(No Model.) 4 Sheets—Sheet 1.

S. MARCUS.

ELECTRICAL IGNITING DEVICE FOR GAS ENGINES.

No. 306,339. Patented Oct. 7, 1884.

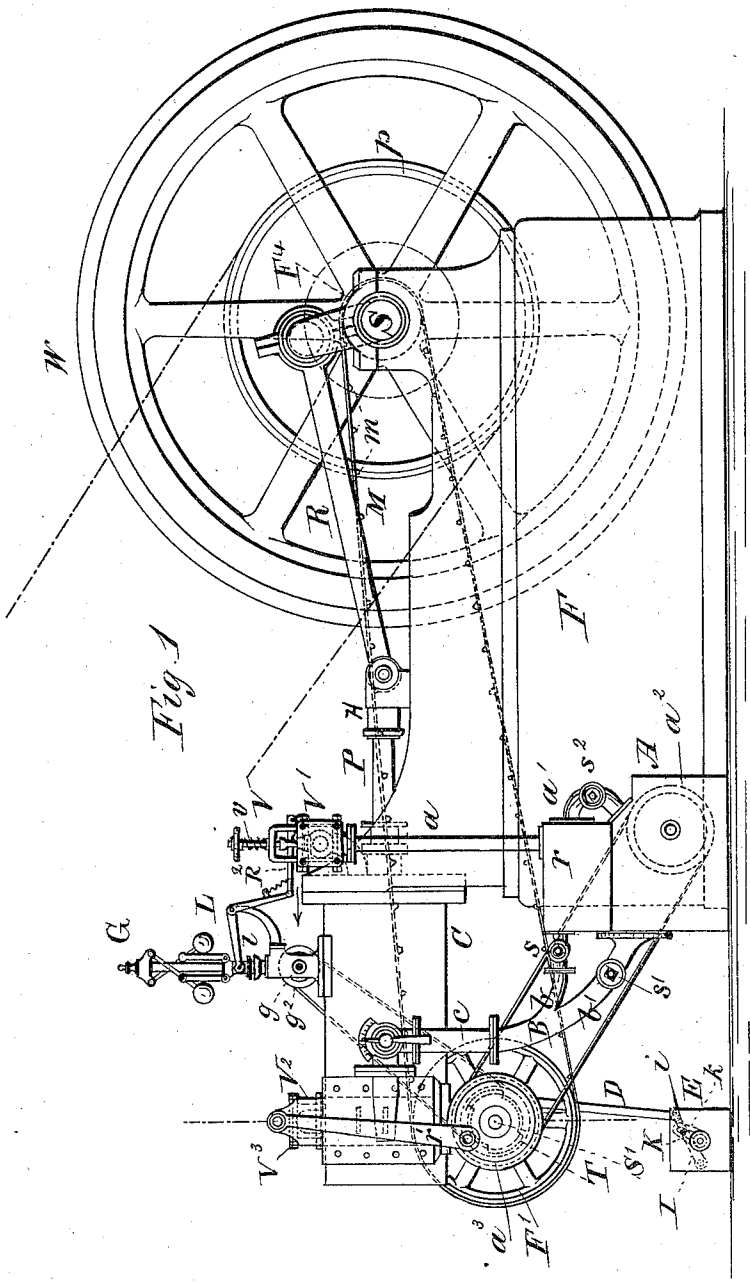

Fig. 1.

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(No Model.) 4 Sheets—Sheet 2.

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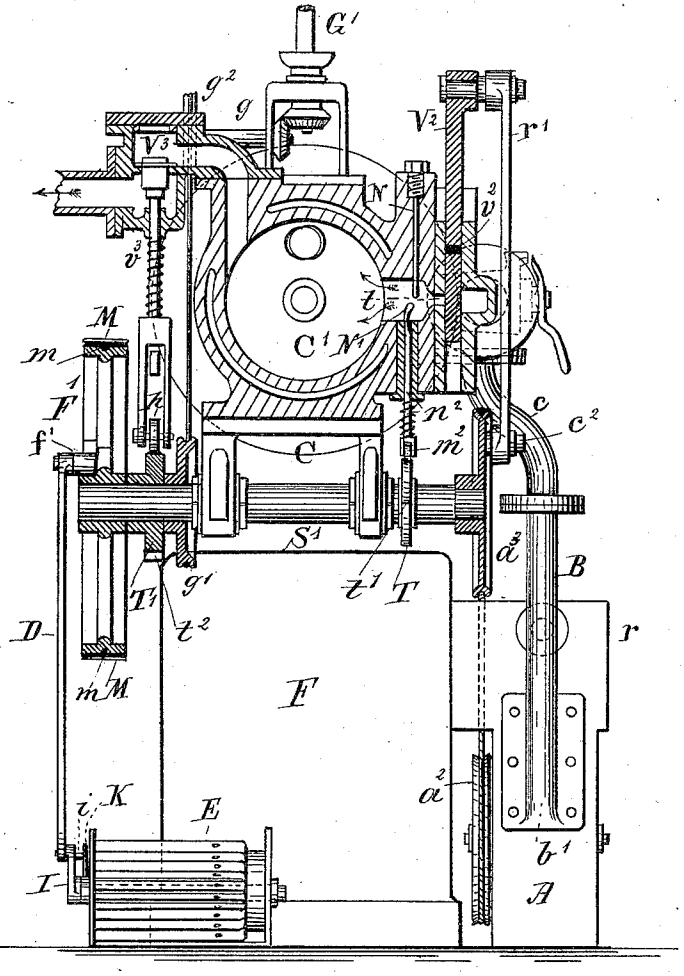
Fig. 2.



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(No Model.) 4 Sheets—Sheet 3.

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ELECTRICAL IGNITING DEVICE FOR GAS ENGINES.

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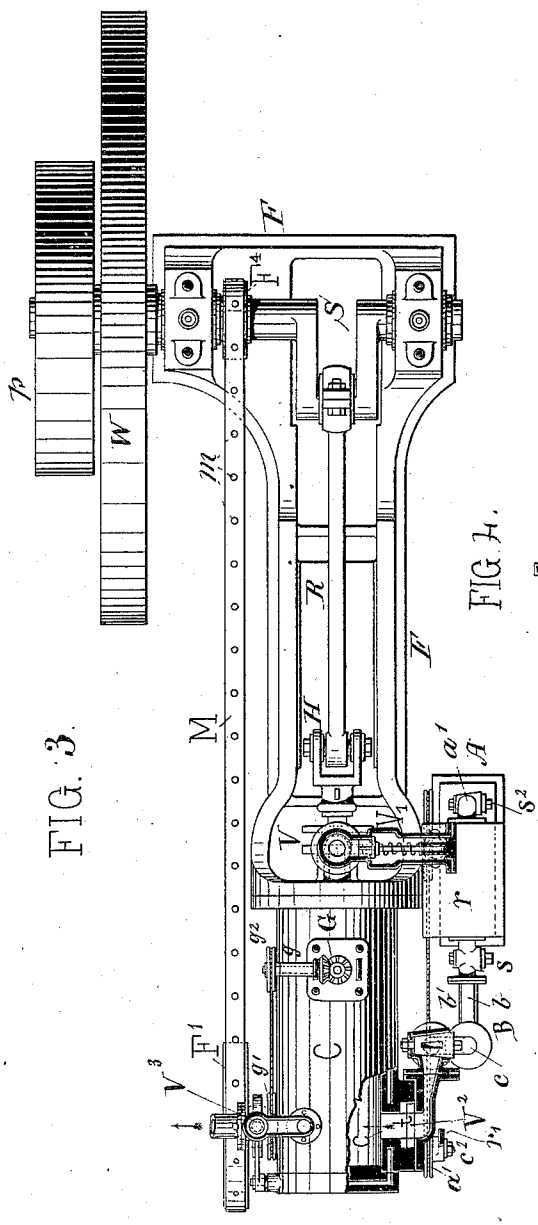

FIG. 3.

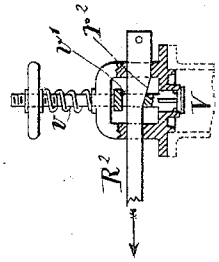

FIG. 4.

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(No Model.) 4 Sheets—Sheet 4.

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ELECTRICAL IGNITING DEVICE FOR GAS ENGINES.

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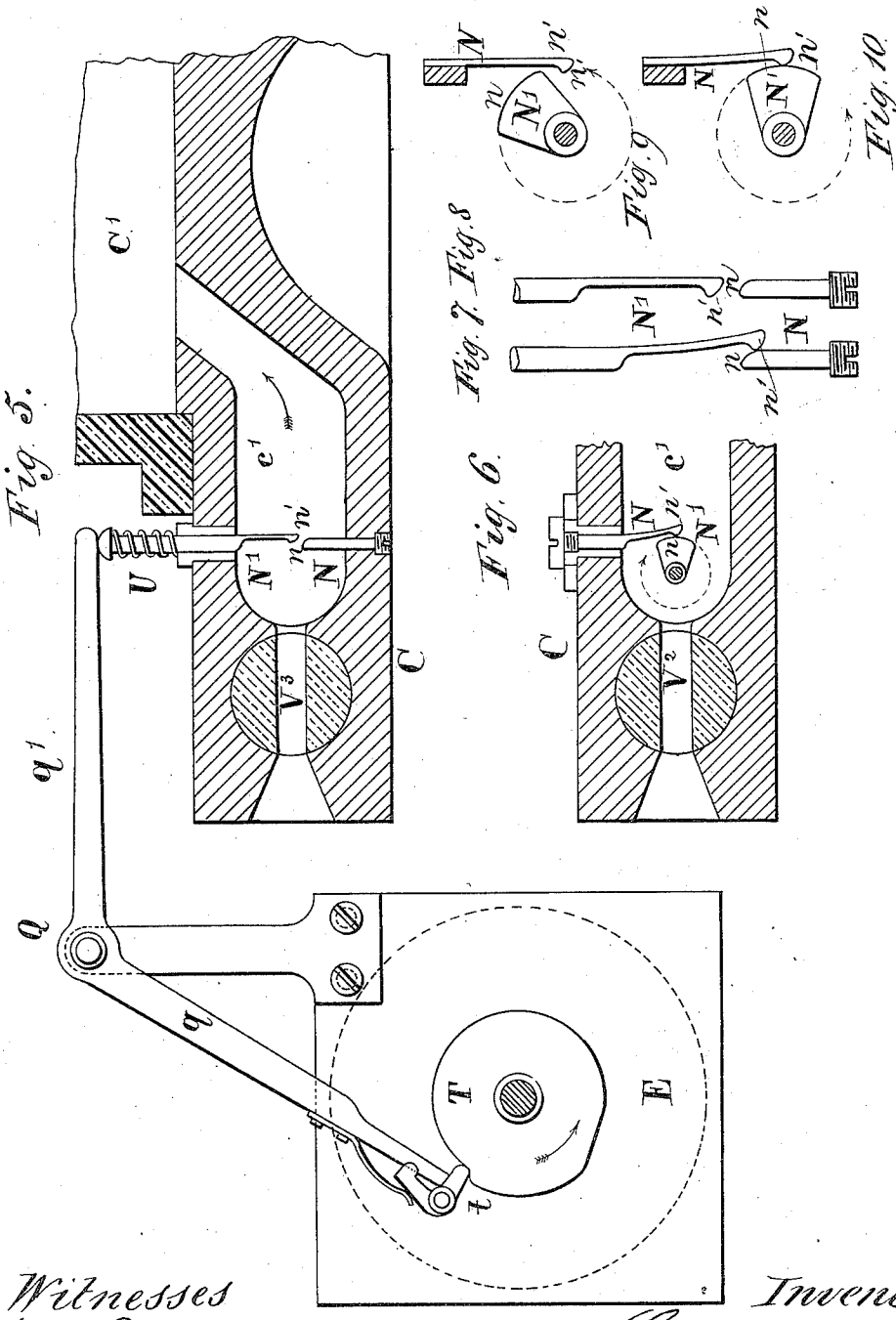

Witnesses
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UNITED STATES PATENT OFFICE.

SIEGFRIED MARCUS, OF VIENNA, AUSTRIA-HUNGARY.

ELECTRICAL IGNITING DEVICE FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 306,339, dated October 7, 1884.

Application filed August 13, 1883. (No model.) Patented in Belgium May 13, 1882, No. 57,900; in France May 15, 1882, No. 148,954; in Germany May 23, 1882, No. 26,706, and May 20, 1883, No. 25,947; in Italy June 30, 1882, XVI, 14,290, XXVIII, 401, and in Austria-Hungary July 24, 1883, No. 17,407, and No. 29,829.

To all whom it may concern:

Be it known that I, SIEGFRIED MARCUS, a subject of the Emperor of Austria-Hungary, residing at Vienna, in the Province of Nether-Austria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Electrical Igniting Devices for Gas-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My present invention relates to that class of gas-engines for which I have filed an application for patent on or about the 12th day of June, 1882, and for which Letters Patent have since been granted under date of October 2, 1883, No. 286,030; and it relates to improvements of and in the engine proper, as well as to improvements of and in the igniting devices.

I desire it to be understood that, although I do not herein lay claim to any features of invention not connected or in co-operation with the said igniting devices, I reserve myself the right to claim the same in a separate application for patent therefor; and in order that the subject-matter of this part of the invention may be more fully comprehended it will be necessary to describe briefly the general construction and operation of the engine, though said igniting devices may be applied for use with any other gas-engine.

In the accompanying drawings, Figure 1 is a side elevation, Fig. 2 a vertical transverse section, and Fig. 3 a top plan view, partly in section, of a horizontal gas-engine embodying my improvements. Fig. 4 is a detail view of the admission-valve. Figs. 5, 6, 7, 8, 9, and 10 are detail views, showing the construction and operation of my improved arrangement of contact-points.

Like letters of reference indicate like parts wherever such may occur.

In its general form the engine is constructed upon substantially the same principles as the type of engine shown and described in the application for patent above referred to, with the exception of the improvement made, and which I will now describe.

F is the main frame, of suitable construction to support the engine-cylinder and operative parts of the engine. S is the main driving-shaft, carrying a single driving-pulley, F^4, the fly wheel or wheels W, and the transmission pulley or pulleys *p*. C is the engine-cylinder; P, the piston-rod; H, the cross-head; R, the connecting-rod that connects the piston-rod with the main driving-shaft S.

The cylinder and piston are constructed to perform the function of an air-compressor, drawing in air at each backward stroke, compressing and expelling the air at each forward stroke. For this purpose the cylinder C is at its forward end provided with a suction and a check or escape valve, V V′, respectively. The valve-casing of the latter valve is connected by a pipe, *a*, with the compressed-air reservoir *r*, and the latter by a pipe, *a′*, provided with a stop-cock or valve, s^2, with the atomizer A. By means of a pipe, B, having two branches, *b b′*, provided with stop-cocks or valves *s s′*, the air-reservoir and atomizer are both connected with the mixing-chamber *c*. By means of this arrangement a charge of air is admitted through pipe *a* into the atomizer, to be there saturated with a hydrocarburet.

Any suitably-constructed devices for atomizing or vaporizing the hydrocarburet may be employed. I prefer to use the atomizer shown and described in Letters Patent granted to me under date of April 3, 1883, No. 275,238.

The explosive charge may be ignited by any suitable means. I prefer to effect this by an electric spark produced by a magneto-electric generator—such, for example, as the one shown and described in Letters Patent granted to me under date of April 3, 1883, No. 275,237, and indicated in the accompanying drawings at E.

A counter-shaft, S′, is located at or near the rear end of the cylinder C, and below it and from this counter-shaft all the operative parts of the

engine are operated, said shaft being driven from the main driving-shaft S.

To obtain a more regular and certain cut-off, instead of the rotating or oscillating valve or stop-cock employed in the construction of engine shown in my said application for patent, I employ a reciprocating or slide valve, V^2, having a port, v^2. The valve is connected by a rod, r', to the crank c^2 of a pulley, a^3, on counter-shaft S', that carries also a driving-pulley, F', belted to pulley F^4 on main shaft S by a steel belt, M, having lugs or teeth m, that take into recesses formed in the peripheries of the pulleys, whereby a uniform motion is transmitted from shaft S to shaft S'. The slide-valve V^2 uncovers the admission-port t of the cylinder at each vertical movement in each direction; hence the speed of pulley a^3 should be so timed relatively to the speed of shaft S as to make one revolution to every two revolutions of the said shaft S. By this means I obtain a positive, rapid, and uniform cut-off.

To regulate the volume of the explosive charge, and consequently the speed of the engine, I employ a governor, G, the shaft g of which is driven from the counter-shaft S' by belt and pulleys $g' g^2$, the former on the counter-shaft, the latter on the governor-shaft, the speed of the governor-shaft being the same as that of the main driving-shaft.

The governor-slide G', Fig. 1, is connected by means of a bell-crank lever, L, to a valve-operating rod, R^2, that has the bevel or inclined operating-face r^2, working in a slot, v', of the stem v of the suction-valve V. By means of this arrangement the valve V is kept more or less open when the speed of the engine increases beyond a normal speed, this being effected by the inclined face r^2 of rod R^2, forcing the valve V inwardly off its seat as the said rod is drawn in the direction of the arrow, Figs. 1 and 4, by the bell-crank lever L, the arm l of which is elevated by the governor-slide as it is raised by the centrifugal motion of the governor-balls spreading under an increase of speed, as will be readily understood. The valve V being more or less open, a portion of the air drawn into the cylinder in front of the piston during the backward stroke escapes therefrom during the forward or positive stroke of the piston. Of course, the volume of air escaping from the cylinder through the suction-valve is determined by the extent to which such valve is held open, the explosive charge being thus regulated and determined by the speed of the engine, as will be readily understood. The atomizer A is driven from shaft S' by slide-valve pulley a^3 on shaft S' and a pulley, a^2, on the brush-shaft of the atomizer.

Instead of driving the induction-core of the magneto-electric generator by means of a toothed steel belt, as described in the application for Letters Patent above referred to, and imparting to said core a variable rotary motion, I prefer to actuate the core positively, and to give it an oscillating instead of a rotary motion, and drive it from the same shaft, S', that actuates the cut-off slide V^2. By means of this construction I greatly simplify the operating mechanism of these parts, and at the same time obtain better results. Both the magneto-electric generator and cut-off slide V^2, being operated from the same shaft, will therefore work synchronously, both being timed by and relatively to the speed of the main driving-shaft S, consequently to the movements of the piston, the relative arrangement being such that the charge of explosive gas will be admitted to the chamber C' of the cylinder when the piston has traversed about one-fourth of its forward course, and the electric spark to ignite the charge will be produced within the explosive chamber c' of the cylinder immediately after the cut-off has taken place. The induction-core is positively driven from the pulley F' by a crank, f', and connecting-rod D, connected to an eccentric lever, I, that carries a stud, i, which latter works in the slot k of a crank, K, on the shaft of the induction-core, as shown in dotted lines, Fig. 1. The electric spark is here produced by the rapid separation of two contact points or pins, one of which is a stationary pin and the other a movable pin.

Various means may be employed to bring the movable pin in and out of contact with the stationary pin. Such means I have shown and described in the application for Letters Patent for gas-engines, and in Letters Patent for magneto-electric generators, above referred to, as well as in Fig. 5 of the accompanying drawings; or this result may be obtained as hereinafter described.

I have found that when simple contact and interruption of contact of two conductors is resorted to to produce the electric spark the contacting bodies soon become inoperative by loss of their conducting properties. This loss of conductivity is due to the speedy heavy deposit of carbon upon the contacting bodies, which practically and completely isolates them from each other, so that no metallic contact takes place at all, and the explosive charge is not ignited. To avoid this difficulty I enlarge the contacting-surfaces and cause them to move into and out of contact with sufficient friction to remove any deposit of carbon thereon.

As shown in Fig. 5, the movable contact-pin N' is brought into and out of frictional contact with the fixed pin N by the lever Q, the arm q of which is lifted by cam T, depressing the arm q', and with it the pin N', which is thus made to slide over the pin N. When the lever-arm q drops over the nose t of cam T to elevate the arm q', the spring U rapidly retracts the pin N' from pin N, and both the making and the breaking of the contact is effected with sufficient frictional power between the two pins to remove any deposit of carbon thereon.

To obtain the necessary frictional force, I preferably make one of the pins more or less elastic.

As shown in Fig. 5, the movable pin N′ is made in the form of a spring having an enlarged and preferably slightly flattened or flattened and corrugated contact-surface, n', that impinges upon a corresponding surface, n, of the pin N.

Instead of making and breaking the contact of the pins, as described, this may be effected in a much simpler manner, as shown in Fig. 2.

N is the fixed pin, and N′ the sliding pin, which is attached to or forms a part of a rod, n^2, that carries a roller, m^2, which roller rides upon a cam, T, which is mounted on the counter-shaft S′, instead of being mounted on the shaft of the magneto-electric generator. As the cam rotates, the pin N′ is brought into frictional contact with pin N, as described, and when the roller m^2 rides over the nose t' of cam T the pin N′ is retracted from pin N by spring U, as plainly shown.

V^3, Fig. 2, is the exhaust-valve, the stem v^3 of which carries a roller, h, that rides upon a cam, T′, on the counter-shaft S′, by means of which cam the valve is operated. As the cam rotates, the valve is held upon its seat until the roller drops off the nose t^2 of said cam, when the valve suddenly opens to allow the escape of the spent gases. It will thus be seen that the admission and exhaust valves, the governor, the atomizer, and magneto-electric generator, and the making and breaking of the contact between the pins to produce the electric spark that ignites the explosive charge are all operated or effected from one and the same shaft, S′; that the latter is driven from the main driving-shaft, I may say, positively, since the toothed steel belt performs, practically, the function of gearing, and is even less liable to produce variable motion than such gearing; that the cams, crank-disks, or pulleys on said shaft S′ are so arranged relatively to one another that the mechanical devices operated thereby will perform their functions in proper time, and act in harmony to produce the desired result. It will further be seen that the governor regulates the volume of the charge admitted by regulating the volume of air that is passed through the atomizer, and consequently regulates the speed of the engine. Of course, it will be understood that the atomizer may be dispensed with if the suction-valve is connected with a reservoir containing an explosive gas under pressure, or not.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a gas-engine, an admission-valve, an exhaust-valve, a governor for automatically regulating the volume of air for each explosive charge, an atomizer for atomizing a liquid carbon compound, a magneto-electric generator, and a movable contact point or pin for producing an electric spark to ignite the explosive charge, all operated from the same shaft, substantially as and for the purposes specified.

2. The combination of the cylinder C, its piston and piston-rod, the shaft S, a compressed-air reservoir, an atomizer for atomizing a liquid carbon compound connected with said air-reservoir, a magneto-electric generator, the admission-valve V^2, contact-pins N N′, and exhaust-valve V^3, with the counter-shaft S′, pulleys F a' g', the cams T t', and suitable connecting-rods for connecting the admission and exhaust valves, the atomizer and electric generator, with their operative organs on shaft S′, substantially as and for the purposes specified.

3. The combination, with the shaft S′, the shaft of the magneto-electric generator, and the slotted crank K, of the lever I, pin i, rod D, and crank-disk or pulley F, substantially as and for the purposes specified.

4. The combination, with the exploding-chamber of a gas-engine, of the contact-pins N N′, having extended contacting-surfaces, and the spring n^2, in combination with the cam T, operating to make and break the contact between the two pins by causing them to slide one over the other with sufficient frictional contact to prevent the deposit of carbon thereon, as described, for the purposes specified.

In testimony whereof I affix my signature in presence of two witnesses.

SIEGFRIED MARCUS.

Witnesses:
JAMES RILEY WEAVER,
CLARENCE W. HYDE.