

(No Model.)

J. W. VAN DYKE.

STEAM GENERATOR.

No. 474,508.

Patented May 10, 1892.

Fig 3

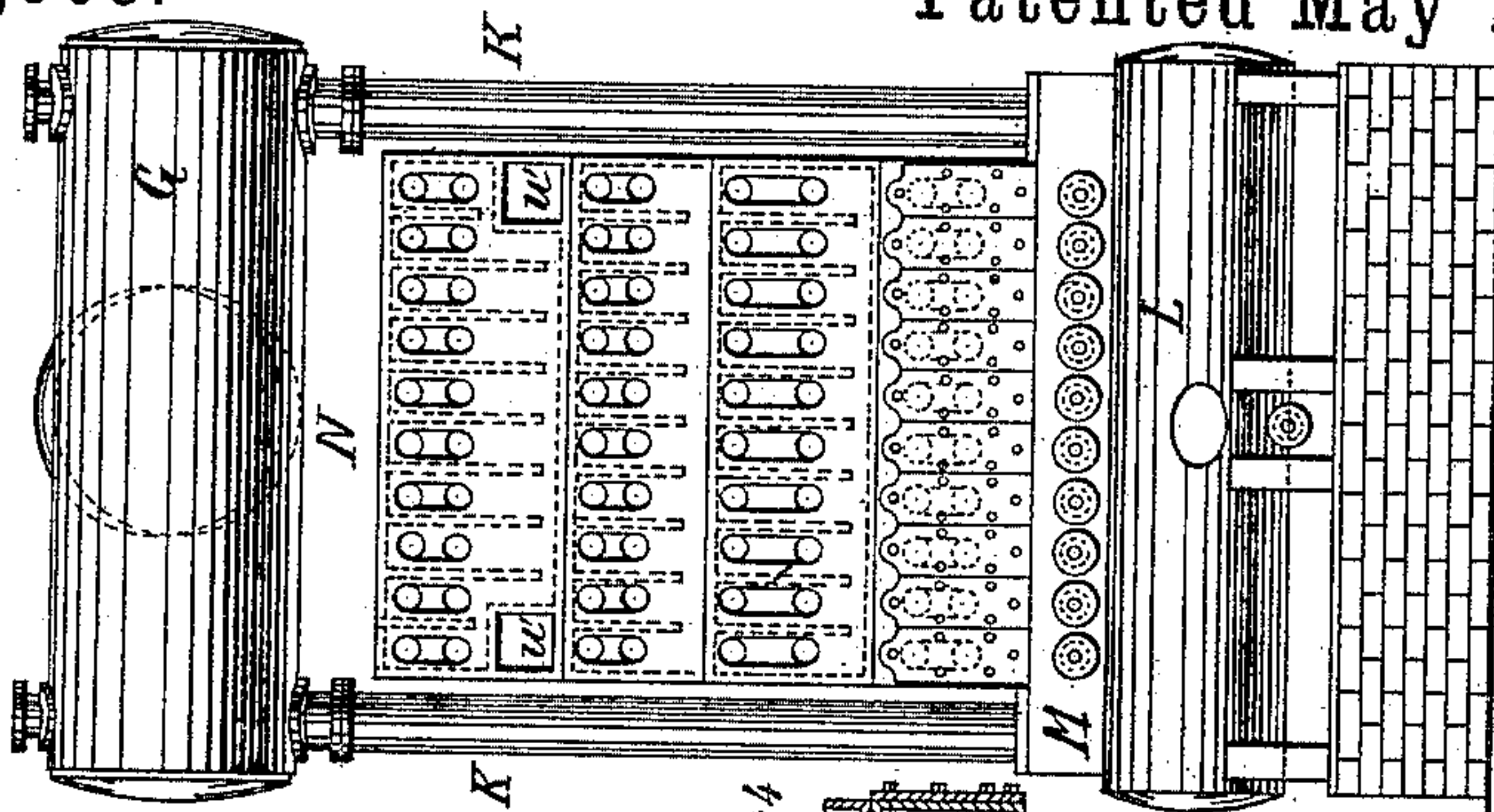


Fig 4



Fig 2

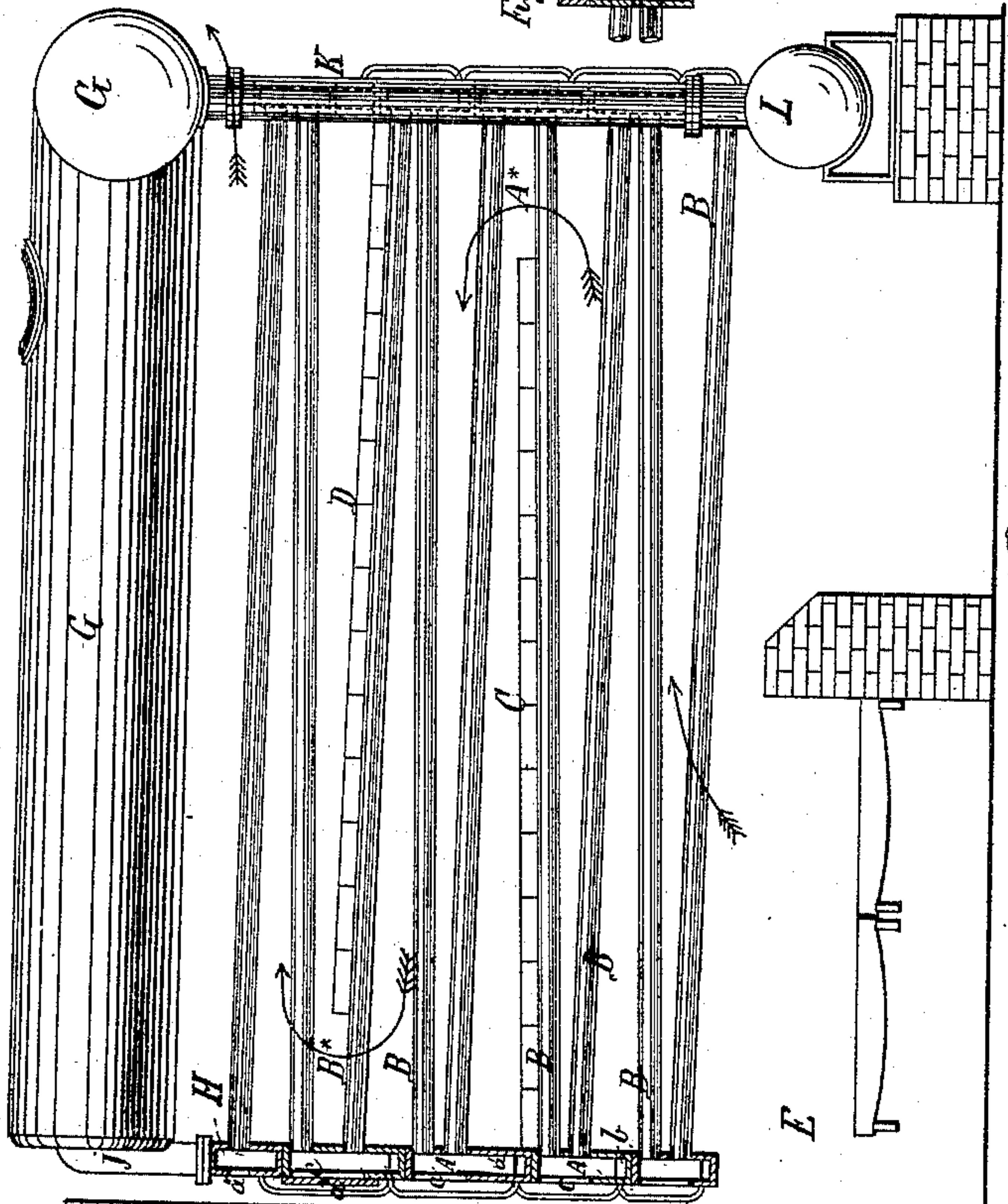


Fig 5

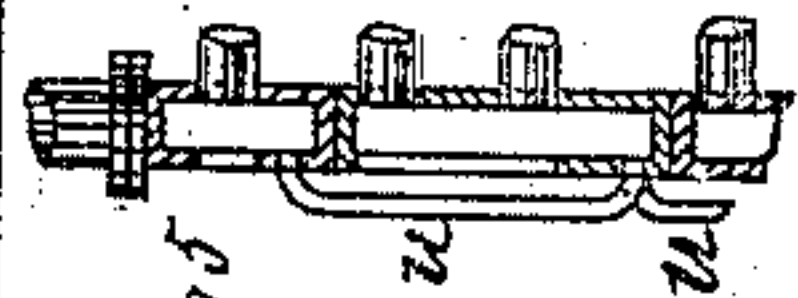
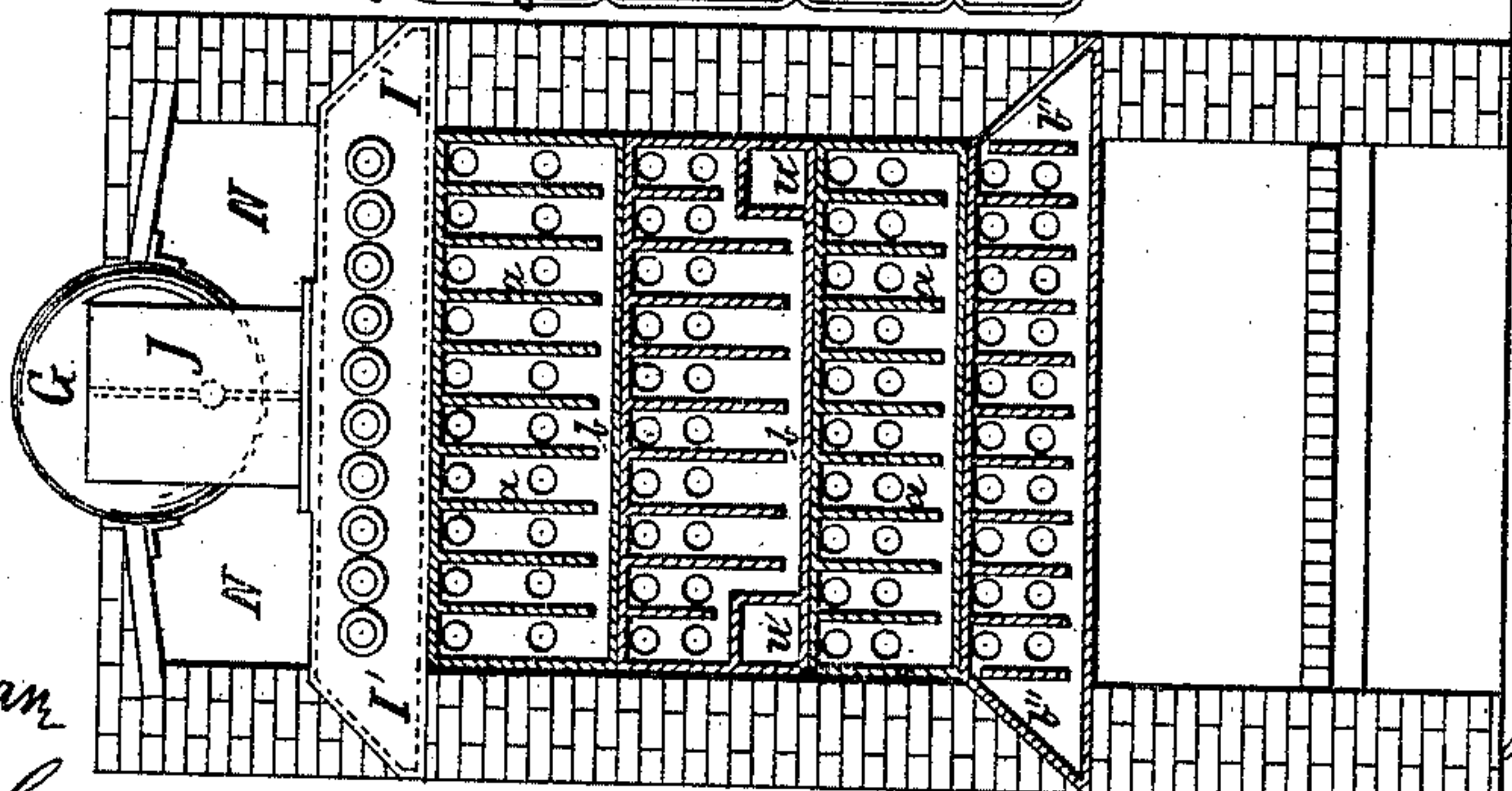


Fig 1



Witnesses

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# UNITED STATES PATENT OFFICE.

JOHN W. VAN DYKE, OF BROOKLYN, NEW YORK.

## STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 474,508, dated May 10, 1892.

Application filed August 11, 1882. Serial No. 69,089. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN W. VAN DYKE, of Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Steam-Generators, of which the following is a specification.

This invention comprises certain novel combinations of parts whereby is provided a sectional steam-generator in which provision is made not only for the efficient production of steam, but for the equalization of the water throughout the tubes, for the facile removal of sediment, for the effective heating of the water preparatory to its transmission to the steam-drum or separating-chamber, for the ready separation of the steam from the water, and for the rapid and determinate circulation of the water.

My said invention also secures the further advantages of an effective application of the flame and hot gaseous products of combustion to the water-tubes; also, of a strong and secure support to the front of the boiler, combined with comparative immunity from "burning out," so termed, by the direct action of the flame from the fire-box upon the adjacent portions of the apparatus.

Figure 1 is a front view and partial sectional view of a steam-generator constructed according to my said invention. Fig. 2 is a vertical longitudinal sectional view thereof. Fig. 3 is a rear view thereof with certain portions removed, the better to show the internal parts. Fig. 4 is a similar detached sectional view representing one part of the apparatus, and Fig. 5 is a detail view showing a feature not illustrated in the preceding figures.

Each end of the boiler is composed of oblong hollow castings A. Each of these castings is divided by vertical partitions *a* into compartments corresponding in number to the number of vertical series of water-tubes included in the apparatus. Each of these partitions *a* reaches nearly but not quite to the bottom of the interior of the castings or chamber, thereby leaving an opening *b* below said partition. Each casting therefore is subdivided into a number of internal compartments, and all the said compartments of each casting are connected at bottom by means of the openings or passages *b*. Formed in the outside of each casting A, opposite the upper

part of each of the internal compartments aforesaid, is an opening or hand-hole *c*, and formed at the opposite or inner side of each of said compartments are two openings, one above the other, and designed to receive the ends of the water-tubes B. The openings or hand-holes *c* afford access to the ends of the water-tubes B when the said ends are thrust into place, and thereby enable the said ends to be securely fastened in position and attached to the casting in direct communication with the compartments. When the boiler is in use and operation, each of these openings or hand-holes is covered by a suitable plate, as, for example, at *d* in Fig. 2.

It will be observed that the openings in which are inserted the ends of the tubes B are at the upper part of the compartments of the castings A, thereby leaving the lower part *a'* of each compartment extended downward considerably below the level of the adjacent end of the lowermost tube B connected with said casting. The tubes B are arranged in zigzag fashion, as represented in Fig. 2, two adjacent ends of two adjacent tubes being attached to one casting A and alternating, so that water passing upward—as, for example, from the lowermost of the tubes B—will pass into the adjacent compartments of the casting, thence upward to the adjacent end of the tube next above, thence backward through said tube to the next casting at the rearmost end of the apparatus, thence upward through the adjacent compartment thereof to the tube B next above, and so on from one tube to another in the vertical series until it reaches the uppermost of the said tubes, and thence into the separating-chamber or steam-drum, as hereinafter explained.

Inasmuch as the compartments of each casting A communicate with each other by means of the openings or passages *b*, it follows that as concerns the tubes of any given level the water therein will be at the same level as that in all. Furthermore, inasmuch as the portions *a'* of the aforesaid compartments extend downward below the level of the lowest of the tubes B connecting therewith, it follows that water-spaces are formed at the front and back of the boiler, which by the impact of the flame and hot gaseous products of combustion and by the heat otherwise communi-



cated from the fire-box or furnace cause the water in said spaces to be heated by heat which would be lost if the ends of the pipes were connected by simple bends instead of  
5 by the compartments in the ends of the casting, as hereinbefore explained.

Provided horizontally between the tubes toward the lower part of the generator is a substantially horizontal partition C of fire-  
10 brick or suitable material, behind which is an opening A\*. In like manner, provided horizontally between the tubes B toward the upper part of the apparatus, is another similar partition D of like material, which has in  
15 front of it an opening B\*. The apparatus is in practice surrounded by the usual brick shell or casing, which being well known in connection with tubular boilers need not here be specifically described. As the flame and  
20 hot gaseous products of combustion pass from the fire-box E to a suitable uptake at F, they are caused to traverse in a zigzag direction by means of the horizontal partitions C and D aforesaid, and are thereby kept in contact  
25 with the tubes B along substantially the entire length of said tubes and for a period sufficient to enable them to give up the greatest available portion of their heat to the said tubes for the generation of steam.

G is what I term the "steam-drum" or "separating-chamber," which may be of cylindrical form and which is placed centrally above that portion of the boiler composed of the tubes B and which has at its rearmost end  
35 a transverse supplemental drum G', which forms a portion of the separating-chamber aforesaid. The uppermost of the tubes B have their outermost or forward ends terminating in the casting H, which, while externally  
40 resembling the castings A, is devoid of partitions, although provided with openings or hand-holes a'', which correspond to the opening or hand-holes c in the castings A. This casting, moreover, extends beyond the sides  
45 of the tubular portions of the boiler, forming shoulders I', which rest upon the adjacent brick-work walls of the shell of the boiler, and thereby assist to support the steam drum or chamber G. The interior of the casting H  
50 communicates by a suitable opening J with the forward end of the drum or separating-chamber G, the opening of the said opening J into the interior of the said drum or separating-chamber being above the normal water-line within the said drum or chamber.  
55 Each end of the supplemental drum G' at the rear of the boiler has its interior connecting with the upper end of a vertical pipe K, the lower end of which communicates with  
60 the interior of the ends of a hollow bottom casting M, which corresponds to the casting H at the upper part of the front end of the boiler and which receives the lower or rearmost end of the lowermost tube B in the same  
65 manner that the casting H receives the upper forward end of the uppermost of said tubes. This casting M communicates by suitable pas-

sages or openings with a mud-drum L, placed below the same. The casting M and the mud-drum L may, however, be formed in one casting, the interior of the one communicating  
70 with the interior of the other. The lowermost of the castings A has its ends—that is to say, the sides of the boiler—extended in the same manner as the corresponding parts  
75 of the casting I' and embedded in the brick-work sides of the shell of the boiler in such manner as not only to assist in sustaining the weight of the front end of the boiler, but also  
80 to provide water-chambers b'' at those portions where the impact of the flame from the fire-box is most severe.

In the operation of the boiler the water passed into the mud-drum L or into any other suitable portion of the boiler, as may be preferred, circulates from the lowest of the tubes  
85 to the uppermost, and is thence injected into the drum or separating-chamber G above the normal water-line of the latter, and, plunging downward from the opening of the pipe J to  
90 the said water-level, affords a ready escape for the steam from the mass of water, thereby insuring dry steam in the upper part of the drum or separating-chamber G and its supplemental drum G', the water freed of steam  
95 then descending to the vertical pipes K into the casting M, thence into the lowermost of the tubes B, and then upward again in a continuous and substantially uniform circulation, the horizontal level of the water in  
100 the tubes B being maintained by the substantial communication between the tubes established by the openings b beneath each of the partitions a in each of the castings, the heat meanwhile communicated from the fire  
105 in the fire-box and from the hot products of combustion circulating, as hereinbefore explained, being applied to the heating of the tubes with substantial regularity throughout, and avoiding any spaces where the gases can  
110 remain stationary, and thereby, so to speak, become dead for all heating purposes. The brick casing or shell of the boiler is so extended to the sides of the drum or separating-chamber G as to provide a flue N under-  
115 neath and along the sides of the drum G and underneath the supplemental drum G', thereby affording additional heat to the water contained in the said drum and supplemental drum.

In order that the boiler may be properly blown off at the front and back, respectively, the hollow castings of each are connected together in the manner indicated in Fig. 5—that is to say, the interior of the topmost casting  
120 has its bottom connected with the bottom of the casting next below by a pipe u, while the said casting next below is connected with the one beneath it by a similar pipe u. In practice these pipes u should alternate at opposite  
125 ends of the castings. It will be observed that the castings of the front are all connected together and that by means of the pipes u and the openings b a communication  
130



exists virtually throughout the interior of the whole of the front of the boiler, and in like manner throughout the whole of the interior of the rear of the boiler, so that when the boiler is blown off at the front and rear, respectively, the entire interior of the boiler may be blown out, whereas if each casting of the front was not made to communicate with all the others, as just described, the said front could not be blown out complete, the same remark applying to the rear of the boiler.

It is to be observed that the parts which I have herein designated as "castings," although intended to be ordinarily made of cast-iron, may, if preferred, be made of wrought sheet metal, although this will incur greater expense and more difficulty in manufacture. Further, when desired, any cast metal may be substituted in place of the cast-iron.

One or more of the castings which constitute, as hereinbefore explained, the front and rear ends of the boiler is provided with passages *u'*, the sides, bottom, and top of said openings being of course closed, and said openings being also provided with any suitable kind of cover or plate, the attachment of said cover or plate being merely a matter of mechanical judgment and requiring no specific description. These openings *u'* afford access to the tubes and also to the horizontal partitions D and C in order that the tubes, partitions, &c., may, when desired, be readily cleaned.

I do not claim a hollow wall or end section composed of separately-formed rectangular chambers bolted together, as shown in the patent of Smith and Stevens, dated August 3, 1869, No. 93,240. Neither do I claim such chambers formed with openings in their sides at a material distance from the bottoms thereof and arranged to form passages by the placing in juxtaposition and bolting together of such separate chambers, as shown in said patents.

I do not claim the construction of steam-generator represented and shown in the Letters Patent No. 93,240, dated August 3, 1869. Neither do I claim the construction of steam-generator represented and shown in Letters Patent of Great Britain and Ireland, No. 1,837,

of 1863, inasmuch as the same, both as to character and operation, differ in essential respects from the various combinations of parts embraced in my said invention.

It is to be understood that for the purposes of this present application I do not claim the several combinations of parts set forth in the claims of my separate application, filed March 12, A. D. 1883, serially numbered 87,965, inasmuch as the same are claimed in and designed to be secured by Letters Patent to be issued in pursuance of said separate application; but—

What I herein claim as my invention is—

1. The combination, with the boiler-tubes B, of transversely-continuous castings having the following features, viz: internal partitions dividing each casting into a series of chambers, a series of openings or sockets coincident with the said chambers for receiving the ends of the boiler-tubes, and a series of openings or hand-holes provided at the opposite sides of the chambers and substantially coincident with the sockets aforesaid, all substantially as and for the purpose herein set forth.

2. The combination, with the boiler-tubes B, of superposed transversely-continuous castings A, constructed with internal partitions *a'*, which provide a series of chambers within each of the said castings, whereby communication is established between the pipes to insure circulation of water from one to another of said pipes, all substantially as and for the purpose herein set forth.

3. The combination, when arranged in substantially the relation herein described, with the boiler-tubes B, of the castings constructed with the partitions *a*, dividing each of said castings into a series of connected chambers, the casting H, devoid of partitions, the steam-drum or separating-chamber G, and the opening J, extended from the casting H and communicating with the interior of the drum G, above the normal water-level thereof, substantially as and for the purpose herein set forth.

JOHN W. VAN DYKE.

Witnesses:

JAMES HARRIS BALSTON,  
JOHN J. ROBERTS.