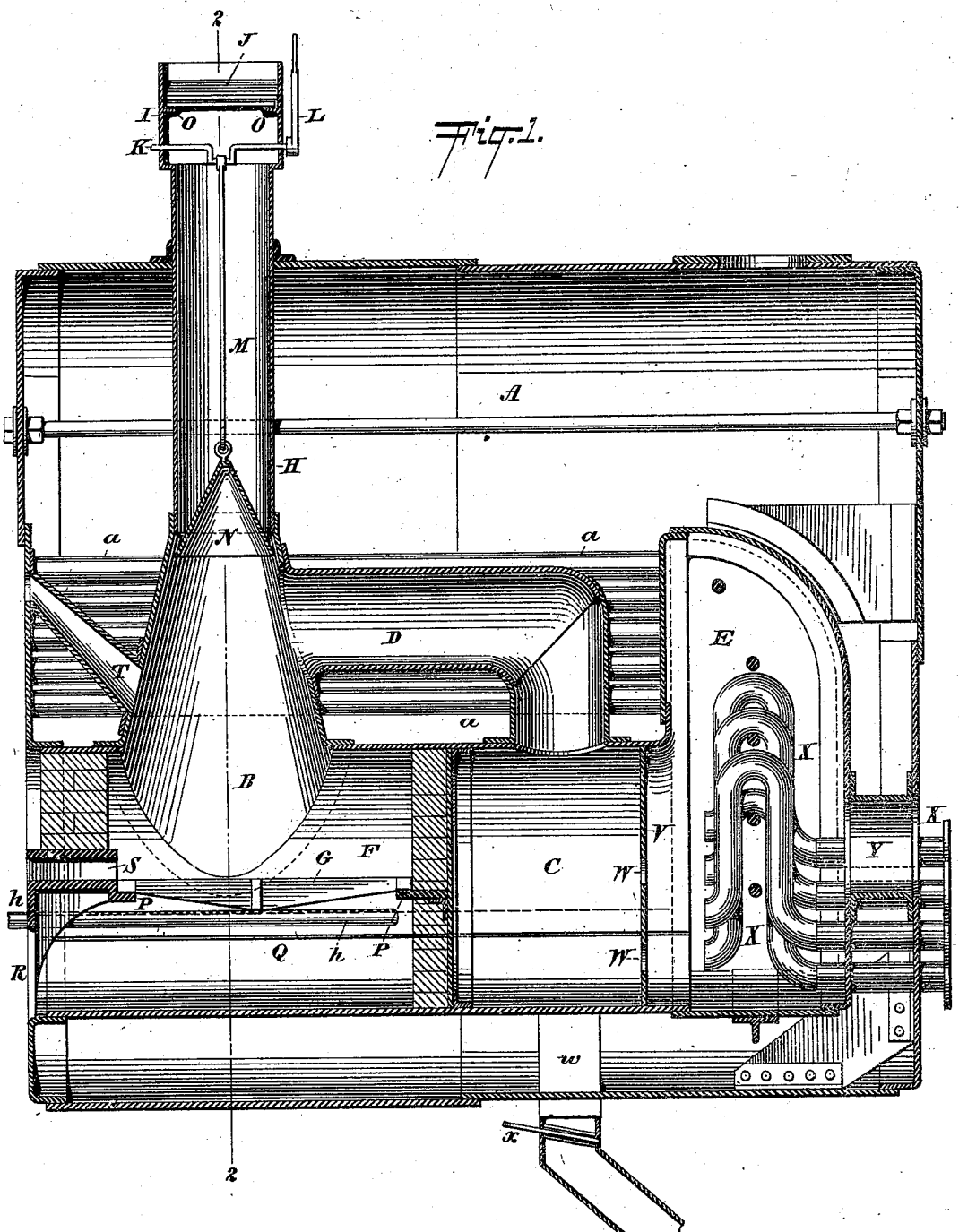
(No Model.) 3 Sheets—Sheet 1.

J. J. BARCLAY.

STEAM BOILER.

No. 501,047. Patented July 11, 1893.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

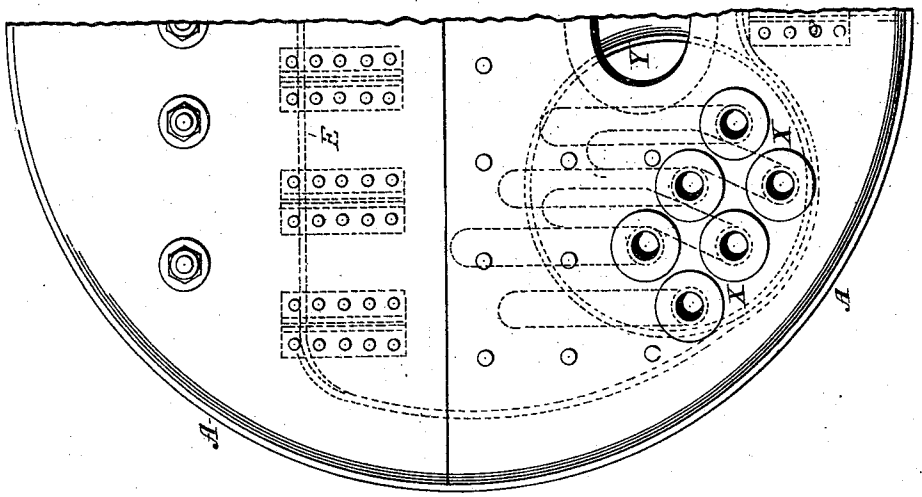
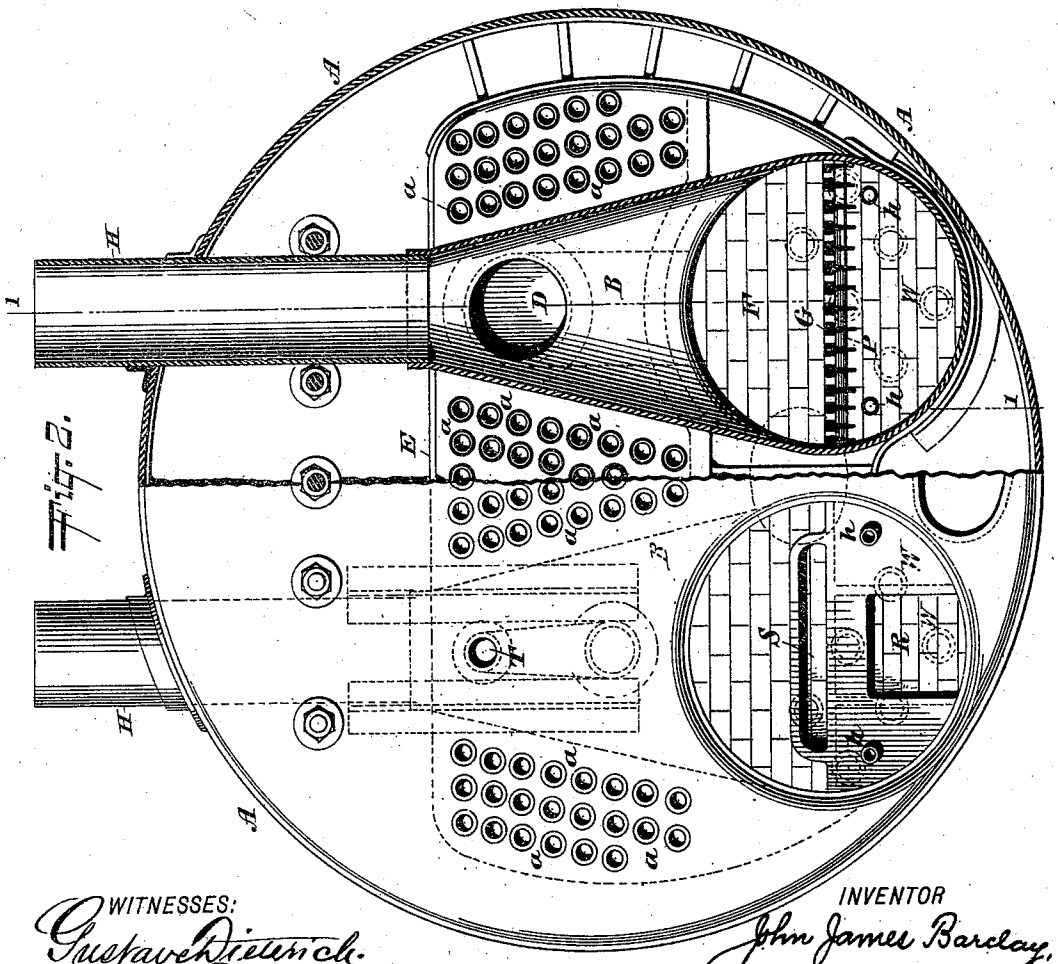


Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

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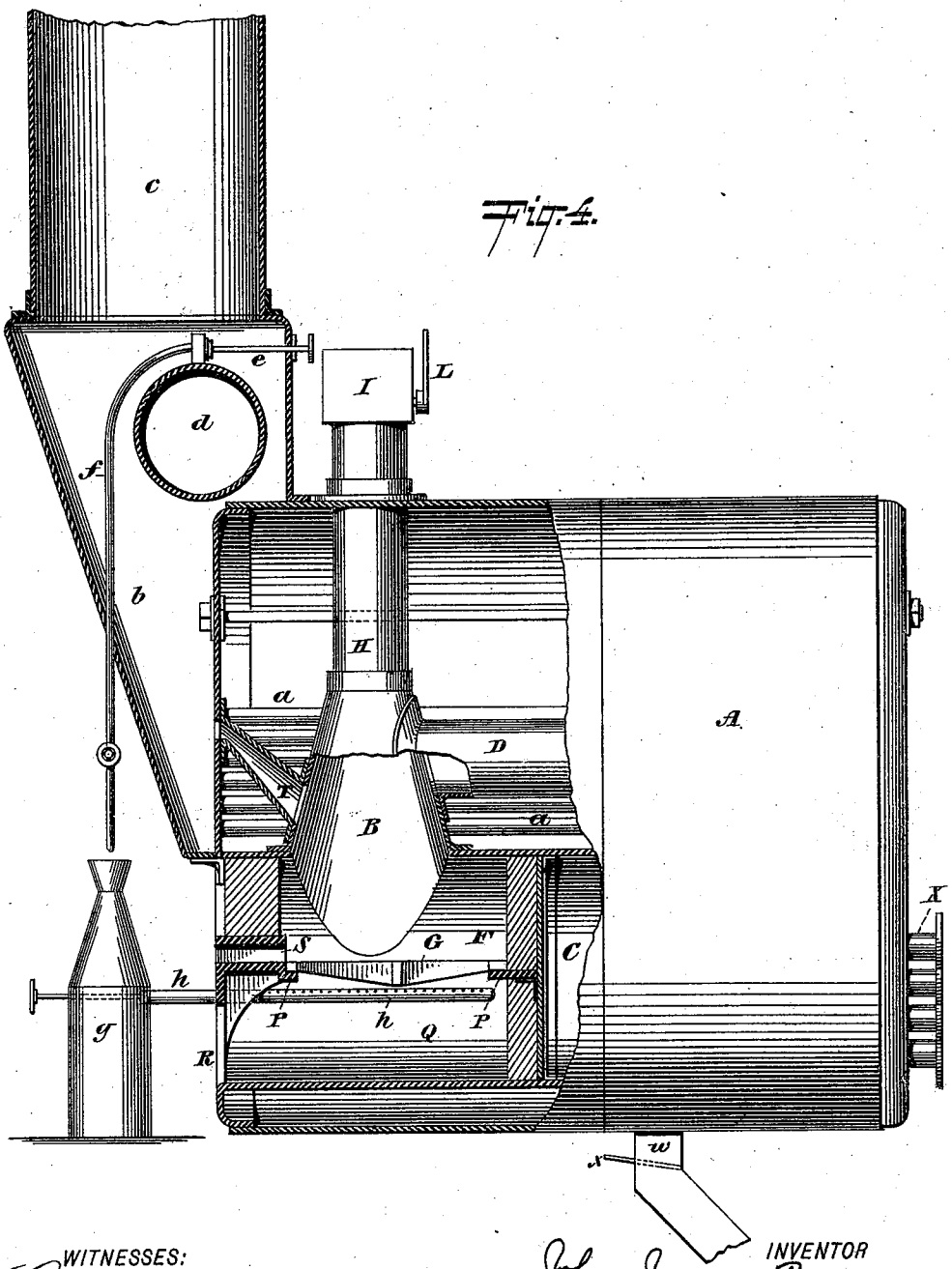
Fig. 4.



WITNESSES:
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UNITED STATES PATENT OFFICE.

JOHN JAMES BARCLAY, OF ELIZABETH, ASSIGNOR OF ONE-HALF TO WILLIAM W. DASHIELL, OF BERGEN POINT, NEW JERSEY.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 501,047, dated July 11, 1893.

Application filed December 9, 1892. Serial No. 454,557. (No model.) Patented in England July 25, 1889, No. 11,864.

To all whom it may concern:

Be it known that I, JOHN JAMES BARCLAY, a subject of Her Majesty the Queen of Great Britain, and a resident of Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Steam-Boilers, (for which I have received Letters Patent in England, No. 11,864, dated July 25, 1889;) and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to use the same.

The invention relates to improvements in steam boilers, and its object is to provide means whereby instead of burning the coal directly in the furnace as is now the common practice, the fuel is in the first place converted into gas and this gas is then burned together with air.

In carrying my invention into practice I provide two gas producers, which are surrounded by the water in the boiler and are fed with fuel from the top through pipes or chutes having bell valves by which they may be closed. The fuel is supported upon suitable grate bars, and beneath the bars are perforated pipes through which air is forced by steam jets. The air together with the steam passing up amidst the ignited fuel on the grate bars generates gas, which is conducted from the upper part of the producer by a downwardly directed passage into a chamber in rear of the producer and from thence through ports into the combustion chamber, where it at once comes into contact with expanded air and complete combustion takes place. The products of combustion return from the combustion chamber through the boiler tubes to the uptake, and so pass to the chimney. The air is supplied to the combustion chamber by pipes or tubular passages at the back of the boiler. Openings are provided in the gas producers, at the front, in order that the contents may be stirred when necessary to insure the descent of the fuel and the uniform generation of gas.

The invention may be more fully understood from the detailed description hereinafter presented, reference being had to the accompanying drawings in which—

Figure 1 is a vertical longitudinal section of a boiler constructed in accordance with and embodying the invention, the section being centrally through the gas producer. Fig. 2 is a front elevation of same, partly broken away, and in section on the dotted line 2—2 of Fig. 1. Fig. 3 is an elevation looking at the rear of the boiler, one half of the latter being removed, and Fig. 4 is a side elevation partly in section of the boiler.

In the drawings A designates the shell of the boiler; B, B, the gas producers; C, C, the gas receiving chambers; D the downwardly extending passages or flues conveying the gas from the upper part of the producers to said receiving chambers, and E the combustion chamber. The gas producers B are in the form of hollow truncated cones merging at their base into the fire chambers F having grate bars G, and at their apex being connected with the lower end of the trunks H, through which the fuel is supplied to the grate bars G.

At the upper end of each trunk H is the box I containing the slide J and the crank shaft K provided with the handle L and supporting through the connection M the bell valve N, which, when lowered through the action of the crank shaft K, will leave intermediate its periphery and the inner walls of the gas producers a space through which the fuel may fall to the grate bars, and when, through the action of the crank shaft K, the bell valve N is elevated, its edges will closely impinge the inner walls at the lower end of the trunk H and effectually close the passage. The slide J serves as an effectual means for closing the box I upon the upper end of the trunk H, and is adapted to he drawn outward therefrom at will. The said slide J rests upon the inclined guides O and upon it the fuel may first be placed and then allowed to fall into the trunk H by the withdrawal of the slide, after which the slide will be returned and the shaft K rotated to lower the bell valve N so as to permit the descent of the fuel to the grate bars G. After the fuel has fallen from the valve H, the latter will be immediately closed upward by the crank-shaft K.

The fire chamber F is provided preferably with brick walls at its front and rear ends and supports the grate bars G upon flanges P; be-

low the grate bars G is the usual ash receiver Q, and at the front of the boiler an opening or door R is provided for the removal of the ashes and an opening S for the dislodgment of any clinkers from the grate bars G. The gas producers B are, also, provided with the openings T extending upward through the front ends of the boiler, said openings being smaller at their upper end and intended for the reception of a rod or other device for stirring the contents on the grate bars in order to insure the descent of the fuel and the uniform generation of gas.

The gas receiving chambers C are directly in rear of the gas producers B, and are connected with the latter by means of the flues D which form passages extending from the upper portion of the gas producers downwardly to the upper portion of the gas receiving chambers C; and in rear of the gas receiving chambers C is provided the combustion chamber E, a partition V separating said combustion chamber E from the gas receiving chambers C and being provided with ports W through which the gas may escape from the receiving chambers C into the combustion chamber E.

At the back of the boiler A is the series of pipes X which extend from the outer atmosphere into the combustion chamber E in which, as shown, they are preferably coiled into serpentine form; and these pipes convey the air into the combustion chamber in which it is expanded and combined with the gas to produce perfect combustion. The back of the boiler is also provided with the opening Y through which shavings, wood or other fuel may be fed into the combustion chamber E at the starting of the operation of the boiler, and this opening Y will in use have a door of any suitable construction whereby it may be closed during the employment of the boiler.

In the drawings I illustrate a series of air pipes X, but it will be understood that the number and size of these pipes will vary with the size and conditions of the boiler, and hence I do not limit the invention to any particular number or size of the pipes X. It is my object however to employ a sufficient number of the pipes X to insure the admission of about five pounds of air to four pounds of the gas created in the gas producers B and conveyed to the combustion chamber.

In the drawings the shell of the boiler A incloses two gas producers B, two gas receiving chambers C, and one combustion chamber E, the latter being sufficient in size to receive the gas from both the receiving chambers C. The invention is not confined, however, to the employment of both gas producers B and both receiving chambers C, since for some purposes it may be desirable to employ simply one-half of the apparatus shown, or, in other words, a single gas producer B with one receiving chamber C and one combustion chamber. It is obvious also that for large boilers a larger number than two of the gas producers, gas receivers and combustion chambers may if desired be employed.

From the upper portion of the combustion chamber E the tubes *a* pass to the usual up-take *b* leading to the chimney *c*.

At the front of the boiler A I provide means for supplying mixed air and steam below the grate bars G, and in the present instance for the purpose of producing the mixed air and steam and delivering it to the grate bars I illustrate an auxiliary steam generator *d* having a valve *e* and being connected with a pipe *f* leading downward to the upper bowl-shaped end of the blower *g*, from which perforated air pipes *h* extend inward through the front of the boiler and beneath the grate bars G. The invention is not confined, however, to any special means for supplying mixed air and steam to the grate bars, nor to the use of the steam generator *d*, since, if preferred, the pipe *f* might lead directly from the boiler A instead of from an auxiliary generator *d*. In the event of the pipe *f* being led from the boiler A it would be desirable to connect a supply pipe leading from a source of fresh water to the boiler, to compensate for the steam used by the pipe *f*.

In the use of the boiler hereinbefore described the fire will be started upon the grate bars G in the customary manner, the fuel being supplied through the trunk H, and simultaneous with the burning of the fuel on the grate bars G the mixed air and steam will be supplied through the perforated pipes *h*, below the grate bars G. After the fire on the grate bars G has become started and the gas is being generated a small proportion of fuel, such as shavings or wood, will be placed into the combustion chamber E and lighted, the result being that a crude gas will be formed in the gas receivers B and pass through the flues D into the receiving chambers C and thence in restricted form escape through the ports W into the combustion chamber E, where it will meet the fire started therein and combining with the expanded air from the pipes X, perfect combustion will result. The products of combustion will escape through the tubes *a* to the up-take *b* and chimney *c*. It will not be necessary to furnish additions to the fuel in the combustion chamber E, since the heat therein due to the combustion of the gas will be intense and keep the coiled ends of the pipes X in a highly heated state, thus maintaining the conditions necessary for continuous combustion. It will be necessary to add, from time to time, fresh supplies of coal to the grate bars G, in order that the creating of the gas may be continuous and uniform. The gas is restricted on its passage from the chambers C to the chamber E in order that only such a supply thereof may pass into the chamber E as will assuredly be fully consumed and its heat economically utilized. The chambers C form reservoirs to receive the gas and uniformly deliver it in proper quantity to the combustion chamber, with the result of se-

curing uniformity in the consumption and heat and the greatest economy in the use of fuel.

At the base of the receiving chambers C, C, will be provided a chute *w* having a slide *x* by which the escape of tar cinders may be effected.

From the use of my invention great economy of fuel and saving of labor will result; it admits also of cheap qualities of coal being employed; the generation of steam will also be more regular than heretofore. It will be observed also on reference to Fig. 1 that the arrangement and conditions of the boiler are such as to afford the maximum amount of heating surface.

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

1. In a steam boiler the gas producer B located over the fire chamber F, the receiving chamber C, and the flue D passing from said producer to said chamber, combined with the combustion chamber E having air inlets and communicating with said chamber C, and the boiler tubes *a* leading from the combustion chamber, the whole being of metal and supported within the boiler shell, substantially as and for the purposes set forth.

2. In a steam boiler the metal gas producer B located over and collecting the gas from the fire chamber F, combined with the metal combustion chamber E receiving said gas and having inlets for the supply of air, and the boiler tubes *a* leading from said combustion chamber, the whole being inclosed within the boiler shell A and arranged and operating substantially in the manner and for the purposes described.

3. In a steam boiler the metal gas producer B located over and collecting the gas from the fire chamber F, and provided at its upper end with means for feeding the fuel combined with the metal receiving chamber C in line with the said fire chamber, the flue D extending from said producer to said receiving chamber, and the metal combustion chamber E having inlets for air, outlets for the products of combustion, and a communication with the said receiving chamber, the whole being inclosed within the boiler shell A and arranged and operating substantially in the manner and for the purposes set forth.

4. In a steam boiler, the cone-shaped gas producer connected at its upper end with the trunk to receive the fuel and at its lower end forming the fire box, combined with the bell-valve at the upper end of said producer, the receiving chamber connected with the gas producer, and the combustion chamber connected by ports with said receiving chamber and having an outlet for the products of combustion the whole being of metal and inclosed within the boiler shell; substantially as set forth.

5. In a steam boiler the gas producer, and the combustion chamber receiving the gas, combined with the series of pipes leading into said chamber and coiled therein the whole being of metal and inclosed within the boiler shell; substantially as set forth.

6. In a steam boiler the gas producer, combined with the connected receiving chamber and combustion chamber, the latter having air inlets and an opening to receive fuel; substantially as set forth.

Signed at New York, in the county of New York and State of New York, this 30th day of September, A. D. 1892.

JOHN JAMES BARCLAY.

Witnesses:
CHAS. C. GILL,
ED. D. MILLER.