

No. 698,248.

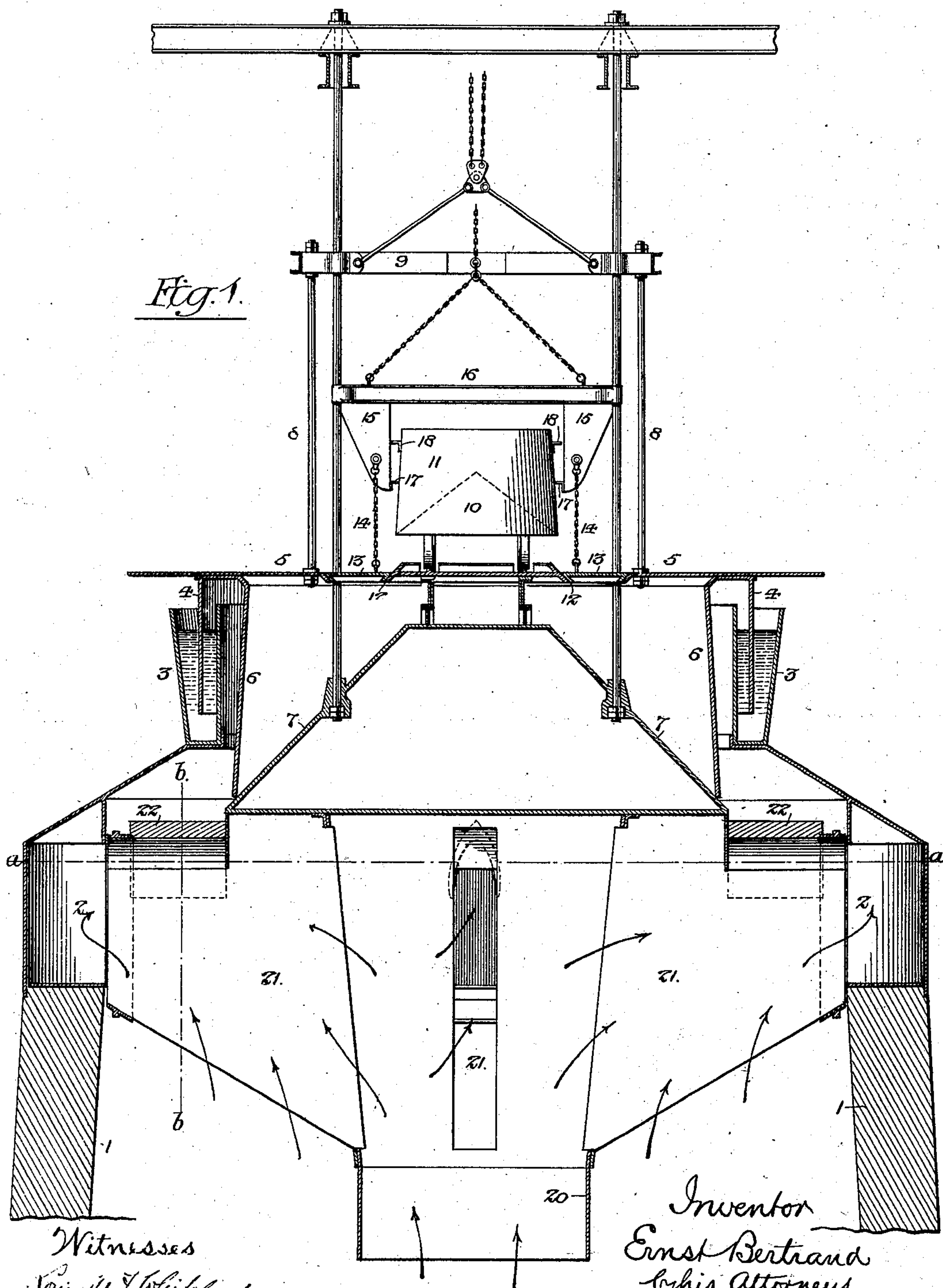
Patented Apr. 22, 1902.

E. BERTRAND.  
BLAST FURNACE.

(Application filed May 1, 1899.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses  
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Fig. 2.

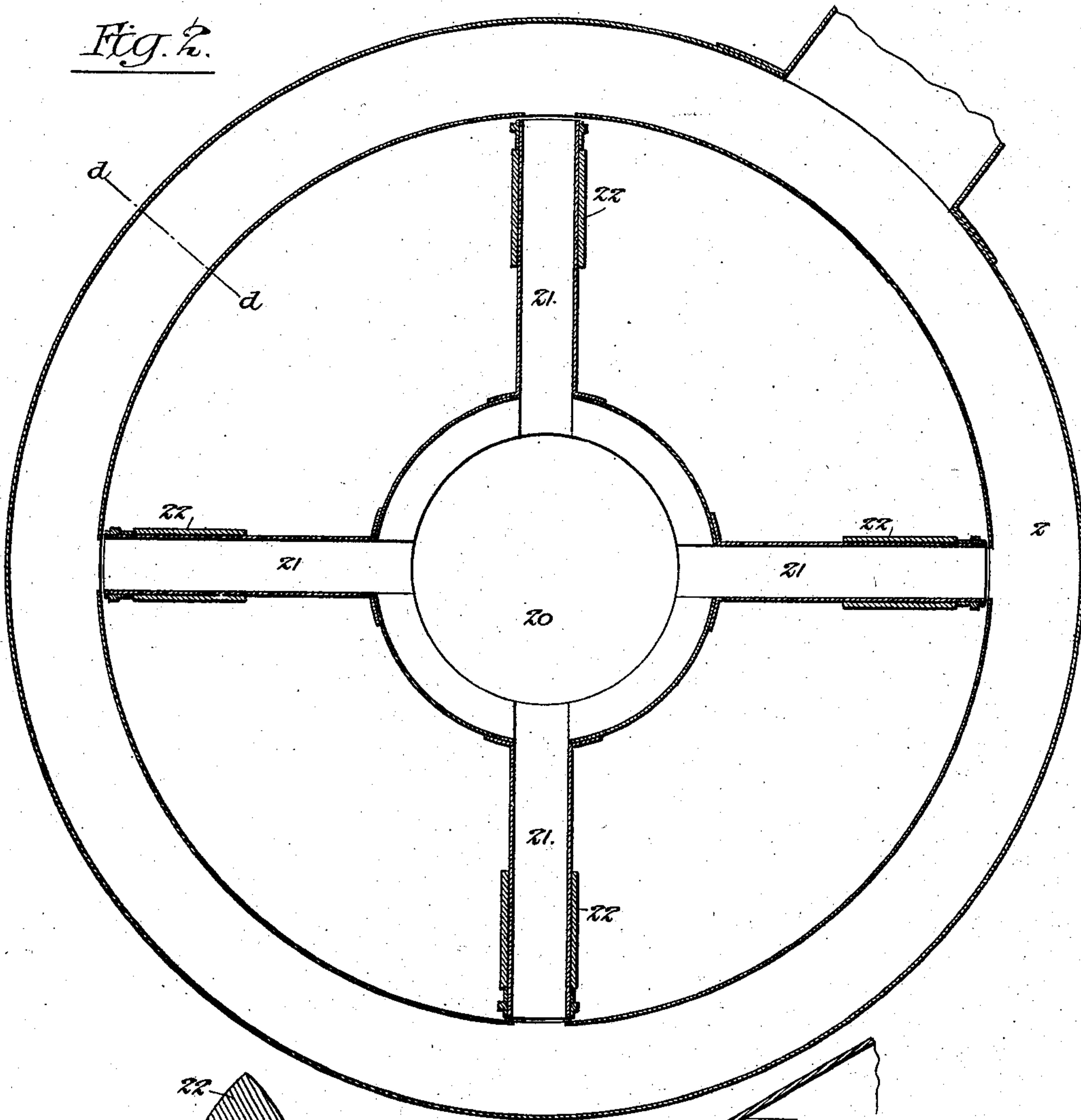
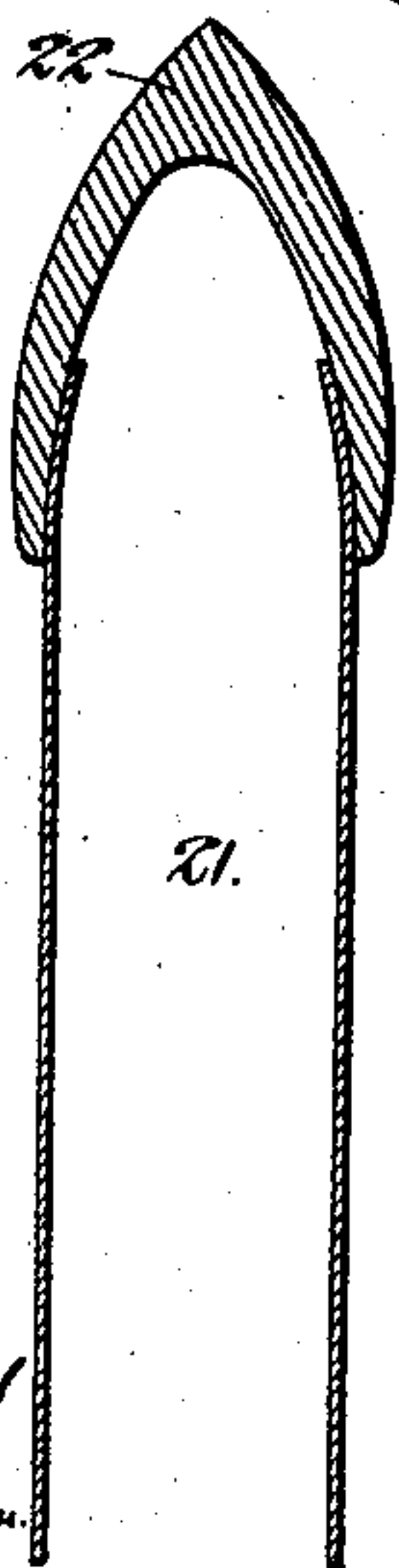
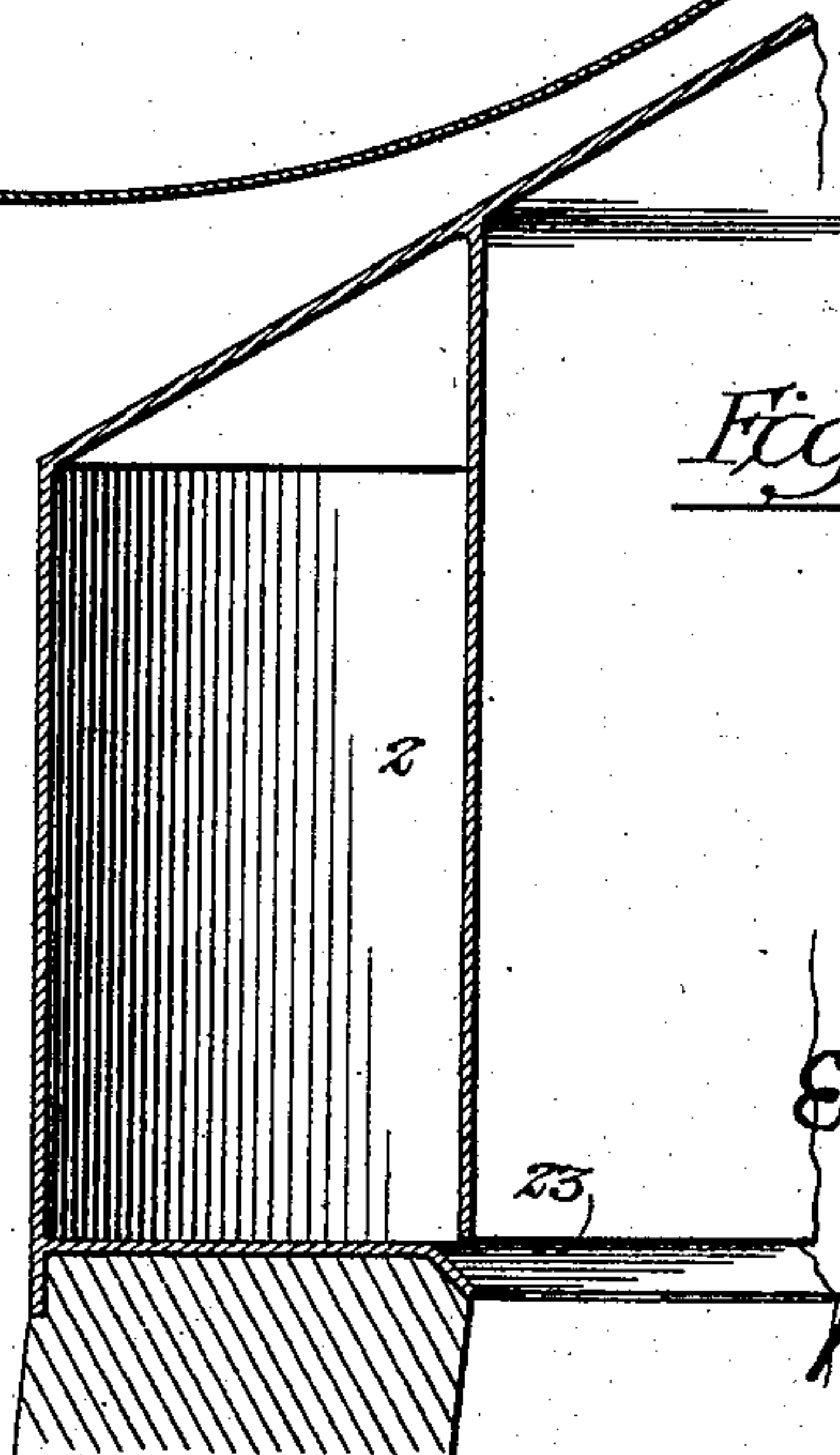


Fig. 3.



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Fig. 4.



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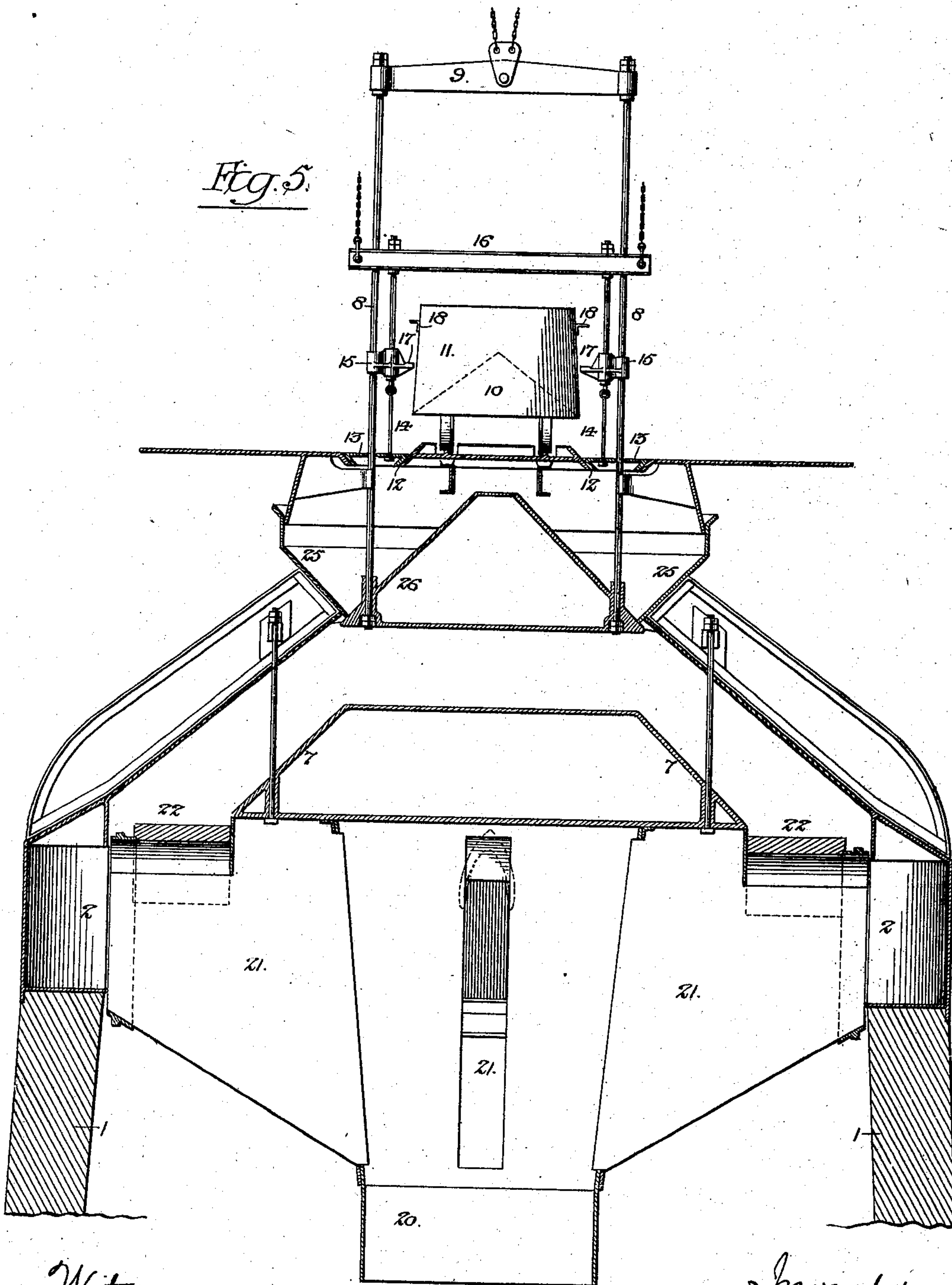
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3 Sheets—Sheet 3.

*Fig. 5.*



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# UNITED STATES PATENT OFFICE.

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## BLAST-FURNACE.

SPECIFICATION forming part of Letters Patent No. 698,248, dated April 22, 1902.

Application filed May 1, 1899. Serial No. 715,202. (No model.)

*To all whom it may concern:*

Be it known that I, ERNST BERTRAND, a citizen of the United States, and a resident of Kladno, Bohemia, Austria-Hungary, have invented certain Improvements in Blast-Furnaces, of which the following is a specification.

One object of my invention is to so construct a blast-furnace as to provide for the more acceptable feeding of the fuel and ore thereto than usual, a further object being to prevent packing of the charge in the furnace, another object being to so govern the escape of gases from the furnace as to effect substantially uniform draft throughout the different portions of the mass contained therein, and a still further object being to prevent or materially lessen the loading of the escaping gases with dust, and thus prevent the rapid accumulation of such dust in the washers, hot-blast stoves, and steam-boiler flues through which the gases from the furnace are usually passed in order to utilize their heat.

In the accompanying drawings, Figure 1 is a view, partly in elevation and partly in vertical section, of the upper portion of a blast-furnace and mechanism employed in connection therewith, the whole being constructed in accordance with my invention. Fig. 2 is a sectional plan view on the line *a a*, Fig. 1. Fig. 3 is an enlarged transverse section on the line *b b*, Fig. 1. Fig. 4 is an enlarged transverse section on the line *d d*, Fig. 2; and Fig. 5 is a view similar to Fig. 1, but illustrating a modification of the furnace-feeding mechanism.

In an ordinary blast-furnace having at the top a fixed hopper and a bell movable vertically, so as to open or close the bottom of this hopper, the furnace cannot be charged full; otherwise it will be impossible to lower the bell. Consequently the material must fall from the bell onto the mass in the furnace through a distance at least equal to that of the movement of the bell in opening, which has the effect not only of breaking the soft or brittle coke, coal, or ore, but also of packing the material in the furnace closer than it should be, so that it is difficult for the gases to find their way through said material uni-

formly. In my furnace, therefore, I reverse the usual arrangement and employ a fixed bell and a movable hopper, the latter having by preference a liquid seal, so as to prevent the escape of gases and yet permit its free vertical movement.

It is a well-known fact that in ordinary blast-furnaces the greater portion of the gases ascend at and near the walls of the furnace and that there is not as free and extended a flow of gas at the center of the same as is desirable. This feature is the more pronounced the more the side walls of the upper part of the furnace are flared or inclined outwardly, for the material when sinking down into the furnace will spread more and more sidewise on account of the increasing section of the furnace and will therefore become looser and looser at the sides, while it remains compact at the center. Consequently the gases will be more apt to pass through the material at the sides of the charge than at the center. I therefore provide in the upper portion of the furnace a central structure around which the fuel, ore, and limestone or other material constituting the furnace charge is fed, so that said material as it passes downwardly beyond the central structure can flow inwardly beneath the same and can thus spread centrally as well as outwardly. This central structure has radiating arms, which serve to further divide the upper portion of the charge and prevent the close packing of the same, and both the central structure and the radiating arms are by preference hollow and open at the bottom, said radiating arms communicating with the central hollow structure and also with a discharge-ring at the top of the furnace structure, whereby the central structure and its arms constitute conduits or passages for the escape of the gases, thereby insuring draft through the central portion of the furnace charge, as well as through the outer portions of the same, and effecting substantially uniform action upon all portions of the charge in the furnace.

In the drawings, 1 represents the upper portion of the furnace-wall, upon which is the hollow annular box 2, which constitutes the



gas-discharge ring of the furnace, this box supporting an annular trough 3, which contains water, sand, or other medium for sealing the annular flange 4, which depends from the top plate 5 of the feed-hopper 6, the latter consisting of an annular casing adapted to close down upon a bell or cone 7, which is fixedly mounted in a central position at the furnace-top.

10 The hopper 6 is connected by suitable rods 8 to a lifter bar or frame 9, which may be acted upon by hoisting mechanism of any available character, so that said hopper can be raised and lowered.

15 On the top of the hopper 6 are rails for the wheels of the charging-bogie, which has the usual conical bottom 10 and vertically-movable shell or mantle 11, and in the top of the hopper is an annular opening 12, so disposed as to receive the contents of the bogie when the mantle 11 is lifted, and to this opening is fitted an annular valve 13, said valve being connected by chains 14 or other suitable means to brackets 15, depending from a lifter bar or frame 16, which can be raised and lowered by any suitable form of hoisting mechanism, the brackets 15 having projecting bars 17, which are adapted to engage with bars 18 on the mantle of the bogie, so that the effect of the raising of the bar or frame 16 is first to lift the annular valve 13 and then when the bars 17 and 18 come into engagement to lift the mantle of the bogie, so as to discharge the contents of the latter through the annular opening 12 in the top of the hopper, reverse conditions accompanying the descent of the bar or frame 16.

When as many loads of material as the hopper is designed to accommodate have been discharged into the same, the hopper is lifted, so as to permit its contents to slide down the sides of the cone or bell 7 into the top of the furnace, thus permitting the feeding of the latter without a long drop of the material into the same and without the compacting effect upon the material due to such long drop.

Beneath the cone or bell 7 and extending down into the upper portion of the furnace is a central depending hollow structure 20, open at the bottom and communicating with a series of hollow radiating arms 21, four of which are shown in the present instance, although any desired number may be used. Each of these hollow arms is open at the bottom, so as to communicate with the interior of the furnace, and is in communication at its outer end with the annular gas-discharge ring 2. Hence said central chamber and its hollow arms provide for the free escape of the gases from those portions of the charge beneath the same and insure draft through the central portion of the charge as well as through the outer portions of the same. The central casing and its hollow arms also serve to prevent the compacting of the material

solidly in the furnace, since the material as it passes down below the hollow arms 21 and central casing 20 flows beneath the same, and thus loosens up the mass, so that the gas can penetrate all portions of the same.

Those portions of the hollow arms 21 which extend from the bell or cone 7 outwardly to the gas-ring 2 have heavy arched caps 22, which serve as armor to prevent injury to these portions of the arms by the flow of successive portions of the charge onto and around the same.

In order to provide for the discharge of those gases which rise in close proximity of the furnace-walls, the annular gas-discharge ring 2 has at its lower inner corner an inlet 23, as shown in Fig. 4.

In the modified construction of furnace shown in Fig. 5 the cone or bell 7 is shorter than that shown in Fig. 1, and there is above the same a fixed hopper 25, the bottom of which is closed by a vertically-movable cone or bell 26, which can be raised, so as to close the hopper, or lowered, so as to discharge the contents of said hopper into the space between the cone 7 and the upper portion of the casing, the construction otherwise being similar to that hereinabove described.

The central gas-chamber 20 may be dispensed with and the hollow arms 21 extended so as to meet at the center of the furnace, if desired; but the use of the central chamber is preferred.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. A blast-furnace having a feed bell or cone and a vertically-movable hopper above the same, said hopper having a normally closed top and being provided with an external seal whereby its vertical movement is permitted without causing escape of gas.

2. A blast-furnace having a hopper with a valve in the top of the same, a feeding-bogie, and supports therefor in combination with a single means for successively raising said valve and discharging the contents of said feed-bogie.

3. A blast-furnace having a feed-hopper with a vertically-movable valve in the top of the same, a feed-bogie, supports therefor, a shell or mantle on said bogie, and a lifting bar or frame connected to the hopper-valve and having portions for engaging and lifting the shell of the feed-bogie after the valve has been lifted to a certain extent.

4. A blast-furnace having at its upper portion an outer gas-discharge chamber, a central hollow gas-receiving chamber and hollow arms open at the bottom and connecting said central gas-receiving chamber with the outer gas-chamber whereby the gases can escape both through the central chamber and through the hollow arms.

5. A blast-furnace having at the top a feed bell or cone and below the same a central structure with radiating arms extending down-



wardly beyond said feed-cone, and arched armor-plates for protecting said depending portions of the arms.

5 6. A blast-furnace having at the top an outer gas-discharge chamber and a central gas-chamber, hollow arms providing communication between said central gas-chamber and outer gas-chamber, and passages leading from the combustion-chamber of the furnace  
10 into the outer gas-chamber independently of said arms.

7. A blast-furnace having at the upper portion a discharge-chamber, hollow arms communicating therewith and extending in-  
15 wardly into the upper portion of the furnace, said hollow arms being open at the bottom

throughout their extent so as to receive gas from the material in the furnace.

8. A blast-furnace having a stationary feed-bell in the upper portion, a central gas-col- 20 lecting chamber below said feed-bell, and terminating in the upper portion of the furnace, an outer gas-discharge chamber and hollow arms leading from said central gas-collecting chamber to the outer discharge-chamber. 25

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ERNST BERTRAND.

Witnesses:

ADOLPH FISCHER,  
RUDOLF LANG.