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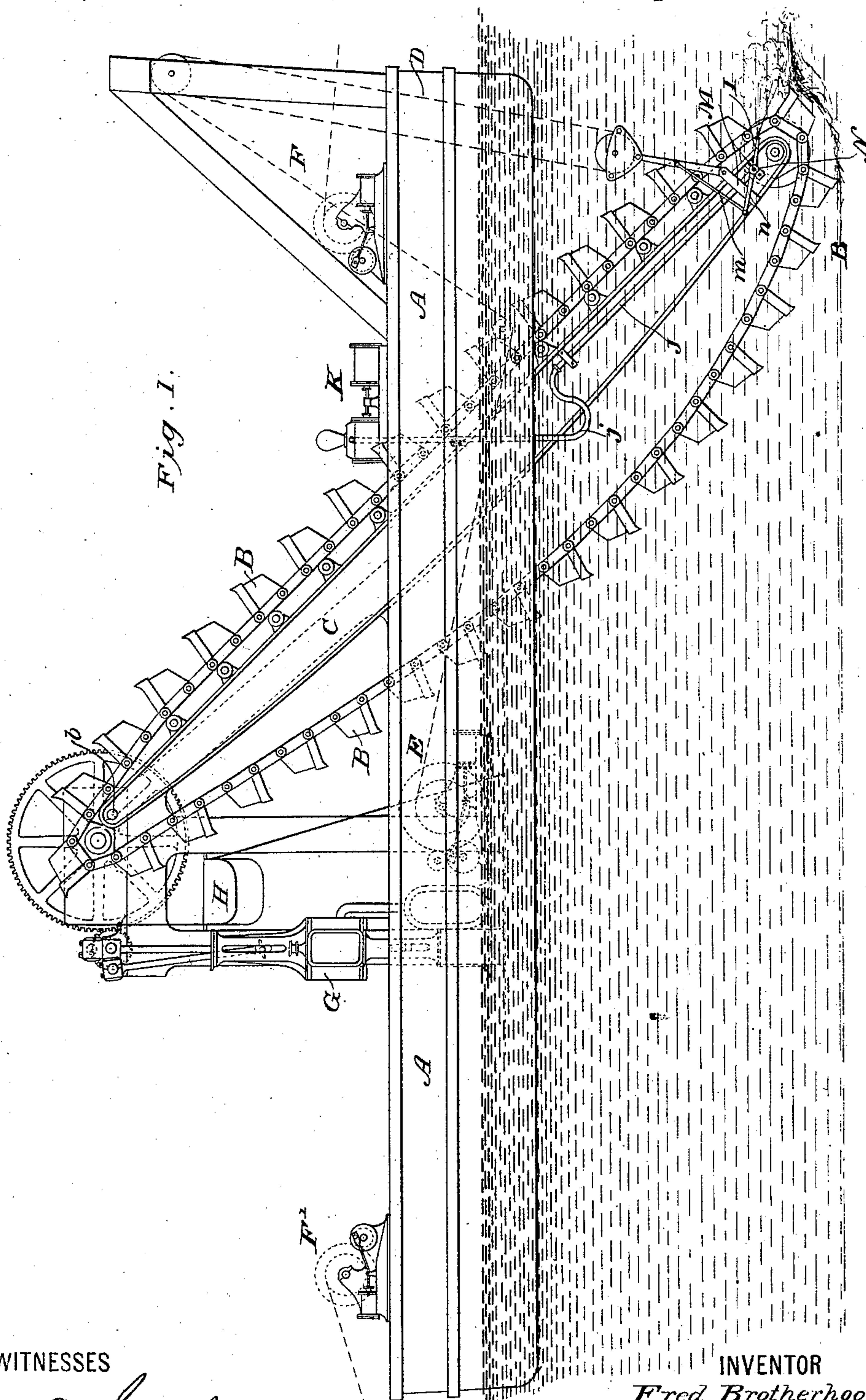
3 Sheets—Sheet 1.

F. BROTHERHOOD.

METHOD OF EXCAVATING AND APPARATUS THEREFOR.

No. 285,565.

Patented Sept. 25, 1883.



WITNESSES

Wm A. Skinkle
Geo W. Young

INVENTOR

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By his Attorneys

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(No Model.)

3 Sheets—Sheet 2.

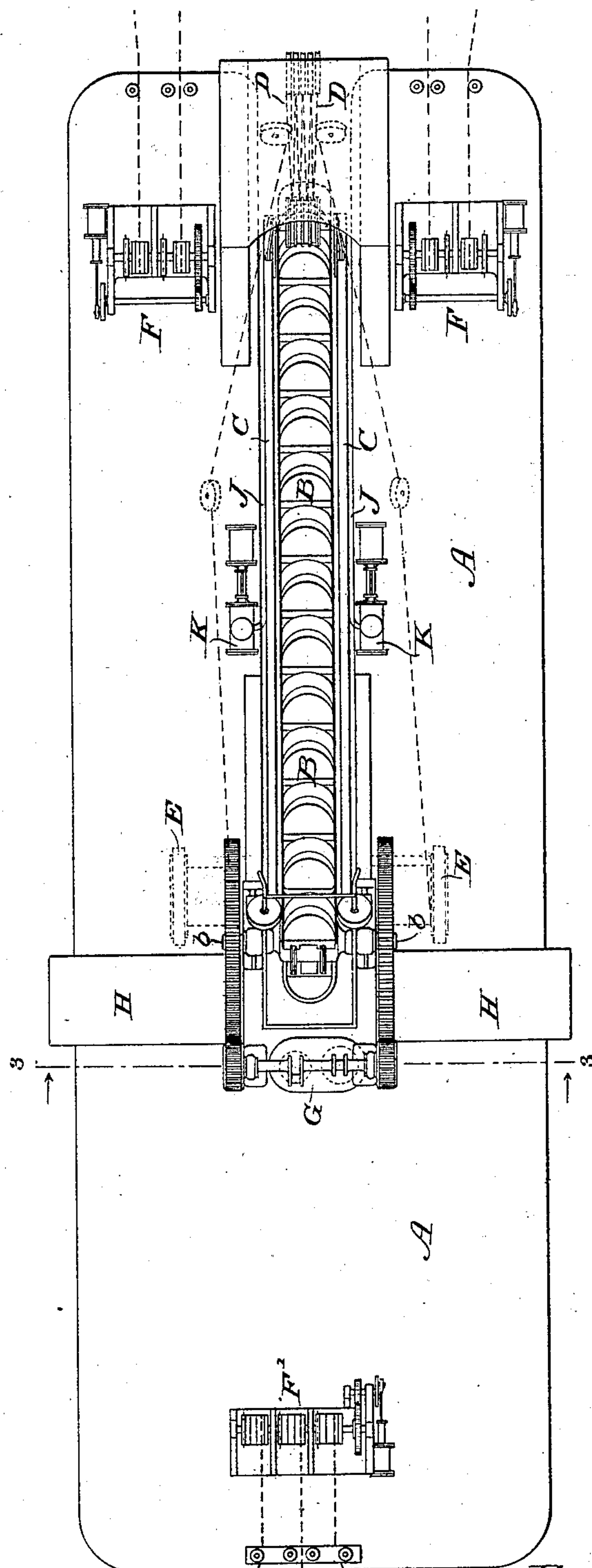
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Fig. 2.



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Fig. 5.

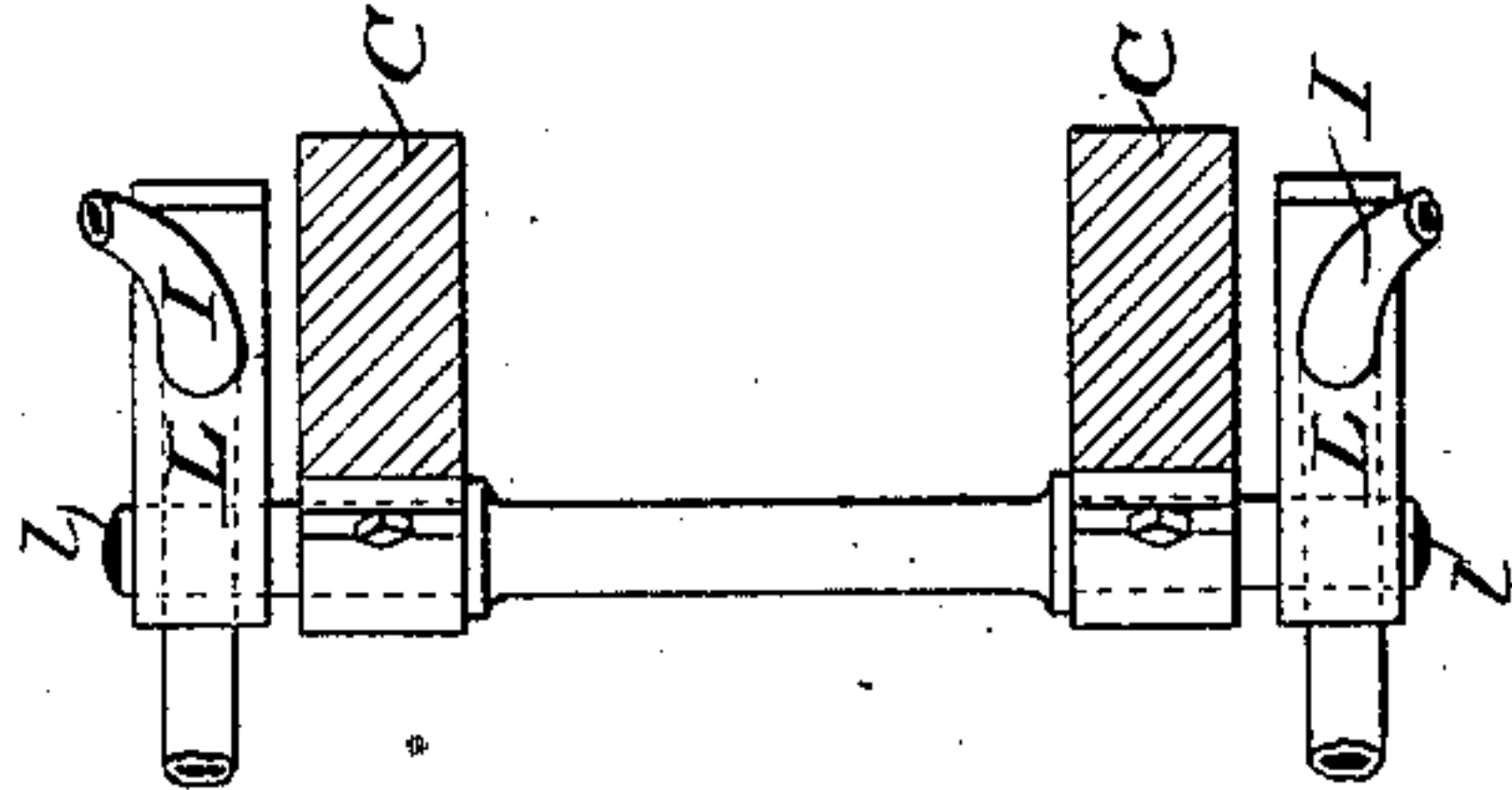


Fig. 4.

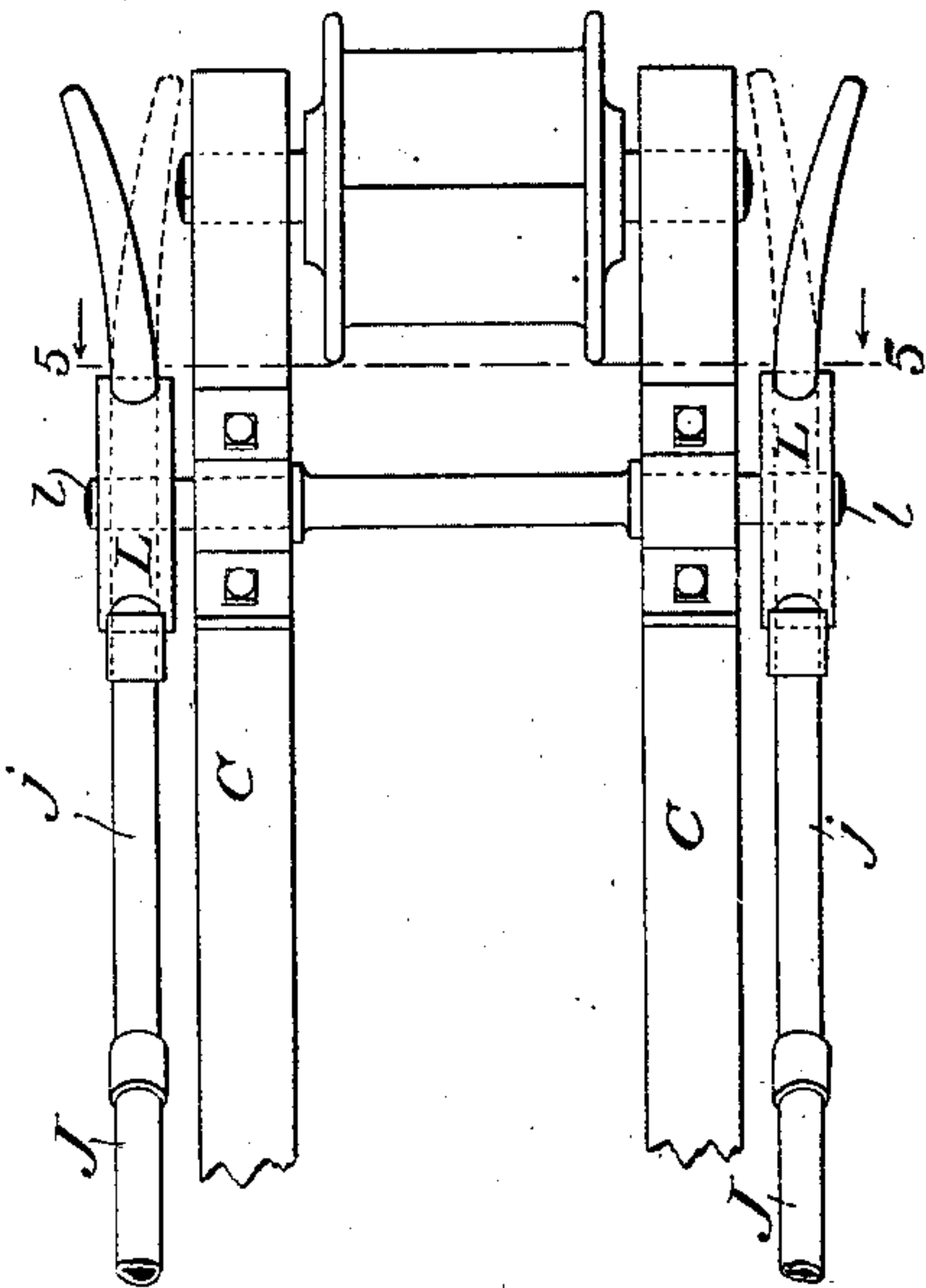


Fig. 6.

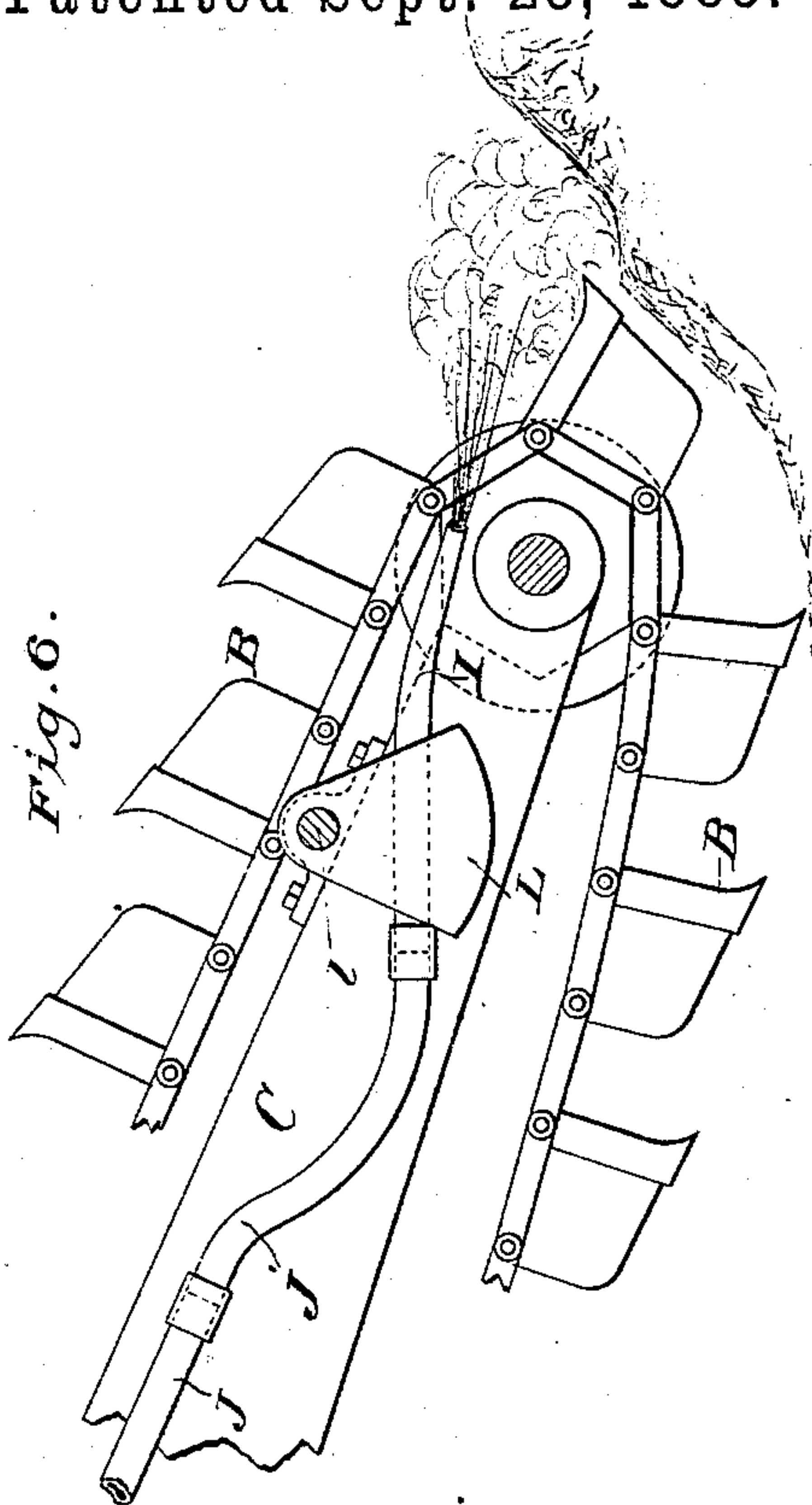


Fig. 7.

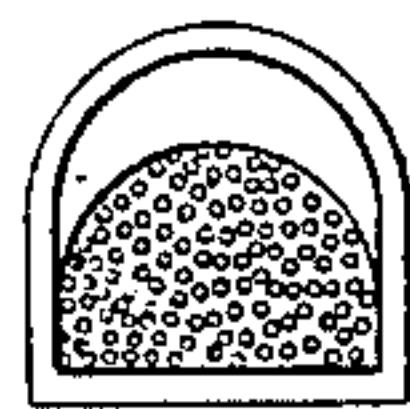
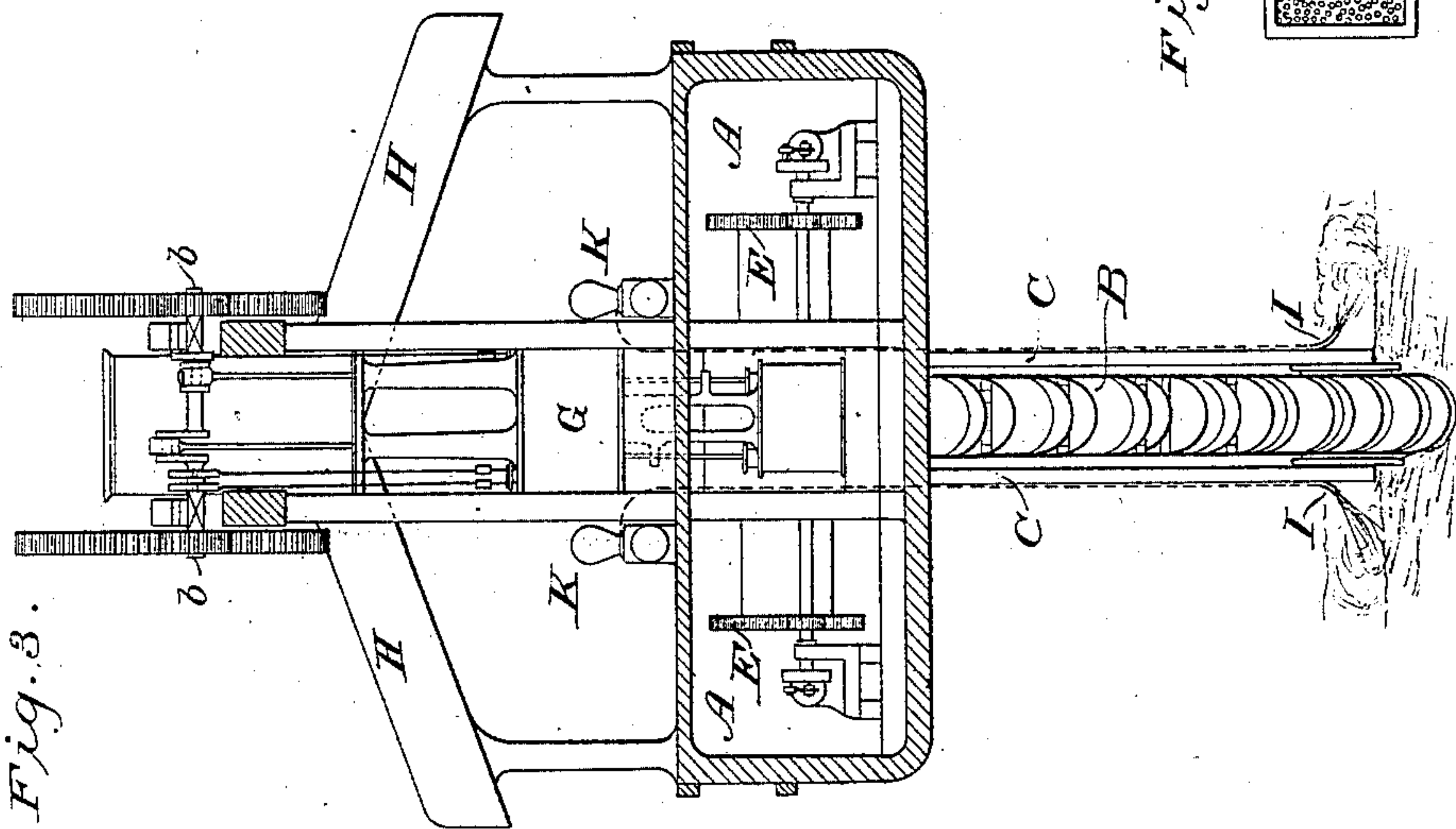


Fig. 3.



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UNITED STATES PATENT OFFICE.

FRED BROTHERHOOD, OF CHARLESTON, SOUTH CAROLINA.

METHOD OF EXCAVATING AND APPARATUS THEREFOR.

SPECIFICATION forming part of Letters Patent No. 285,565, dated September 25, 1883.

Application filed July 5, 1883. (No model.)

To all whom it may concern:

Be it known that I, FRED BROTHERHOOD, of Charleston, in the State of South Carolina, have invented an Improvement in the Method of Excavating and in Apparatus Therefor, of which the following is a specification.

My invention relates to an improved method of and apparatus for removing or excavating phosphate rock and analogous materials, such as the various mineral or metallic substances which are found in more or less extensive and compact bodies covered or surrounded by mud, sand, gravel, or other substances readily separable from the material to be excavated.

Heretofore, in the employment of machines for securing phosphate rock in the usual way, the rock and the overlying and surrounding or intermixed mud, &c., have been excavated and elevated together. In this manner not only is there required considerable labor and power in excavating and elevating refuse matters, but the working capacity of the apparatus is reduced in proportion to the amount of refuse material which is handled unnecessarily. Now, in accordance with my invention I remove the refuse, or the greater part thereof, from the material to be secured before excavating and elevating it, and I do this by directing forcible jets of water, steam, or air against and over the material to be secured, thereby washing away or blowing off the refuse.

My invention may be beneficially adapted to use in working mines or excavating on land as well as in excavating under water; but as it is in this instance applied in connection with a dredging-machine for securing phosphate rock, such application needs only to be described in order that those skilled in the art may understand not only this particular application but the various other analogous uses to which my improvements, or the main feature thereof, may be applied.

In the accompanying drawings, Figure 1 is a side elevation, showing with sufficient fullness for the purpose of this description a dredging-machine with my improvements. Fig. 2 is a plan view. Fig. 3 is a view partly in rear elevation and partly in vertical section on the line 3 3 of Fig. 2. Fig. 4 is a plan or

top view, showing on an enlarged scale the lower end of the bucket-ladder, with self-adjusting jet-nozzles at the outer sides thereof; Fig. 5, a view partly in end elevation and partly in section on the line 5 5 of Fig. 4. Fig. 6 is a view partly in side elevation and partly in section, showing a jet-nozzle at the inner side of the bucket-ladder. Fig. 7 is a plan view of one of the dredge-buckets.

The dredge-vessel A is of any suitable and well-known construction, and is provided with all the needed appliances, including the endless chain of buckets B; the hinged bucket-ladder or vertically adjustable-frame C, swinging about its pivotal support at b, and supported and raised and lowered at its opposite end by means of chains D D, passing over suitable pulleys and connected with winches E E; the bow and stern windlasses F F F'; an engine, G; gearing connected with the engine for driving the chain of buckets; and inclined chutes, H H, into which the dredged material is emptied in succession by the buckets to be delivered into scows at the sides of the dredge-vessel.

So far as described by reference to the above-enumerated parts there is nothing new in the apparatus, and the operation of those parts and all other features of the fully-organized dredging apparatus are well understood.

In connection with the above-described endless chain of buckets or equivalent excavating and elevating devices, I provide means by which to deliver a jet or jets of water, or it may be air or steam, if preferred, forcibly against and over the material which is to be secured, so that all readily removable substances—such as mud, slime, sand, &c.—will be washed or blown away, thus exposing the rock and leaving it comparatively clean to be broken up and lifted by the buckets.

By preference there are two jet-nozzles, I I, one at either side of the bucket-ladder, and the jets are directed against and over the surface of the rock which is about to be acted upon by the buckets. The nozzles connect with supply-pipes J J, leading to pumps K K. In order that the nozzles will always be maintained at proper inclination to direct the jets suitably, they are preferably supported, by self-adjusting pendulums or weighty pivoted

pendent brackets L L. These brackets, by their gravity, will always hang vertically, or nearly so, from their shaft or pivot 1, thus properly directing the jets from the nozzles regardless of variations in the inclination of the bucket-ladder arising from the differences in the depth at which the rock is operated upon. The nozzles connect, by flexible sections *j j* of tubing, with the pipes J J, which are by preference of metal.

In lieu of the pendulum weight or brackets L L, other self-adjusting supports for the nozzles may be employed—such, for instance, as shown in Fig 1, where the pivoted bail M of the raising and lowering devices of the bucket-ladder is pivotally connected by a link-rod, *m*, with a crank arm or lever, *n*, and to the shaft or journal N of this lever, corresponding with the shaft 1 of the brackets L, the nozzles are connected, so as to partake of the rocking movements imparted to the shaft in obvious way by its connection with the bail M.

The pipes J J are joined with the pumps K by suitable flexible connections, to permit of the inclination of the bucket-ladder being varied, and the pumps are operated in well-known way.

In order to reduce to the minimum the amount of sand, mud, and water delivered into the chutes along with the rock, each of the buckets is made with one or more holes in its bottom. A bucket with a number of small holes in its bottom is shown in Fig. 7. In this way the water brought up by each bucket runs out and is directed into the following bucket, thereby materially assisting in wash-out any sand or mud which may be with the rock.

From the above description it will readily be understood that by my method of excavating and elevating phosphate rock I avoid a vast amount of labor which would ordinarily be required in washing the rock, either afloat or ashore, besides increasing the amount of work accomplished in a given time by the apparatus employed.

It is obvious that the pumps for supplying the nozzles need not be of any particular construction, and that they may be located and operated as most convenient. It is further obvious that the nozzles may be forked, as represented in Fig. 4, where one branch of each nozzle is shown by dotted lines, and is curved inward, so as to direct the jet against and over

the rock in front of the buckets. In some cases the inwardly-directed jets only would be needed, and then the nozzle branches shown in full lines would be dispensed with, and those shown by dotted lines used alone; but the outwardly-directed nozzles only are best adapted for use in connection with the dredging apparatus shown, the bow of the vessel A being swung sidewise, first one way and then the other, and the rock thus cleaned off in advance of the action of the buckets. In this way there may be saved small bits of rock broken up by the buckets, some of which would be washed away were the jets to impinge upon the rock directly in front of the buckets.

I claim as my own invention—

1. The hereinbefore-described method of excavating and elevating phosphate rock or analogous material freed or nearly so from mud, sand, or other readily-separable substances, which consists in washing or blowing away the overlying and surrounding substances, and then excavating and elevating the material, substantially as hereinbefore set forth.

2. The combination of the means for directing jets against and over the material to be excavated and elevated, and the excavating and elevating device operating upon said material after the refuse has been cleansed off and washed away from it by the action of the jets, substantially as and for the purpose hereinbefore set forth.

3. The combination of the bucket-ladder, the chain of buckets, and the nozzles from which the jets issue to wash away mud, sand, &c., from the material to be excavated and elevated, substantially as hereinbefore set forth.

4. The combination of the bucket-ladder, the chain of buckets, the nozzles from which the jets issue to wash away mud, sand, &c., from the material to be excavated and elevated, and the supports by which the nozzles are rendered self-adjusting, substantially as and for the purpose hereinbefore set forth.

In testimony whereof I have hereunto subscribed my name this 2d day of July, A. D. 1883.

FRED BROTHERHOOD.

Witnesses:

C. S. PITCHER,
R. A. BARTON.