

No. 783,132.

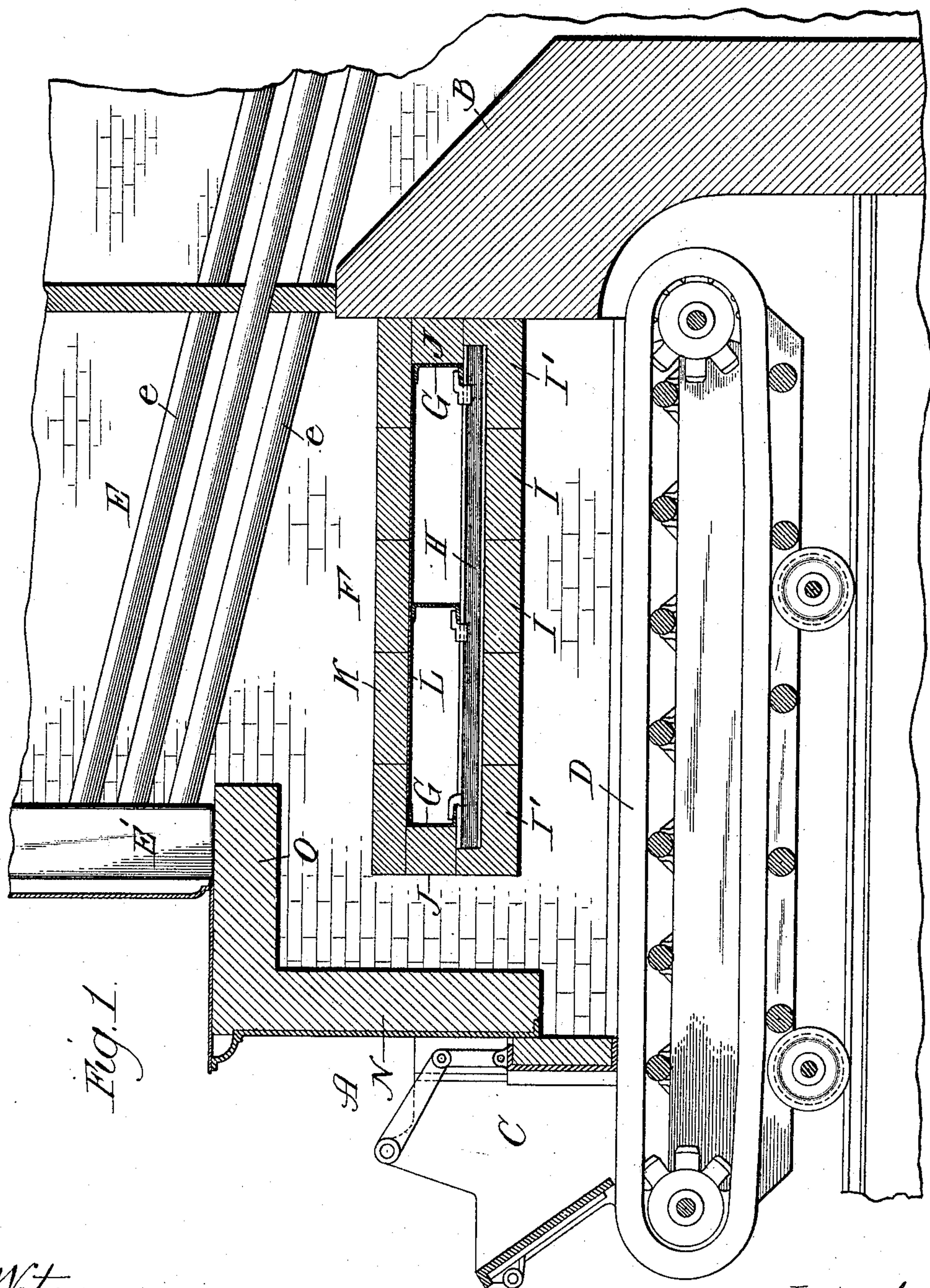
PATENTED FEB. 21, 1905.

H. A. POPPENHUSEN.

FURNACE.

APPLICATION FILED APR. 21, 1904.

2 SHEETS—SHEET 1.



Witnesses

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his Attys



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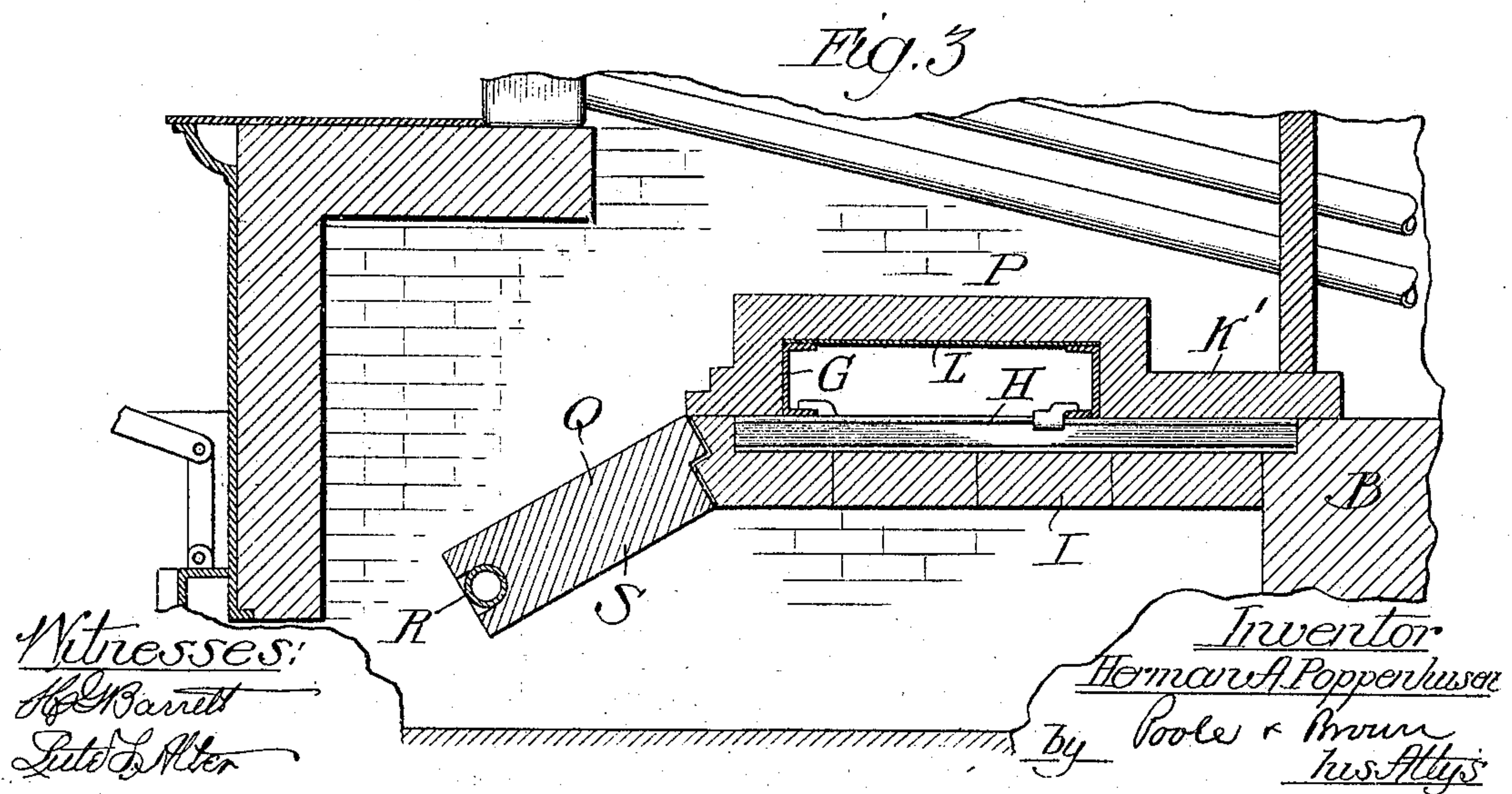
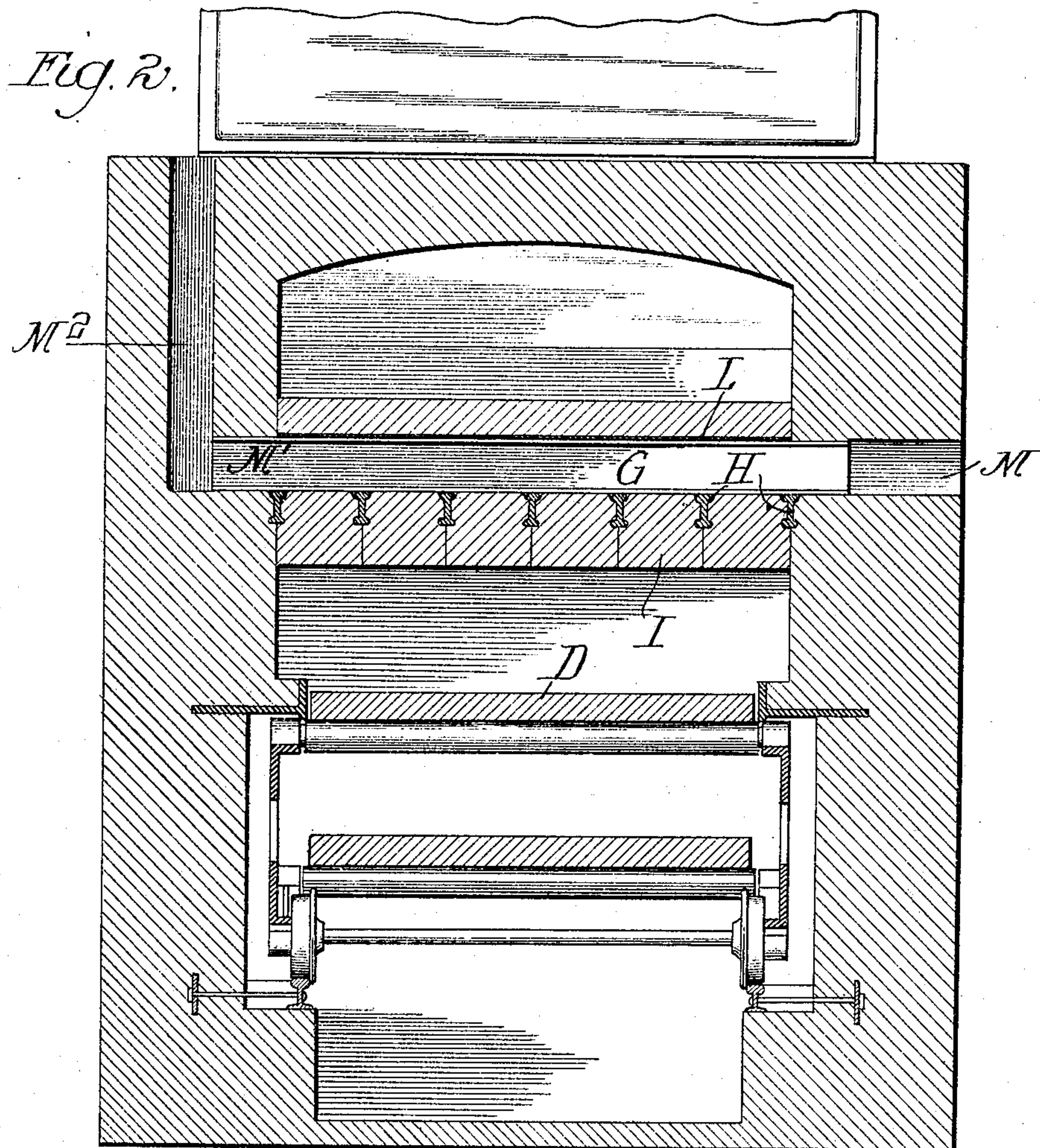
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## UNITED STATES PATENT OFFICE.

HERMAN A. POPPENHUSEN, OF EVANSTON, ILLINOIS.

## FURNACE.

SPECIFICATION forming part of Letters Patent No. 783,132, dated February 21, 1905.

Application filed April 21, 1904. Serial No. 204,276.

*To all whom it may concern:*

Be it known that I, HERMAN A. POPPENHUSEN, a citizen of the United States, and a resident of Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Furnaces; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in means for promoting the combustion of fuel in furnaces of that kind provided with automatic stoking devices, or means by which the fuel fed to the furnace continuously advances during the process of combustion.

The improvements constituting my invention are applicable to furnaces provided with endless traveling or chain grates, with grates which are inclined downwardly and inwardly and provided with rocking grate-bars adapted to facilitate the downward movement of fuel thereover, and all other forms of grates adapted to advance or move the fuel inwardly from the feed-opening of the furnace during the progress of combustion.

In furnaces of the kind referred to as heretofore constructed it has been usual to provide what is known as a "fire-arch" or "coking-breast" extending across or over the grate adjacent to the point at which the fuel is fed thereto and consisting of fire-brick or the like, such fire-arch or coking-breast being maintained at a high temperature by the burning of the gases given out from the volatile constituents of the fresh fuel and by radiating heat upon the fresh fuel as it enters the interior of the furnace, serving to promote the ignition thereof and thereby lessen the production of smoke. Such coking-breast or fire-arches are found to operate best when used with coals containing a large percentage of volatile matter, but has been found less efficient in burning anthracite coal or bituminous or semibituminous coal, which have a small percentage of volatile matter and such as are known as "coking" coals. It has been found that in the use of such anthracite or coking coal especially a percentage of in-

flammable gases generated from the fresh coal when the same is first subjected to the heat within the furnace, which gases are liberated or burned beneath or in contact with the fire-arch or coking-breast, is not large enough to insure the continuous heating of said fire-arch or coking-breast, and to thereby maintain such high temperature immediately adjacent to the feed-opening of the furnace as is necessary to produce constant ignition of the fuel as fast as it reaches the part of the grate adjacent to said feed-opening, it being of course understood that if the ignition of the entering-fuel be not effected as rapidly as the fuel is advanced on or with the grate a greater or less quantity of unignited fuel will be carried inwardly upon the grate and a greater or less portion of the area of the fuel-supporting surface of the grate will be covered with such unignited fuel, with a corresponding loss in the heat-generating capacity of the furnace.

A furnace embodying my improvement is provided with a deflecting partition, wall, or arch which extends from the rear or bridge wall of the combustion-chamber or fire-box of the furnace forwardly over the grate to a point near the fuel-inlet or feed-opening of the furnace and which terminates at such distance from the front wall of the furnace, or that in which the feed-opening is formed, as to leave a relatively narrow outlet space or passage for the upward passage of the burning gases and products of combustion between the forward edge of said wall, partition, or arch and the front wall of the furnace above said feed-opening. A deflecting wall, partition, or arch thus arranged may be used either with or without a coking-breast or fire-arch of the kind heretofore employed; but when such coking-breast or fire-arch is present it may be located over the opening between the front or forward edge of said deflecting partition, wall, or arch and the front wall of the furnace and at such distance above said division wall or arch as to afford ample space for the passage of burning gases. Such deflecting wall, partition, or arch whether used in connection with a coking-breast or fire-arch or not serves to prevent the direct upward passage of the burning gases and products of combustion from the burning



fuel upon the main or inner portion of the grate and to deflect the same forwardly toward the inlet or feed opening of the furnace, so that all of said burning gases or products of combustion will be carried over or in contact with the fresh or unignited fuel as it enters the furnace, thereby insuring the prompt ignition thereof. In a furnace thus constructed, therefore, the heat from the burning gases and products of combustion arising from the combustion of the fixed carbon or non-volatile elements of the fuel will be used to effect prompt ignition of the fresh and unburned fuel entering the furnace. In the operation of a furnace provided with such deflecting wall, partition, or arch, therefore, prompt and rapid ignition of the fresh fuel is equally effected whether the fuel used have a low or high percentage of volatile constituents. It follows, therefore, that in a furnace constructed in accordance with my invention anthracite, semi-anthracite, or bituminous coal, and such coals having a small or large quantity of volatile constituents may be burned with equal facility.

A deflecting wall, partition, or arch embodying my invention is so constructed that all parts of its lower surface at any line extending transversely of the furnace are at equal distances above the top of the fuel resting upon the grate. In other words, such deflecting wall, partition, or arch is distinguished from a curved or sprung arch in having its bottom surface transversely horizontal, although said bottom surface or part thereof may be arranged in an inclined position from front to rear of the furnace. Such deflecting wall, partition, or arch embodying my invention is, moreover, built up or formed of metallic beams, girders, or supporting members and fire-brick or refractory tiles arranged to completely cover and inclose the metallic supporting parts, so as to protect them from the heat of the furnace.

My invention may be understood by reference to the accompanying drawings, in which—

Figure 1 is a view in central longitudinal vertical section of a boiler-furnace embodying my invention. Fig. 2 is a cross-section of the same, taken upon line 2 2 of Fig. 1. Fig. 3 is a detail section of the arch or partition only, showing a modified form of construction therein.

As shown in the said drawings, A designates the front wall of the furnace; B, the bridge-wall thereof; C, the fuel-hopper, located on the front wall of the furnace in connection with the fuel-inlet or feed-opening thereof, and D an endless traveling or chain grate of that class which is driven by suitable actuating devices, so that the upper lap of the grate moves inwardly or from the feed-opening toward the bridge-wall of the furnace.

E designates a boiler, shown in said draw-

ings as a water-tube boiler, having a front header E' and a plurality of water-tubes e, which extend downwardly and rearwardly from said header.

The deflecting partition, wall, or arch of the furnace is indicated by F and extends from the bridge-wall B forwardly to a point near the front wall A of the furnace, a space being left between the forward edge of said deflecting-partition F and said front wall, which constitutes the outlet-opening for the upward or outward passage of the products of combustion. The said bridge-wall B is extended upwardly past the top surface of the grate high enough to join the rear margin of said deflecting-partition F. The deflecting-partition F thus arranged serves to prevent the passage of the burning gases and products of combustion arising from the fuel on the grate directly upward and rearwardly and to deflect all of said burning gases or products of combustion forwardly or toward the feed-opening of the furnace, and all of said burning gases or products of combustion are therefore directed or carried over and into contact with the fresh or unburned fuel resting on the grate adjacent to the feed-opening, with the result that such fresh fuel is subjected to a high degree of heat, and the prompt ignition of such fresh fuel as soon as it enters or shortly after its entrance to the furnace is thereby facilitated. After such burning gases and products of combustion pass around the forward edge of the deflecting-partition F they pass upwardly and rearwardly and into contact with the heating-surface of a steam-boiler or to any other space or inclosure in which the heat thereof may be utilized and thence to the outlet flue or stack.

The deflecting-partition F is made or built up as follows: G G G designate three girders, preferably provided with stiffening-flanges at their upper and lower edges, which extend across the furnace from side to side and rest upon their ends on the side walls of the furnace. Connected with said girders G G G by any suitable means are a series of beams H H H, which extend from front to rear of the furnace and extend below the girders. Said beams H H H are adapted for interlocking connection at their lower edges with a series of fire-brick or tile I I I', such interlocking connection of said beams H H H with the brick being so constructed and arranged that the latter may be applied to the beams or removed therefrom by sliding them endwise on or from said beams, the parts in this respect being constructed in the same manner as disclosed in a prior patent granted to Green and Gent, No. 676,606, granted June 18, 1901. The end tiles or brick I' I' of the series of fire-brick that are so engaged with or hung from the beams H are constructed to project upwardly over or cover the ends of said beams, as clearly seen in Fig. 1. In this respect also



the construction shown in the drawings is like that of said prior Green and Gent patent.

In the particular construction shown and illustrated more particularly in Fig. 2 the said beams H H H are provided with flanges at their lower edges which engage grooves in the adjacent side faces of the fire-brick I I I' I'; but said fire-brick may be otherwise interlocked with beams. On the ends of said beams H H, which project beyond or outside of the girders G G, are built fire-brick walls J J, which reach to the level of the top of the girders G G. Supported on the said girders and making a close joint with the tops of the walls J J is a horizontal wall K, of fire-brick or tile, which may be sustained in any suitable way upon the metallic structure, but as herein shown rests upon a horizontal plate L, which rests upon the tops of the girders G.

The fire-brick I I', together with the end walls J J and the top wall K, constitute a complete inclosure for the metallic parts by which the arch is supported, said inclosure being of refractory material and adapted to prevent the transmission of an injurious degree of heat to the metallic supporting frame or structure. If the rear or innermost girder G be in contact with or nearly in contact with the bridge-wall, the wall J adjacent to the bridge-wall may be omitted, its function in that case being performed by said bridge-wall.

If preferred or found necessary in any particular case, the ends of the space or passage formed between the girders G G and between the fire-brick I I and top wall K may be arranged to communicate at one end with an inlet-opening M, formed in one of the side walls of the furnace, and with an outlet-opening M', formed in the opposite side wall. Said opening M', may communicate with an upwardly-extending outlet passage or flue M<sup>2</sup>, as shown in Fig. 2. This construction provides means affording a cooling current of air through or over the metallic supporting parts of the partition. As shown in said Figs. 1 and 2, a wall N, of fire-brick or like refractory material, is built against the front wall A of the furnace above the feed-opening to protect the said front wall from heat, and an arch O is arranged to extend rearwardly from the top of the wall G to a point beneath the header E of the boiler, said arch O corresponding generally with the fire-arch or coking-breast heretofore used, but being located a sufficient distance above the partition F to afford ample space for the upward and rearward passage of the products of combustion on their way to the stack or exit-flue of the furnace. Said fire-arch O, to the extent to which it may be heated by the burning of the volatile matters passing upwardly along the wall E and into contact therewith, serves to perform the same function as is performed by the fire-arch or coking-breast heretofore used.

As illustrated in Figs. 1 and 2, the bottom surface of the fire-arch is parallel with the grate, and as said grate is horizontal the said bottom-surface of the arch is also horizontal. Said arch may, however, be modified in various ways in respect to its inclination from front to rear of the furnace.

As shown in Fig. 3, the partition is horizontal at its rear part and downwardly inclined in its front portion and is made as follows: In this instance the partition or arch consists of a main horizontal rear portion P and a downwardly-inclined forward portion Q. The main part P of the arch is supported by metallic parts consisting of girders G G and beams H, having connected therewith fire-brick I I and I' I' and provided with a top plate L, supporting end walls J J and a top wall K, in the same manner as before described. In this instance, however, the beams H H extend to and rest upon the bridge-wall R, the rearmost girder G is located at some distance forward of said bridge-wall, and the rear end of the said beams H are covered by a top wall H', which rests immediately upon the tops of the fire-brick I, which are supported by the said beams H. This construction in the rear part of the arch is possible, because it is subjected to less heat than the forward part thereof. The front portion Q of the arch is formed by means of a transverse water-tube R, which extends through the side walls of the furnace and is supported in the same, and fire-brick or tile S, which are notched at their lower ends to engage said water-tube and provided with downwardly-facing shoulders on their rear ends which rest on an upwardly-facing shoulder or ledge on the fire-brick I' at the front margin of the main part P of the partition. Said front part Q of the arch is shown as inclined downwardly and forwardly, so as to deflect or direct the flames and products of combustion downwardly and into immediate contact with the fresh or unburned fuel as it enters the feed-opening. This construction, in which the part Q of the arch is supported by a water-tube R, may be found desirable in cases where the forward edge of the arch is subjected to heat so great as to make desirable the use of a water-tube as a support for the said forward edge.

It will be manifest that in the construction shown in said Fig. 3, if the fire-brick S, constituting the front part of the arch, are first removed from place the suspended fire-brick I I I' I' may be removed endwise from the beams H, as necessary for renewal or repairs of the arch.

I claim as my invention—

1. A furnace embracing a grate, means for advancing the fuel on the grate, and a deflecting-partition which extends from the rear of the furnace forwardly over the grate, said deflecting wall or partition embracing metallic



supports and fire-brick applied to cover said metallic support both above and below the same.

2. A furnace embracing a grate, means for  
5 advancing the fuel on the grate, and a deflect-  
ing-partition which extends from the rear of  
the furnace forwardly over the grate, said de-  
flecting wall or partition embracing transverse  
girders which rest on the side walls of the fur-  
10 nace, longitudinal beams connected with the  
said girders and extending below the same,  
fire-brick hung upon said beams, a supporting-  
plate sustained by said girders, and a horizon-  
15 tal fire-brick wall resting on said supporting-  
plate.

3. A furnace embracing a grate, means for

advancing the fuel on the grate, a deflecting-  
partition which extends from the rear of the  
furnace forwardly over the grate, said deflect-  
ing wall or partition embracing a rear part 20  
consisting of a metallic support and fire-brick  
covering the same and a forward part em-  
bracing a water-tube and fire-brick or tiles  
supported by said water-tube.

In testimony that I claim the foregoing as my 25  
invention I affix my signature, in presence of  
two witnesses, this 16th day of April, A. D.  
1904.

HERMAN A. POPPENHUSEN.

Witnesses:

C. CLARENCE POOLE,  
GERTRUDE BRYCE.