with the gas called "methane," which is a compound of twelve parts, by weight, of carbon with four parts, by weight, of hydrogen, even the smallest proportion of acetylene endows the mixture with high illuminating value, and that if thirty per cent. of methane be mixed with hydrogen, carbon monoxid, or water-gas, although that mixture will have no illuminating value, yet on the addition of acetylene in any proportions the mixture will develop light, and the same is true for other hydrocarbons of high illuminating value.

In order to produce economically a mixture of carbon monoxid and hydrogen with methane fitted for enrichment by acetylene or other highly-luminous hydrocarbon and in order also to produce economically acetylene and to effect such enrichment thereby, I employ novel apparatus substantially of the construction and operation hereinafter particularly described and claimed.

In the drawings, Figure 1 is a longitudinal vertical section of an apparatus embodying my invention. Fig. 2 is a longitudinal horizontal section thereof as on the line $x\,x$ of Fig. 1.

The numeral 1 designates a structure embodying the generating-chamber 2, the ash-box 3, and the gas-dome 4. This chamber comprises the lower cylindrical portion a and the upper bulged or expanded portion a'. It is lined with fire-bricks and is provided with suitably-located grate-bars 5.

6, 7, and 8 indicate air-blast tubes, one, 6, of which discharges at a point below the grate, while the others discharge at different heights into the combustion or generating chamber, so as to quickly raise the mass of coke, anthracite, or other carbonaceous fuel therein to a state of incandescence by causing the combustion in the upper portion of the fuel of the carbon monoxid formed at the bottom of the fuel-bed.

In the body of the generating-chamber, about half-way up the mass of fuel therein—*i. e.*, intermediate the portions a a'—is arranged a water-jacket 9, which is fitted at intervals in its circumference with injectors 10, by means of which tar or other cheap hydrocarbons may be injected by steam into the mass of incandescent fuel. At other points in the circumference of the jacket are arranged the air-blasts 7. The purpose of the water-jacket is to protect injectors, air-blast nozzles, &c., from the action of the heat. The form of the water-jacket is shown in Fig. 1 and is such that as the fuel descends past the construction in the generator it leaves below the upper ledge of the jacket a space 11, into which discharge the air-blast tubes 7 and the steam-injectors 10 for the tar or other hydrocarbons. Below the grate-bars is situated a steam-inlet 12.

Above the surface of the fuel the generator is connected by means of a conduit 13 with a superheater 14, the upper portion of which is filled with checker-work 15 of fire-brick, while the lower portion contains ingots of iron 16. In the top of the superheater are arranged inwardly-directed steam-injectors 17, by means of which steam may be injected into the superheater. There is also arranged in the upper part of the superheater a tube 17^a, by means of which air may be injected.

Leading from the bottom of the superheater is the horizontal branch or neck 18 of a vertical pipe 19, which is provided at its upper end with a snift-valve 20, while the lower end depends into a water seal 21. Leading from this seal is a pipe 22, provided with a valve 23, which pipe opens into the lower portion

of an appropriate washer 23ª. In the present instance this washer comprises a chamber divided into two vertical compartments or channels 24 25 by a vertical partition 26. In the top of the chamber are arranged sprinklers 27, which are connected with a common feed-pipe 28, whereby a spray of lime-water may be delivered into the channels 24 25, as hereinafter described. The lower portion of the chamber is provided with an overflow 29, which leads to a suitable point of discharge.

Adjacent to the washer is an acetylene-generator 30, the same comprising a chamber having communication at its lower end, by means of a pipe 31, with the washer. In this chamber, slightly above the pipe 31, is supported an inverted truncated cone 32, which affords a bottom for a calcic-carbid store within the chamber. This cone is foraminated and its open lower end or apex is equipped with a cone-valve 33, which is attached to a vertical guide-rod 34, that extends through the carbid and works in a bracket in the upper portion of the chamber. The cone-valve rests upon an eccentric 35, the shaft 36 of which extends through the wall of the chamber and is driven from a suitable source of power, whereby the valve is given a continuous jigging motion. The lower end of the chamber opens into a movable water-containing pan 37, in which the lime and sludge is deposited.

The feed-pipe 28, above referred to, extends into the bottom of the chamber 30 and communicates with a suitable pump 38.

In practice the apparatus above described is used as follows: Fuel having been placed in the generating-chamber 2 and ignited is blown up to incandescence by an air-blast through the tubes 6, 7, and 8, and the products at a high temperature are led through the superheater and allowed to escape by the snift-valve 20, the valve 23 being closed. During the process of blasting a small quantity of air is admitted through the air-tube 17ª at the top of the superheater. This causes combustion of any carbon monoxid in the products of combustion which are being generated and completes the heating of the superheating-chamber to a dull red. The fuel being incandescent and the superheater hot, the snift-valve is closed and the valve 23 is opened, all air-blast being cut off. Tar or other heavy liquid hydrocarbon is then injected, by means of steam, through the injectors 10 into the center of the incandescent fuel. The steam is converted into water-gas, (a mixture of hydrogen and carbon monoxid,) while the tar or other hydrocarbon is decomposed by heat into a mixture of hydrogen and methane in its passage through the incandescent fuel with deposition of carbon, which adds to the fuel. During this operation steam is also admitted in small quantities through the inlet 12 below the grate-bars and, forming water-gas, rises through the fuel and prevents tar or hydrocarbons remaining in the fuel and getting over-decomposed. A certain quantity of sooty and tarry matter will pass forward with the gas into the superheater, and in order to prevent this choking up the interstices between the fire-bricks 15 a regulated supply of steam is forced in through the injectors 17, which steam again forms water-gas with any carbonaceous matter that may be present and prevents any stoppage of the superheater. The mixed gases, consisting of hydrogen, carbon monoxid, and methane, pass on through the water seal 21 and the pipe 22 to the chamber 23, in which in its passage up and down the channels 24 25 the gas is washed and purified by a spray of lime-water delivered from the sprinklers 27. In this way the gas is purified to a great extent from any carbon dioxid and sulfureted hydrogen which it may contain and is also fully saturated with water-vapor. The water-saturated gas enters the bottom of the acetylene-generating chamber 30 and, passing through the openings in the cone, ascends through the calcic carbid. Consequently the water-vapor which the gas contains slowly decomposes the carbid with evolution of acetylene, at the same time thoroughly drying the gas. The amount of acetylene thus mingling with the gas, however, would be, as a rule, too small in quantity to enrich it to the desired point, and therefore the carbid which is passing down is slowly discharged by the rising and falling of the cone-valve 33 into the water at the bottom of the chamber. This water acts as a seal. As the carbid falls into the same the carbid is decomposed with formation of lime and liberation of acetylene, and the lime to a certain extent dissolves in the water, which is kept flowing through the seal. This water is pumped up and supplies the sprinklers for purifying the gas, the degree of enrichment imparted to the gas being regulated at the rate at which the eccentric or cam is driven.

During the period of blowing up the fuel in the generating-chamber 2 to incandescence the pan may be removed and the excess of lime emptied therefrom.

I am aware that it is not new to dry a gas and at the same time mix acetylene therewith by bringing the gas in contact with calcium carbid; but in such processes the gas has not been previously saturated with a definite amount of vapor, but the amount of vapor which it contains is largely dependent upon the temperature. Thus in hot weather the gas would be highly charged with water-vapor and a considerable amount of acetylene would be liberated by drying it over carbid, while in cold weather, when the gas is comparatively dry, little or no acetylene would be liberated. Such processes are therefore not commercially successful except for the sole purpose of drying the gas. In my process, on the other hand, the still warm gas is purposely saturated to a definite extent before bringing it in contact with the carbid, and a maximum amount of water-vapor can be relied upon as

being present, and the amount of acetylene liberated and mingling with the diluting-gas will be a constant quantity.

I claim as my invention—

1. The process of producing gas, which consists in generating a mixture containing methane, hydrogen, and carbon monoxid, then saturating the mixed gas so formed with water-vapor, and passing the saturated gas through calcium carbid, whereby a substantially constant amount of acetylene gas is generated and mixed with the previously-formed gas, substantially as specified.

2. The process of producing gas, which consists first in generating a mixture of methane, hydrogen, and carbon monoxid, second, subjecting such mixture to the action of lime-water, whereby it is washed, purified, and saturated with water-vapor, third, passing the water-saturated gas through calcium carbid, and at the same time independently generating acetylene gas which is mixed therewith, and fourth, utilizing the lime-water formed by such generation in the described washing and purification of the mixture of methane, hydrogen, and carbon monoxid, substantially as specified.

3. In gas manufacture, the process which consists in generating a gas, then saturating the same with water-vapor, and passing the saturated gas through calcium carbid, substantially as specified.

4. The process of producing gas, which consists first, generating a mixture of methane, hydrogen, and carbon monoxid, second, passing this mixture through a superheater, third, subsequently, subjecting the same while still warm to the action of lime-water, whereby it is purified and saturated with water-vapor, and fourth, passing the saturated gas through calcium carbid, substantially as specified.

5. The process of producing gas, which consists first, in generating a mixture of methane, hydrogen, and carbon monoxid, second, passing the mixture through a superheater, third, subjecting the same while still warm to the action of lime-water whereby it is purified and saturated with water-vapor, and fourth, passing the saturated gas through calcium carbid whereby it is dried and acetylene is generated and mixed with the gas, and at the same time causing independent generation of acetylene and mixing the same with the other gas, substantially as specified.

6. In apparatus for generating acetylene, the combination, with a chamber having carbid and water containing portions, of a perforated member between said portions, a valve therefor, a cam for said valve, and means for actuating said cam, substantially as described.

7. The combination, with a chamber having a suitable source of gas-supply, and feed-water means for said chamber, of a second chamber having communication with the first-named chamber, a calcic-carbid store and water-containing space in said chamber, and connections between the water-space and the said feed-water means, substantially as described.

8. The combination, with a chamber having a suitable source of gas-supply, feed-water means, and a water-discharge, of a second chamber having communication with the first-named chamber, a calcic-carbid store and water-containing space in said second chamber, and connections between the water-space and the said feed-water means, substantially as described.

9. In apparatus for producing gas, the combination of a generating-chamber, hydrocarbon injectors and air-blasts directed into the body of said chamber, a steam-inlet, and a superheater connected with said chamber, of a washer into which the gas passes from said superheater, and a carbid-containing chamber into which the water-saturated gas is directed, substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two subscribing witnesses.

VIVIAN B. LEWES.

Witnesses:
HENRY ALFRED HOODBRIDGE,
ALBERT JOHN ROSS.

Correction in Letters Patent No. 615,997.

It is hereby certified that in Letters Patent No. 615,997, granted December 13, 1898, upon the application of Vivian B. Lewes, of London, England, for an improvement in "Processes of and Apparatus for Producing Gas," were erroneously issued to said Lewes and William Wallace Goodwin, as assignee of one-half of the said invention; whereas said Letters Patent should have been issued to said *Lewes and William Wallace Goodwin and Emanuel Stein, said Goodwin and Stein being owners of one-half* interest, as shown by the record of assignments in this office; 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, countersigned, and sealed this 10th day of January, A. D., 1899.

[SEAL.]

WEBSTER DAVIS,
Assistant Secretary of the Interior.

Countersigned:

C. H. DUELL,
Commissioner of Patents.