

No. 640,117.

Patented Dec. 26, 1899.

H. EARLE.  
ORE CONCENTRATOR.

(Application filed Mar. 11, 1899.)

(No Model.)

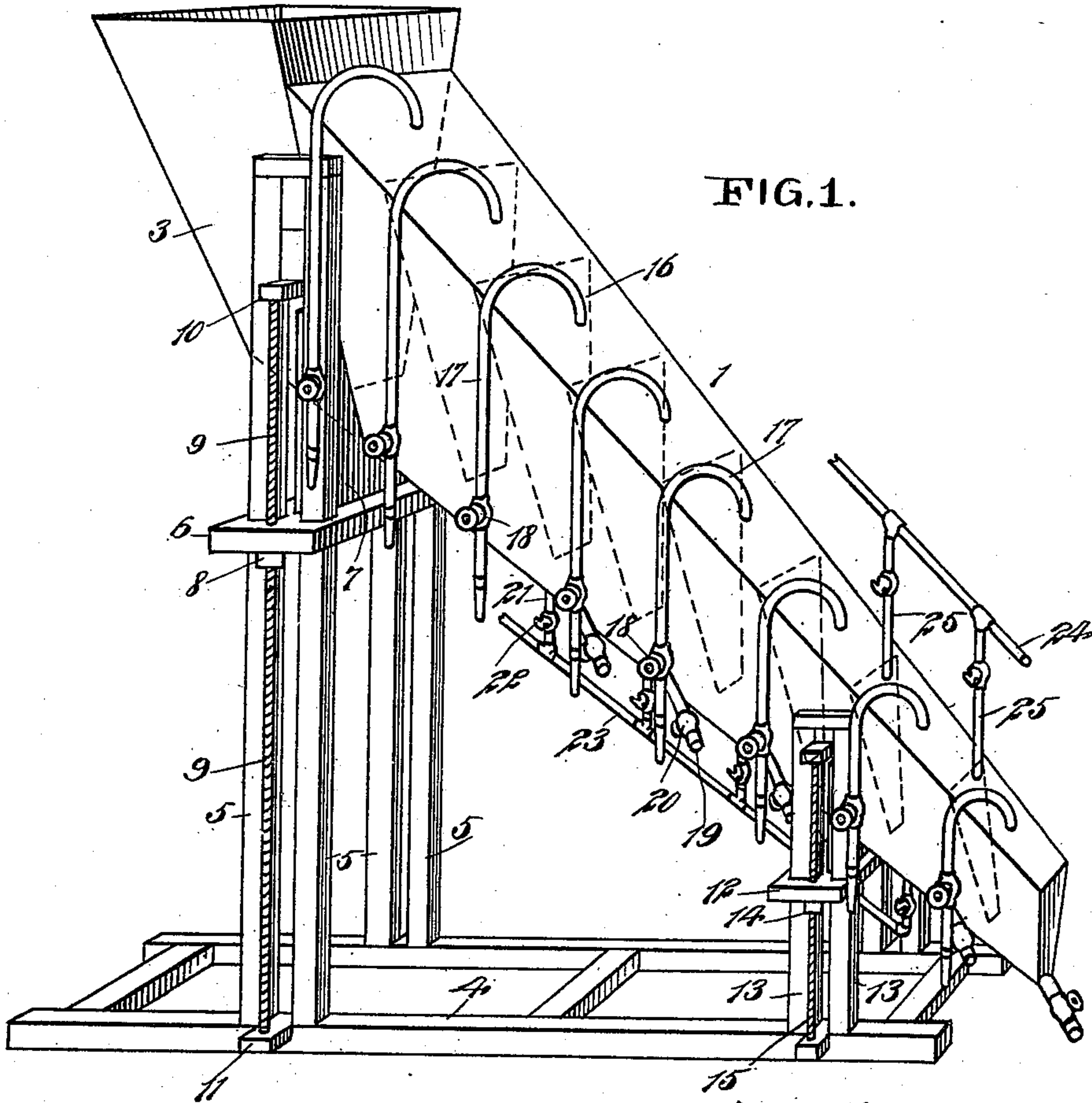


FIG. 1.

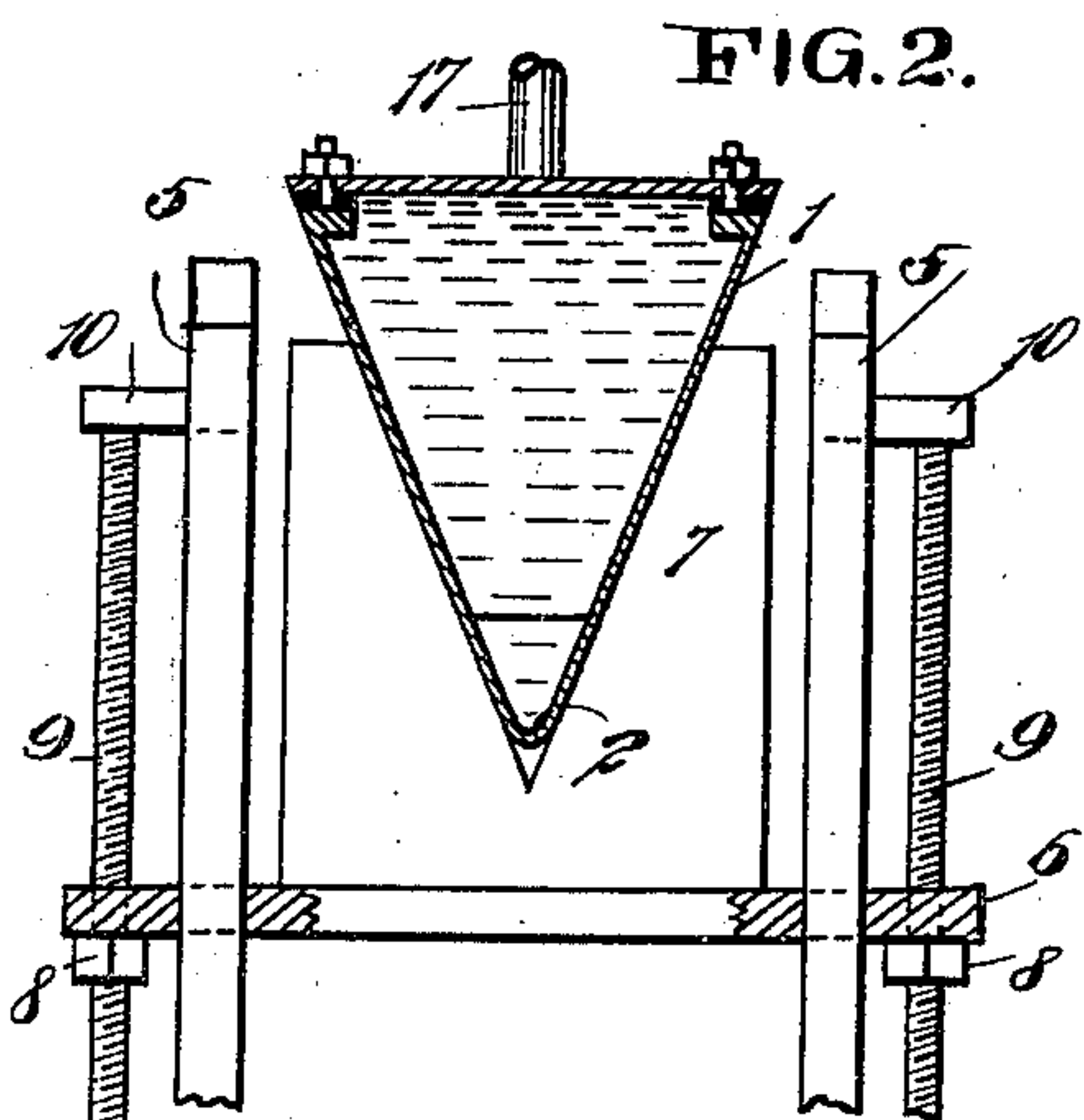


FIG. 2.

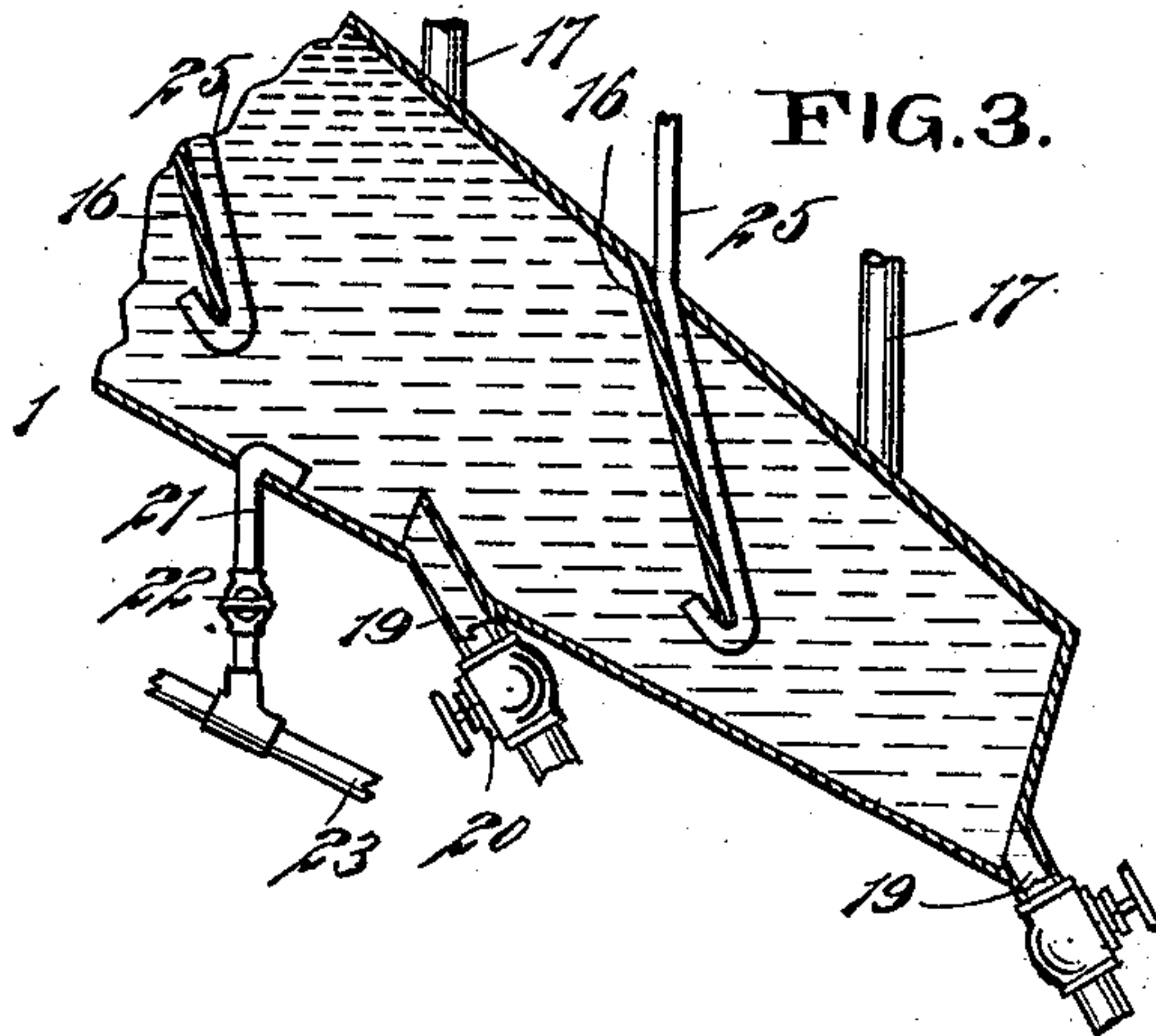


FIG. 3.

WITNESSES:

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# UNITED STATES PATENT OFFICE.

HENRY EARLE, OF CANYON, COLORADO.

## ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 640,117, dated December 26, 1899.

Application filed March 11, 1899. Serial No. 708,662. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY EARLE, of Canyon, in the county of Fremont and State of Colorado, have invented a new and Improved Ore-Concentrator, of which the following is a full, clear, and exact description.

This invention relates to improvements in apparatus for the concentration of ores from the gangue or separation of metalliferous ores from the valueless portion of the rock in which they occur. The chief difficulty as heretofore encountered in the concentration and separation of ores that are in a very fine state of division is that the particles of valuable material are so nearly of the same specific gravity as the valueless material that the valuable portions float in the water and are carried away with the waste matter and lost, and such loss is quite considerable.

The object of my invention is to provide an apparatus chiefly intended to save the finest particles of valuable matter and separate it from the valueless, at the same time saving all the ores or valuable parts of the ores that are in a coarser state of division and that are readily separated by the usual and well-known machines for such purpose.

I will describe an ore-concentrator embodying my invention and then point out the novel features in the appended claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a perspective view of an ore-concentrator embodying my invention. Fig. 2 is a cross-section thereof, and Fig. 3 is a longitudinal vertical section of a portion thereof.

Referring to the drawings, 1 designates the chute or casing of the apparatus, which is V shape in cross-section, its bottom, however, being transversely curved, as at 2. This chute or casing gradually diminishes in depth and width from its upper to its lower end, and it is closed on all sides, so as to make it air-tight. It may be made of sheet metal, having the top soldered thereon, or it may be made of other material and have a removable top which, however, must have an air-tight connection with the body portion.

At the upper end of the chute or casing is

a hopper 3, into which water and material to be treated is first inserted. The chute or casing is arranged in an inclined position, and, as here shown, it is placed in a frame comprising a base 4, at the head portion of which are standards 5, on which a cross-head 6 is vertically movable, and attached to this cross-head is a block 7, having an opening formed in it conforming to the cross-section of the chute or casing. Vertical motion is imparted to the cross-head 6, and consequently to the block 7, to raise or lower the chute or casing, by means of nuts 8, engaging with the lower side of the cross-head 6 and operating on screw-rods 9, passing through said cross-head and connecting at the upper end with blocks 10 on the uprights 5 and at the lower end with blocks 11, extended from the base 4.

The lower end of the chute or casing is similarly supported by a cross-head 12, movable on uprights 13 by means of nuts 14, operating on screw-rods 15. The chute or casing is divided into a series of compartments by vertically-disposed partitions 16. These partitions do not extend entirely to the bottom of the chute or casing. Therefore there is a space between the lower ends of said partitions and the bottom of the chute or casing for the passage of water and material carried thereby, and as the chute or casing diminishes in width from its upper to its lower end the several openings consequently are gradually diminished in size.

The partitions are inclined somewhat toward the lower end of the chute or casing, so that while they will act to deflect water and the lighter material carried thereby they will not act as a serious impediment to the passage thereof.

Leading through the top of the chute or casing and into each compartment is a siphon-pipe 17, adapted to discharge material into a suitable receptacle, as will be hereinafter described, and each siphon 17 has a valve 18. Leading through the bottom of the chute or casing and into each compartment is a discharge-pipe 19, provided with a valve 20. These discharge-pipes are inclined, so that their mouths or receiving ends within the chute or casing are extended toward the upper end of said chute or casing, and to accelerate the passage of material through said



pipes 19 I employ adjacent to each pipe 19 a water-jet pipe 21, each jet-pipe being provided with a valve 22, and all of said jet-pipes are connected to a common pipe 23.

5 To supply the several compartments in the chute with additional water when the same is required, a water-pipe 24 is extended along the top of the chute or casing, and from this pipe 24 valve-controlled branch pipes 25 lead  
10 through the top of the chute or casing downward along the partitions 16 and have their lower ends turned around the lower ends of said partitions, so as to discharge water at the upper side of the partition.

15 The pipes leading from each compartment may be of any convenient length. Each of the pipes leading from the top of each compartment, together with the entire compartment from which it leads, in reality is a siphon, and each partition between each compartment is made air-tight with the walls of the chute or casing. From this fact it is evident that the ore and water or the pulp in  
20 passing through the chute or casing on the bottom under each partition come successively under the action of each siphon, and the intention of the combination of the siphon with the chute or casing is to subject the pulp or material to the upward action of the  
25 current of water flowing through the siphon, which being regulated by the valve in the pipe may be made as strong or weak as desired.

30 From the siphon leading from the top of the first compartment nearest the head of the apparatus only the very lightest waste material is allowed to flow, from the next siphon material slightly heavier, and so on down the whole apparatus, until from those siphons  
35 nearest the tail end the pulp, with the water, is compelled to pass upward against the force of gravity, and owing to the wedge shape of each compartment in the chute or casing this upward current becomes slower and  
40 slower as it rises, thus permitting the fine particles of ore to have time to settle toward the bottom, only the lightest particles of waste matter being permitted to flow from the siphons nearest the head. Each stream of  
45 pulp and water flowing from the siphon may be taken by this to another and similar machine for another and closer separation.

50 In the practical operation of my apparatus the crushed ore and water is allowed to flow into the hopper at the head of the machine  
55 and thence into the chute or casing through the opening at the bottom of the hopper until the entire chute or casing is full, the contained air being permitted to escape through the siphons. By then carefully regulating the flow of water and its suspended matter from each siphon by means of the valves the  
60 result of gradual separation of the heavier ore from the lighter waste material is obtained. That portion of the contained ore which is so large or so heavy as to sink readily to the bottom of the chute or casing is al-

lowed to flow from the pipes 19 in the bottom, and in order to assist this discharge through said pipes the jets 21 are employed. Should  
70 the accumulation of ore get too great at the tail end of the apparatus or the proportion of water get too small, the deficiency of water will be made up through the pipes 24 and 25.

The machine embodying my invention is  
75 well adapted and can be used for the purpose of dividing and separating pulverized ores into different degrees of fineness, preparatory to passing such ores through the usual ore concentrating and separating machines,  
80 the separation and subdivision of such ores into different degrees of fineness and specific gravity rendering the work of more close concentration and separation comparatively  
85 easy.

I propose in concentrating or separating valuable material from the valueless portions of ore to use several of my machines in the operation. By varying the length or width of the machine or apparatus or giving it a  
90 more or less slope or fall it is possible to exactly suit the class of ore to be operated upon, the first machine being arranged to make only an approximate separation of the coarse and fine or heavy and light, and then  
95 each stream of ore and water so separated is to be carried to another machine adapted more closely to make the required separation. This can be carried on to a great extent, as the apparatus is comparatively in-  
100 expensive and requires no great power to operate it.

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

1. An ore-concentrator, comprising a chute or casing closed on all its sides, the said chute or casing being V shape in cross-section and diminishing in depth from its upper to its lower end, means for supporting the chute or  
110 casing in an inclined position, partitions in said chute or casing, forming the end walls of compartments, there being a space between the lower ends of said partitions and the bottom of the chute or casing, and valve-controlled siphons leading through the top of the chute or casing into each compartment, substantially as specified.

2. An ore-concentrator, comprising a chute or casing substantially V shape in cross-section, and diminishing in depth from its upper to its lower end, means for supporting the chute or casing in an inclined position, partitions in said chute or casing, forming end walls of compartments therein, there being  
120 an opening between the bottom of each partition and the bottom of the chute or casing, valve-controlled siphons leading through the top of the chute or casing, there being one siphon for each compartment in the chute or  
125 casing, and valve-controlled discharge-pipes leading through the bottom of the chute or casing into each compartment, substantially as specified.



3. An ore-concentrator, comprising an air-tight chute or casing substantially V shape in cross-section, partitions arranged in said chute or casing and extended nearly to the contracted bottom thereof, valve-controlled siphons leading through the top of the chute or casing, discharge-pipes leading through the bottom of the chute or casing and having their mouths or inlet ends directed toward the upper end of the chute or casing, and water-jet pipes adjacent to said mouths or inlet ends, substantially as specified.

4. An ore-concentrator, comprising an air-tight chute or casing substantially V shape in cross-section, a receiver for material at the upper end of said chute or casing, and adapted to discharge material into said chute or casing, means for supporting the chute or casing in an inclined position, vertically-disposed partitions in the chute or casing, forming end walls of compartments, a siphon-pipe leading from each compartment through the top of the chute or casing, valves in said siphons, and valve-controlled discharge-pipes leading through the bottom of the chute, the inlet ends of said pipes being directed toward the upper end of the chute, water-jet pipes arranged adjacent to the inlets of said discharge-pipes, and a pipe for supplying water to the

chute or casing in its several compartments, substantially as specified.

5. An ore-concentrator, comprising an air-tight chute substantially V shape in cross-section, and diminishing in depth and width from its upper to its lower end, a frame for supporting said chute, means for adjusting the chute vertically in the frame, a hopper at the upper end of the chute, partitions in the chute, dividing the same into compartments, a valve-controlled siphon leading from each compartment, and discharge-pipes leading from each compartment through the bottom of the chute, substantially as specified.

6. In an ore-concentrator, an inclined air-tight chute substantially V shape in cross-section, and divided into compartments having communication at the bottom one with another, means for carrying off lighter material from the top portions of the compartments one independently of the other, and pipes for receiving heavier particles or ores at the bottom of the compartments, substantially as specified.

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Witnesses:

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