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PATENTED JUNE 23, 1903.

A. H. WOODWARD.
STORAGE STRUCTURE.

APPLICATION FILED JUNE 1, 1903.

NO MODEL.

2 SHEETS—SHEET 1.

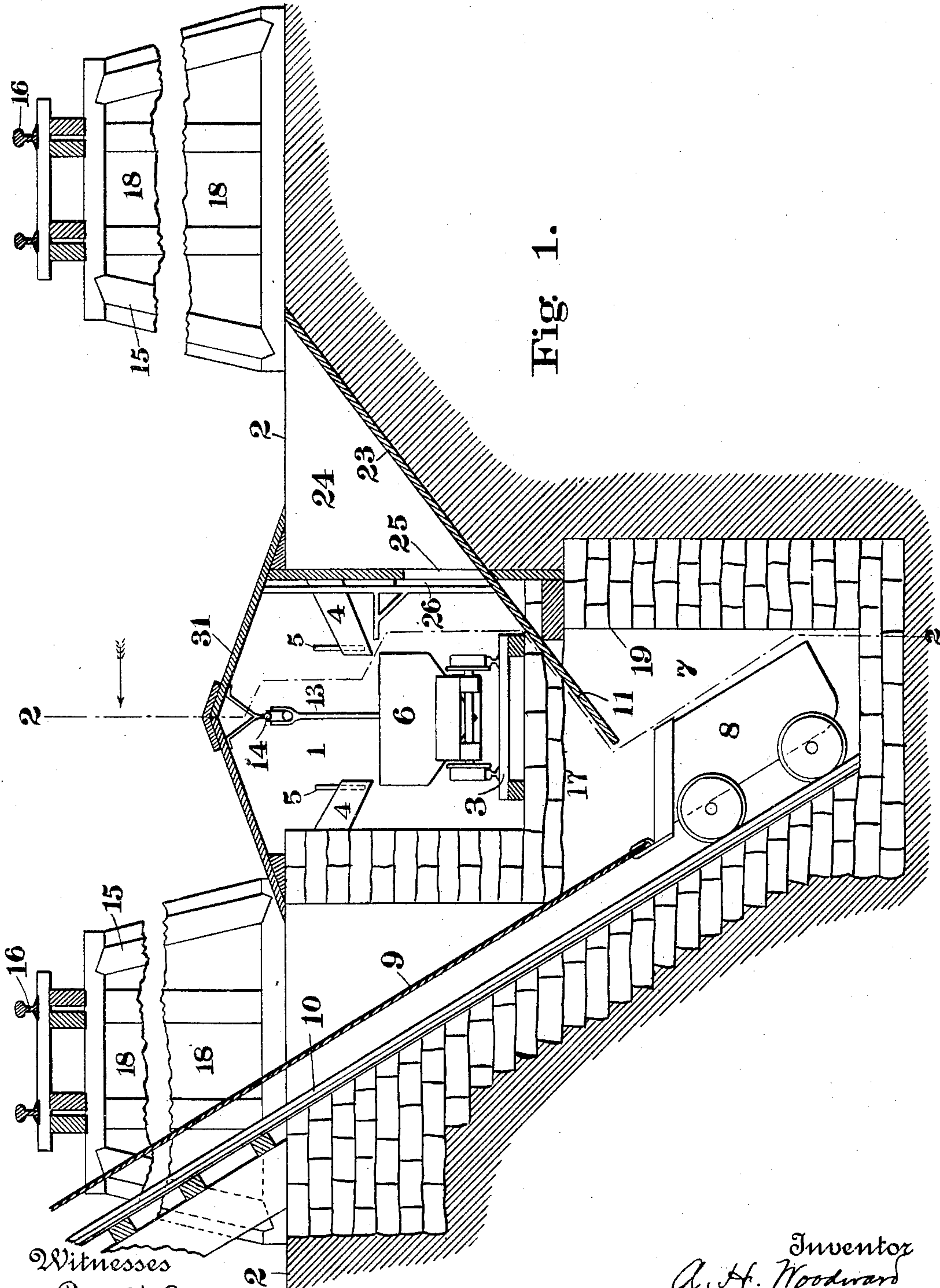


Fig. 1.

Witnesses

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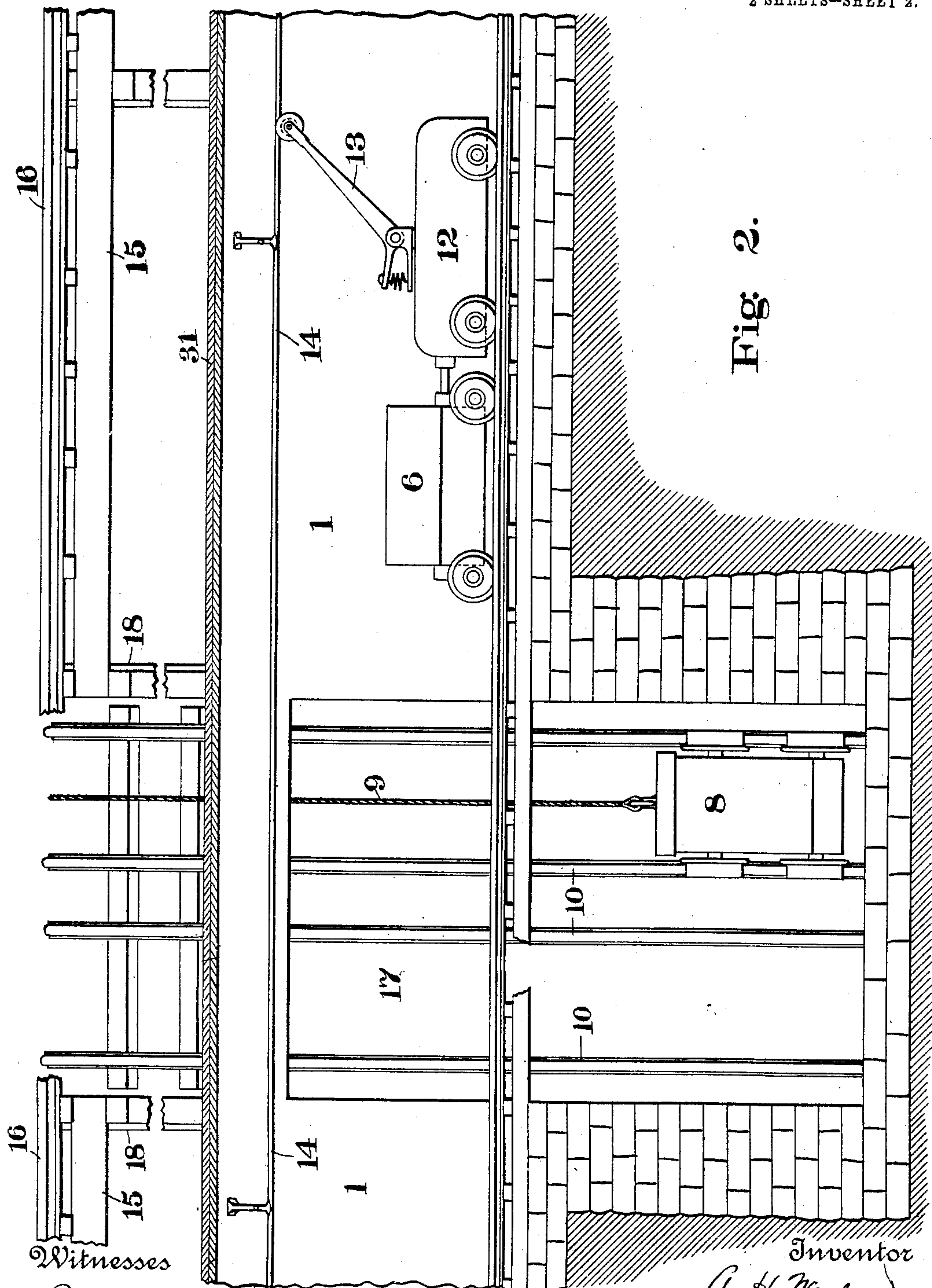
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UNITED STATES PATENT OFFICE.

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STORAGE STRUCTURE.

SPECIFICATION forming part of Letters Patent No. 732,021, dated June 23, 1903.

Original application filed June 16, 1902, Serial No. 111,918. Divided and this application filed June 1, 1903. Serial No. 159,622. (No model).

To all whom it may concern:

Be it known that I, ALLAN H. WOODWARD, a citizen of the United States, and a resident of Woodward, county of Jefferson, State of Alabama, have invented certain new and useful Improvements in Storage Structures, of which the following is a specification.

My invention relates to storage structures, and particularly such structures as are used for storing and handling the various stocks or materials used at blast-furnace plants, such as that disclosed and claimed in my pending application, Serial No. 111,918, filed June 16, 1902, of which the present application is a division. It has been the general custom to keep the stocks used at such plants in stock-houses, to which the material is transported by cars running upon elevated tracks and dumped therefrom upon the ground and when needed loaded into tram-cars or buggies by shoveling into these cars. In these cars the material is transported to the elevator or hoist and there loaded in the cage to be carried to the top of the furnace. In recent years modern blast-furnaces have been equipped with storage-bins into which the material is discharged from cars carried upon elevated tracks. The bottoms of these bins are raised several feet above the ground and each bin provided with a chute or chutes for discharging the material into tram-cars traveling on tracks underneath the chutes. These cars are filled with the stock through said chutes and then run to a car which travels up and down an incline or skip-hoist for conveying the material to the top of the furnace. These bins are very expensive to construct, as the bottoms must be sufficiently high above the ground to bring the doors or gates of the chutes high enough to allow the material to run into the tram-cars and the bottoms must be very strong to support the weight of ore, limestone, &c., in the bins. The trestles supporting the tracks upon which the cars run to deliver material to the bins must be sufficiently high to get the storage capacity requisite to warrant the great cost of the structure in order to attain the economy desired over the old stock-house method of storage and handling. In many expensive plants the trestles on which the elevated tracks are carried

have not been built with a view to the use of such bins, and hence the introduction of such bins is not practicable, because the necessary height of the bottom of the bin above the ground to permit the use of the tram-cars in the manner above mentioned would so materially decrease the storage capacity as to more than counterbalance the economy derived from the modern bin structure. Moreover, in order to secure the proper height and maintain a sufficient storage capacity it would not only increase the grade to an impracticable extent, but would be very expensive to raise the trestles and would entail in many cases such a radical change in railroad-yards and in the disposition of the tracks as to make such an expedient impracticable, not only on account of the larger expense of reconstruction and rearrangement, but because of the additional expense of elevating the roof of the old stock-house.

My invention as disclosed in my said original application enables me to provide blast-furnace plants or the like, and more especially those in which the conditions above indicated exist, with a storage structure and plant for feeding blast-furnaces having all the advantages of the modern bin structure and at a greatly-reduced cost, not only of installation, but of maintenance, the present invention having special reference to a specific form of that invention in which a tunnel or a conduit with power-operated means for shifting the cars in the conduit is used.

In the drawings, Figure 1 is a transverse section through the skip-hoist pit of a storage structure embodying my invention; and Fig. 2 is a central vertical section on the line 2 2, Fig. 1.

Referring to the drawings, in which the same reference characters relate to the same or corresponding parts in all the views, the numeral 1 indicates a tunnel the bottom of which is sufficiently below the level of the ground 2 to allow the tram-cars 6, running on a way or track 3 on the bottom of the tunnel, to pass under various chutes 4, which project from different points along the bins to discharge material into the cars as they are run underneath the same. The ground 2 serves as the floor or the direct support for

the same in my bin structure, thereby avoiding the expense of raised bin-bottoms, and instead of raising the retaining-walls alongside of the open ditch or conduit, as covered
 5 by the claims of my aforesaid application, the conduit is covered by a roof 31, sloping toward each side, so that the material will slide toward the chutes, as shown in Fig. 1. On each side and a sufficient distance from
 10 the edge of the tunnel is a trestle 15, supporting tracks 16, on which travel the cars carrying material for delivery to the storage-bins, the said material being dumped in the usual manner into the bins at the points desired.
 15 The spaces underneath the trestle may be divided into any suitable number of bins by means of partition-walls 18, preferably secured to the trestles, thereby providing bins for the storage of various stocks or materials
 20 used. At a suitable point in the tunnel 1 a pit 7, communicating with the tunnel through an opening 17, is sunk a sufficient depth to permit the skip-hoist car 8 to be run below the track 3, so that the tram-cars 6 may be
 25 brought from the various points along the storage structure and dumped into the skip-hoist car. The skip-hoist pit 7 is preferably lined with a stone retaining-wall 19, and, if desired, a similar wall may be placed along
 30 the sides of the tunnel 1. From this pit the incline 10, carrying the tracks for the skip-hoist car, extends to the top of the furnace. The chutes 4 on the bins, provided with any common form of gate 5, are adapted to dis-
 35 charge material from the bins into the tram-cars traveling in the tunnel 1. For the storage of the coke I preferably use a bin located opposite the skip-hoist, so that the coke may be dumped directly into the skip-hoist car,
 40 and thereby avoid rehandling. A common form of suspension-scales, (not shown herein,) provided with an opening to permit the passage of the contents from the tunnel-car into the skip-hoist car in the pit below, such as
 45 that disclosed in my aforesaid application, may be used, nor have I shown herein the operator's platform and the controlling mechanism for the skip-hoist cars, as those features likewise form no part of the present in-
 50 vention and may be of the type disclosed in said application or any other approved type. The chute 11, leading from the central or coke bin, is a continuation of the bottom 23 of a recess in the inner edge of the floor 2,
 55 forming a hopper 24, having an opening 25, closed by a door or gate 26, the latter of which is operated by any suitable means—as, for example, by the means shown in my pending application heretofore referred to. This chute
 60 passes underneath the tunnel and is arranged to discharge material from the bin 24 directly into the skip-hoist car.

I have shown two tracks on the skip-hoist leading into the pit; but it is obvious that
 65 any suitable number of these tracks may be employed. With two such tracks one car may be hoisted as the other is lowered.

With a storage structure made according to my invention it is not necessary to provide an inclined bottom, as is customary in
 70 the modern bin structures, since it is found by experience that the stocks of ore, limestone; &c., slide over a bed formed thereof at about the same angle as it will slide over
 75 the usual inclined bottom. The material which thus forms, in effect, the inclined bed can be used in cases of emergency, for it can be loaded into cars through the chutes by shoveling.

I have shown the skip-hoist entering the
 80 tunnel transversely thereto at an intermediate point; but it is obvious it may enter at either end or any suitable point, if desired.

By the use of the tunnel form of my invention as herein described and claimed the ex-
 85 pense of the side walls is dispensed with and the storage capacity is increased to the extent of the width of the ditch and the height of the trestles. Any well-known ventilating system for forcing dust, &c., out of the tun-
 90 nel and air into the same may be used.

While of course it is desirable to use tracks as the "way" in the ditch, it is obvious that
 95 this term "way" includes any means over which a car may be hauled, such as the bottom of the tunnel, which may be used where tracks may not be desired.

Any suitable means may be employed for hauling the cars through the tunnel, such as
 100 some common form of rope-haulage plant or an electric motor, the latter of which I have shown conventionally in the drawings, where
 105 12 indicates such a motor coupled to a transfer-car 6 and receiving its current from a conducting-wire 14, suspended from the roof
 110 of the tunnel, by means of a trolley 13, which can be swung about its pivotal support as usual, or the said cars may be pushed by hand or pulled by a rope attached to the cars.

I do not in this application claim, broadly,
 115 the open conduit or ditch, with its cooperating elements, for feeding materials to blast-furnaces, nor do I claim, broadly, herein a storage structure comprising an elevated track, the space beneath which forms one or
 120 more bins, with the ground as the bottom or floor, a conduit, the bottom of which is sufficiently below the ground level to permit a car to travel thereunder, chutes extending over the sides of the conduit so as to dis-
 125 charge material into said car, as these features form the subject-matter, in varying breadths, of the claims of my said application Serial No. 111,918. I should further observe that by the employment of that form of my
 130 invention in which the conduit or ditch is covered over, so as to form a tunnel, an important advantage is derived, for the reason that it obviates the series difficulties now encountered in those regions where large stocks
 135 of ore are carried through the winter where the temperature falls below the freezing-point. In such places the ore freezes on the outside for two or three feet, thereby forming an im-

pervious crust, and great trouble is consequently experienced in breaking and handling this frozen ore. With a tunnel covered over, such as that embodied in my invention, 5 located under the center of a large pile of ore it is manifest that all of the ore, except the outside frozen crust, can be readily handled as well in winter weather as at any other time, since the central portion or the portion 10 within the crust above designated does not freeze. As a result of this construction, the ore may be stored in large stocks over the conduit, and although the outer crust be frozen, the portion covered thereby can be 15 readily withdrawn through chutes discharged into the cars within the conduit, and this without necessitating the hitherto great trouble and expense of breaking and handling the frozen ore.

20 I claim as my invention—

1. A plant for feeding materials to a blast-furnace, having in combination a tunnel provided with chutes or passages extending to the surface of the ground, and having an opening 25 in its bottom for the passage of materials, gates for closing said chutes, a skipway extending from the top of the furnace to a point below the opening through the bottom of the tunnel, cars movable along the tunnel and 30 skipway, and means for shifting the cars along the tunnel and other cars on the skipway, substantially as set forth.

2. A plant for feeding materials to a blast-furnace, having in combination a tunnel provided with chutes or passages extending to the surface of the ground and having an opening 35 in the bottom thereof for the passage of materials, gates for said chutes, a skipway extending from the top of the furnace to a

point below the opening through the bottom 40 of the tunnel, cars movable along the tunnel and skipway, and means for shifting the cars along the tunnel and skipway, and chutes or passages extending from the coke-storage floor under the tunnel to the cars on the skip- 45 way, substantially as set forth.

3. A storage structure comprising a conduit provided with chutes or passages extending to the surface of the ground and having an opening in the bottom thereof for the pas- 50 sage of materials, gates for said chutes, a skip-hoist extending from the top of the furnace to a point below the opening through the bottom of the conduit, cars movable along the conduit and skip-hoist and means for shifting 55 the cars along the conduit and skip-hoist, and chutes or passages extending from the storage-floor under the conduit to the cars on the skip-hoist, substantially as described.

4. A plant for feeding materials to a blast- 60 furnace, having in combination a tunnel provided with chutes or passages extending to the surface of the ground, and having an opening in its bottom for the passage of materials, gates for closing said chutes, a skipway ex- 65 tending from the top of the furnace to a point below the opening through the bottom of the tunnel, cars on the skipway, and means for moving the said cars, and other cars movable along the tunnel and underneath the chutes, 70 substantially as described.

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

ALLAN H. WOODWARD.

Witnesses:

J. H. WOODWARD,
R. H. BANISTER.