No. 616,494. Patented Dec. 27, 1898.

F. C. ROBERTS.

BLAST FURNACE CHARGING APPARATUS.

(Application filed Apr. 1, 1898.)

(No Model.) 3 Sheets—Sheet 1.

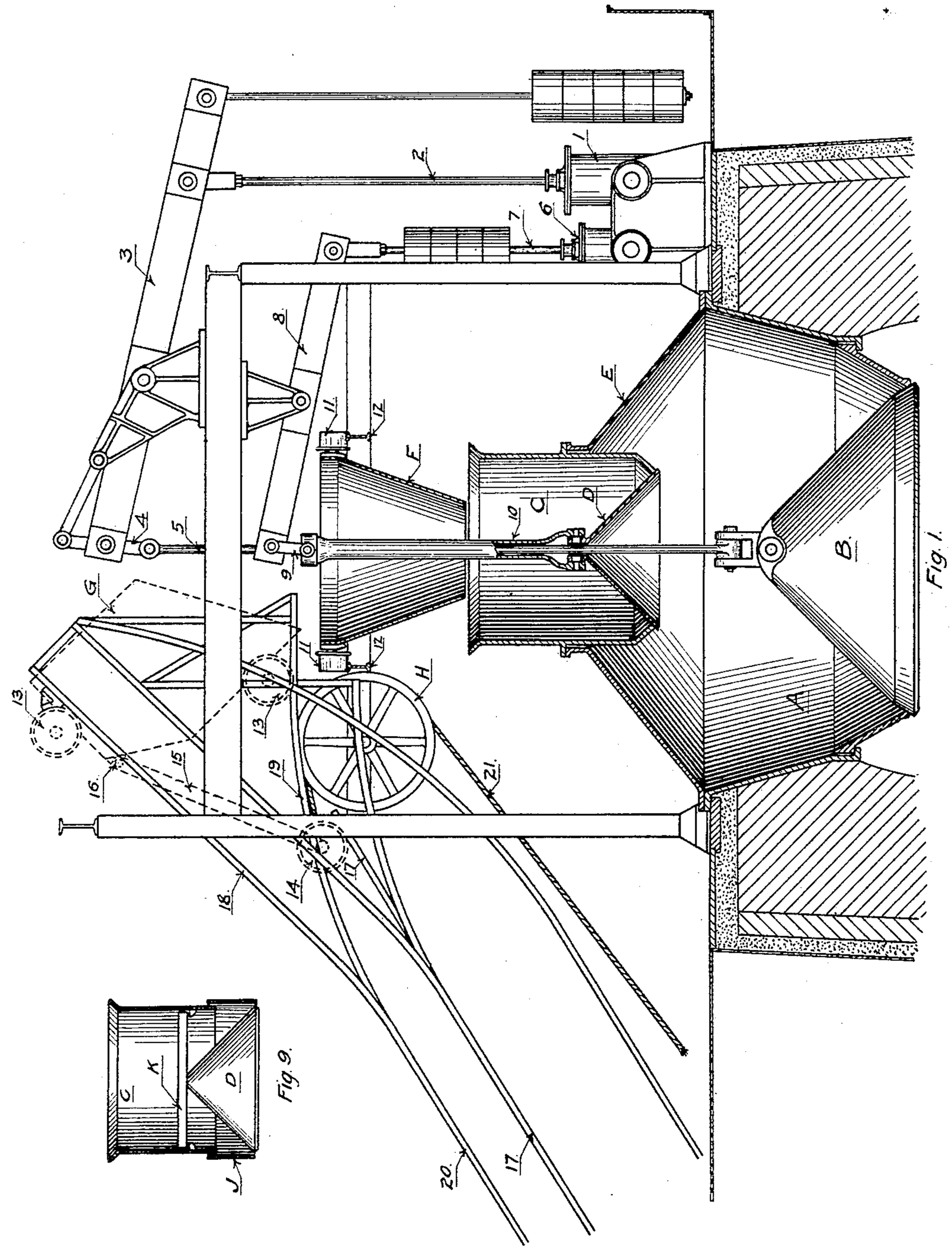

Fig. 1.

Fig. 9.

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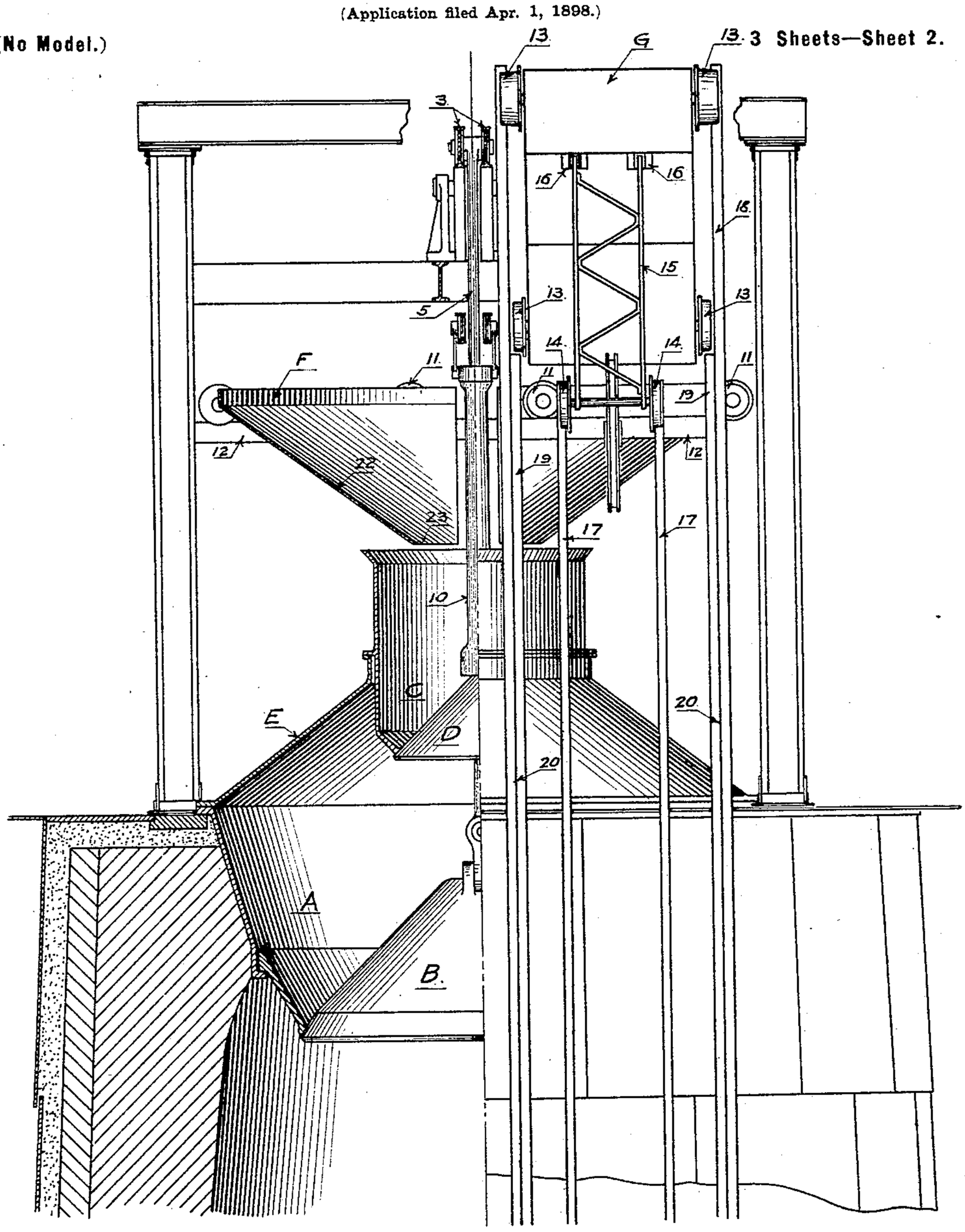

Fig. 2.

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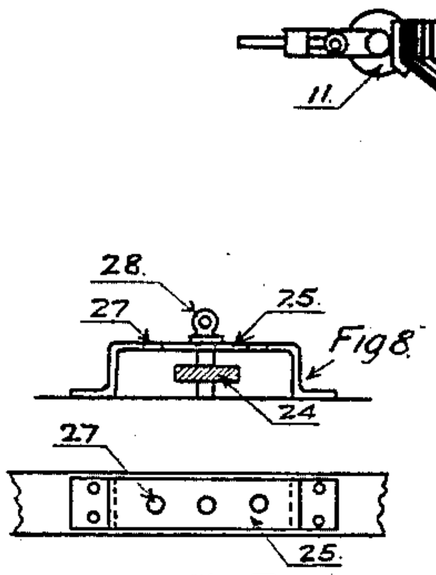

Fig. 8

Fig. 7

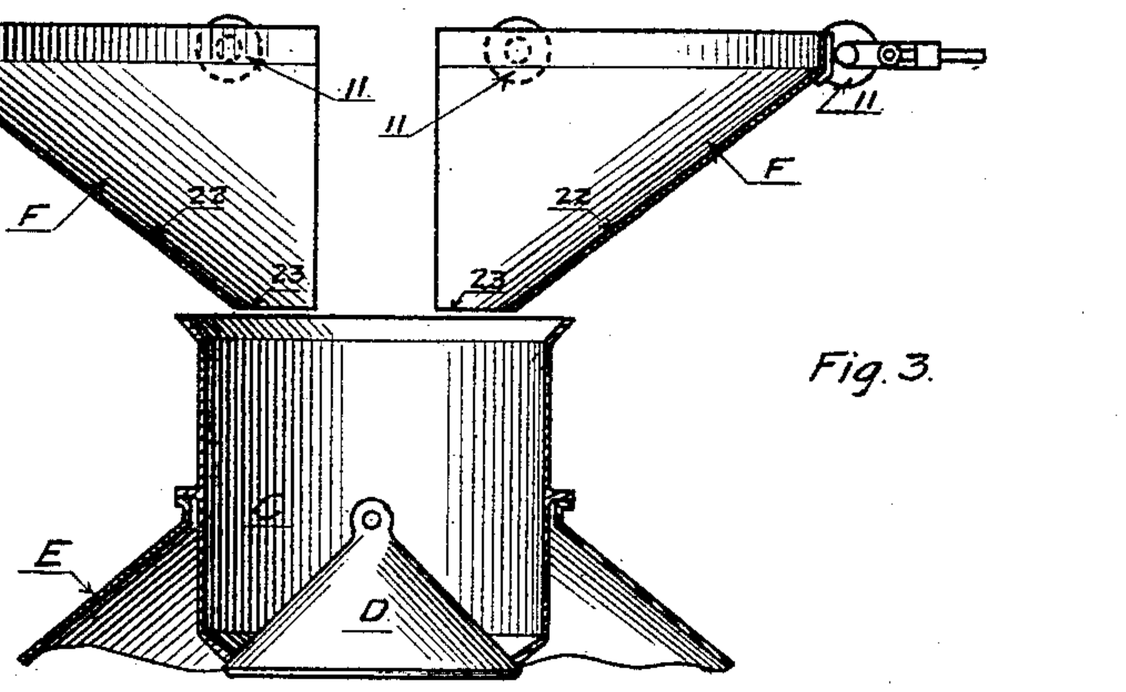

Fig. 3.

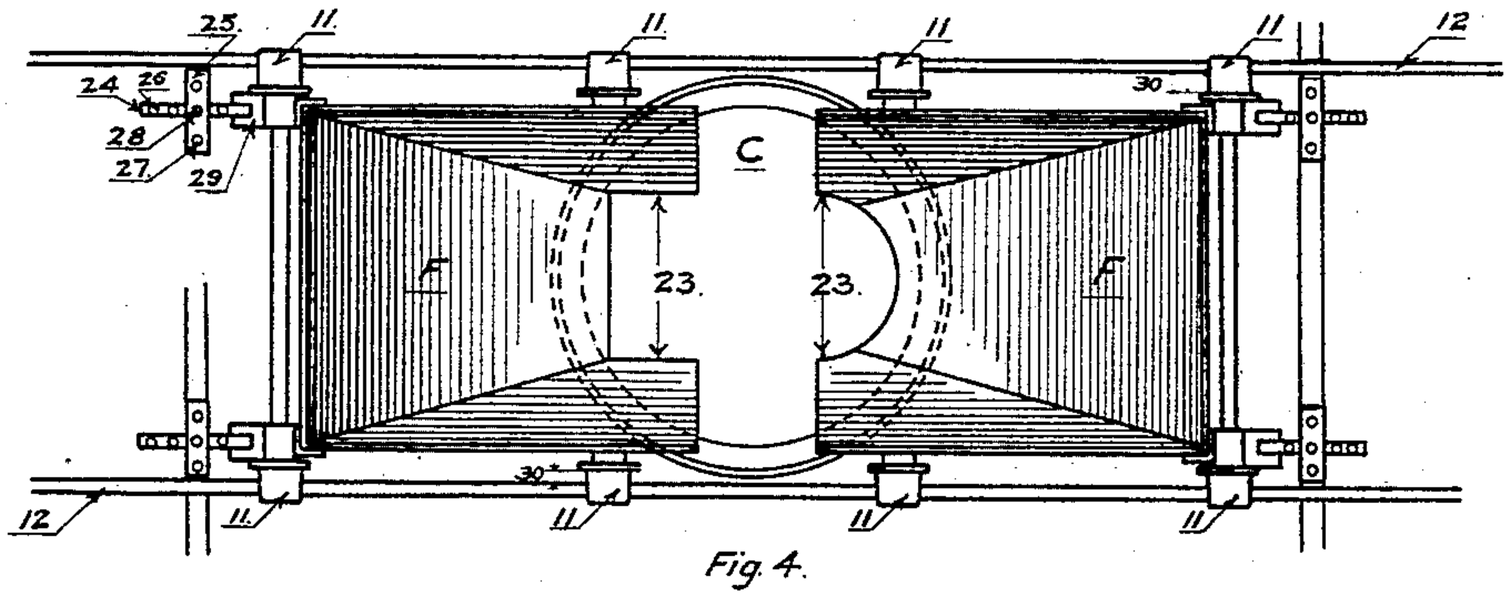

Fig. 4.

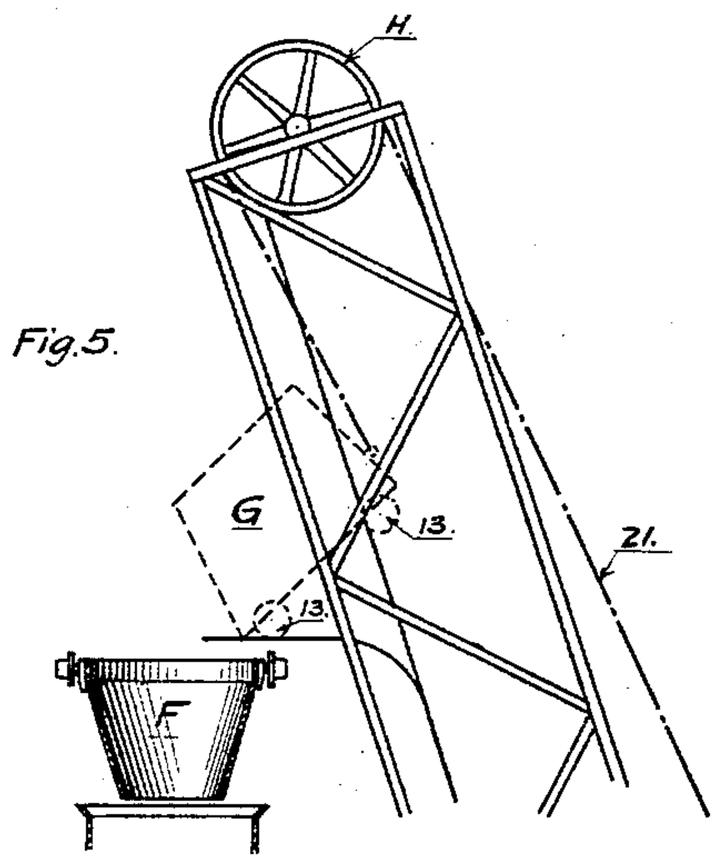

Fig. 5.

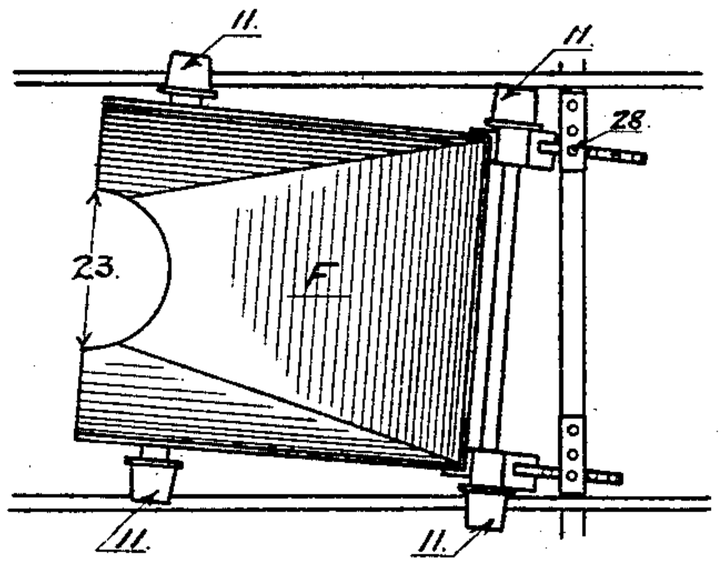

Fig. 6.

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UNITED STATES PATENT OFFICE.

FRANK C. ROBERTS, OF PHILADELPHIA, PENNSYLVANIA.

BLAST-FURNACE-CHARGING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 616,494, dated December 27, 1898.

Application filed April 1, 1898. Serial No. 676,086. (No model.)

To all whom it may concern:

Be it known that I, FRANK C. ROBERTS, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia, State of Pennsylvania, have invented a new and useful Blast-Furnace-Charging Apparatus, of which the following, taken in connection with the accompanying drawings, is a full and clear specification.

My invention relates to improvements in the apparatus for charging the necessary materials into the top of the blast-furnace, whereby the labor and consequent expense involved are much reduced and a better distribution of the charge secured.

It is well known that in order to properly and efficiently charge or fill a blast-furnace it is essential that the materials when dumped into the hopper at the top of the furnace shall be distributed around said hopper in as regular and uniform manner as possible. It is also desirable that the charging apparatus embrace what is known as a "gas-seal," whereby when the bell closing the mouth of the furnace is lowered the furnace-gas is prevented from escaping into the atmosphere.

A very common method of filling or charging a blast-furnace consists in hoisting to the elevation of the top of the furnace the cars or barrows containing the materials to be charged by means of an inclined plane or vertical elevator. The cars or barrows are then wheeled to the hopper, their contents dumped into the hopper, and the cars or barrows returned to the head of the elevator, all of which is performed by manual labor.

The foregoing-described operation involves considerable labor expense; and the object of my invention is to substitute an automatic device for much of the labor now generally employed at the furnace-top and thus effect a reduction in expense. I attain this object by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section through the upper part of a blast-furnace, showing my charging apparatus. Fig. 2 is a combined end elevation and section at right angles to Fig. 2, the right-hand side of the figure showing the elevation and the left-hand side the section. Fig. 3 is a section showing the supplementary hopper and distributing-chutes separated from the rest of the apparatus. Fig. 4 is a plan of the distributing-chutes. Fig. 5 is an elevation of a different design of skip-hoist from that shown in Fig. 1. Fig. 6 is a plan of a distributing-chute, showing the transverse adjustment of the same. Figs. 7 and 8 are respectively a plan and elevation of the device for holding the chutes in position. Fig. 9 is a vertical section of a different form of supplementary hopper from that shown in the other figures.

In the drawings, A is the furnace-hopper.

B is the bell which closes the mouth of the furnace-hopper and is raised and lowered in this instance by means of the steam-cylinder 1, piston-rod 2, lever 3, link 4, and rod 5.

C is what I term the "supplementary hopper."

D is the bell which closes the mouth of the supplementary hopper and is raised and lowered in this instance by means of the steam-cylinder 6, piston-rod 7, lever 8, link 9, and the hollow rod 10, inside of which passes the aforementioned rod 5.

E is what I term the "hopper-top" and consists of a casting or castings so designed as to cover and inclose the furnace-hopper A and in this instance support the supplementary hopper C.

F is the distributing-chute, carried by attached wheels 11, running on tracks 12, two of these chutes being provided and designed to discharge toward the center of the furnace-top.

G is a skip-car having the open end next the furnace-center and carried by wheels 13, running on tracks 18 and 19.

H is a sheave over which the hoisting-rope 21 passes, the rope 21 being attached to the frame 15, carrying wheels 14, running on track 17. Frame 15 is pivoted to the car G at 16.

The operation of tipping the car G to the position shown in the drawings is performed by providing the rear set of wheels 15 with a wider tread than the front wheels, track 20 being divided, as indicated, into two tracks 18 and 19, the former set of wheels passing to track 18, while the latter set of wheels runs on track 19. Wheels 14 run on track 17, and

being attached to the hoisting-rope 21 and the frame 15, pivoted to G at 16, the rear of car G is elevated to the position indicated by the pushing action of the frame 15, actuated by the hoisting-rope 21.

The operation of the apparatus is as follows: Two skip-cars G are provided. Fig. 2 shows one car G in end elevation, while the second car G and tracks for the same, if represented in this figure, would be shown in relatively the same position on the opposite side of the center of the furnace—*i. e.*, in front of that part of Fig. 2 shown in section. The usual arrangement of a double skip-hoist provides that when one car is at the top of the skip the other car is at the bottom. Thus in the present instance the cars G are raised to the top of the furnace alternately on opposite sides and automatically dumped into the chutes F, each car dumping into its own particular chute. The chutes F being provided with sloping bottoms 22 the materials dumped into them slide down these sloping bottoms 22 into the supplementary hopper C. It is evident that the position of the openings 23 (see Figs. 3 and 4) with reference to the center of the supplementary hopper C will control the distribution of the material sliding down F in the supplementary hopper C. For this reason these chutes F are made adjustable, so that the position best suited to secure a fairly uniform distribution in the supplementary hopper C may be determined in each application by experiment. It is evident that the longitudinal (*i. e.*, lengthwise) adjustment of the chutes F is secured by the fact that they are supported on wheels 11, running on tracks 12. The transverse adjustment (*i. e.*, crosswise) of the chutes F is secured in this instance as follows: The wheels 11 are provided with wide treads, the tracks 12 being located so that when the chutes F are centrally located the outside edges of the treads of wheels 11 bear on tracks 12, leaving a space 30 (see Fig. 4) between the flanges of the wheels 11 and tracks 12. It is thus evident that the chutes F may be moved bodily out of center with the furnace the distance 30 or any less distance. Further, the chutes may be partly turned, as indicated in Fig. 6, so as to deflect the material to one side or the other as it enters the supplementary hopper C. Chutes F may be secured in the various positions indicated by the foregoing adjustments by means of the bars 24, (see Figs. 4, 7, and 8,) pivoted to F at 29 and equipped with holes 26, said bars passing under loops 25, equipped with holes 27, the chute F being secured in position by the pins 28, passing through the holes 26 and 27. The materials having been fairly uniformly distributed in the supplementary hopper C the bell D may be lowered and the materials be discharged into the hopper A, fairly uniform distribution being secured through the medium of the materials passing out of C over the bell D. After the materials are discharged into A, the bell D having been raised, the bell B may be lowered and the materials discharged into the furnace. The gases which arise from the furnace when B is lowered are prevented from escaping to the atmosphere by means of the hopper-top E and the bell D.

Fig. 5 represents a different design of skip-hoist, the car being shown in position to discharge into the chute F.

The openings 23 (see Figs. 3, 4, and 6) at the bottom of chutes F may be made of any desirable shape. The left-hand portion of Fig. 4 shows this opening as rectangular, while the right-hand portion of Fig. 4 shows the opening as circular.

Fig. 9 shows a different design for the supplementary hopper C, wherein the hopper C and bell D are connected together, the bell being supported from C by the bar K. The bell being fixed in position, the hopper C is emptied of its contents by providing a sleeve J, which may be raised and lowered on the outside of C. When J is raised, the contents of C are discharged into the furnace-hopper.

It is evident that for the double skip-hoist shown in Figs. 1 and 2 a single skip-hoist may be substituted in combination with one adjustable chute F.

It is evident that the chutes may be equipped with either the longitudinal or transverse adjustment, or both, and the word "adjustable" herein used be interpreted as applying to either longitudinal or transverse adjustment, or both.

It is obvious that in the combination set out in the annexed claims a different type of hoisting mechanism may be used than that which I have illustrated and described; also, a different design of supplemental hopper and different apparatus for discharging the supplemental hopper; also, a different furnace-hopper, furnace-bell, and different apparatus for operating the same. In said claims, also, the particular form of the chutes F F, the method of adjustment of said chutes, and the means of holding said chutes in position when adjusted may all be varied, provided the other elements of the claims are used as specified.

Having fully described my invention, what I claim, and desire to cover by Letters Patent, is—

1. In blast-furnace-charging apparatus, the combination of a furnace-hopper; a supplementary hopper located centrally over said furnace-hopper and provided with an opening for discharging its contents into the furnace-hopper; means for closing said opening; chutes located on opposite sides of said supplementary hopper; means for moving said chutes toward and away from the center of said supplementary hopper, and a hoisting mechanism to feed said chutes.

2. In blast-furnace-charging apparatus, the combination of a furnace-hopper; a supplementary hopper located centrally over said furnace-hopper and provided with an open-

ing for discharging its contents into the furnace-hopper; means for closing said opening; a chute; a track on which the chute moves toward and away from the center of said supplementary hopper; means for twisting laterally said chute on said track and a hoisting mechanism to feed said chute.

In testimony whereof I have hereunto set my hand this 31st day of March, 1898.

FRANK C. ROBERTS.

Witnesses:
L. K. LACHMAN,
I. G. BAYLEY.