3 Sheets--Sheet 1.

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Hydraulic Canal-Lifts.

No. 153,156. Patented July 21, 1874.

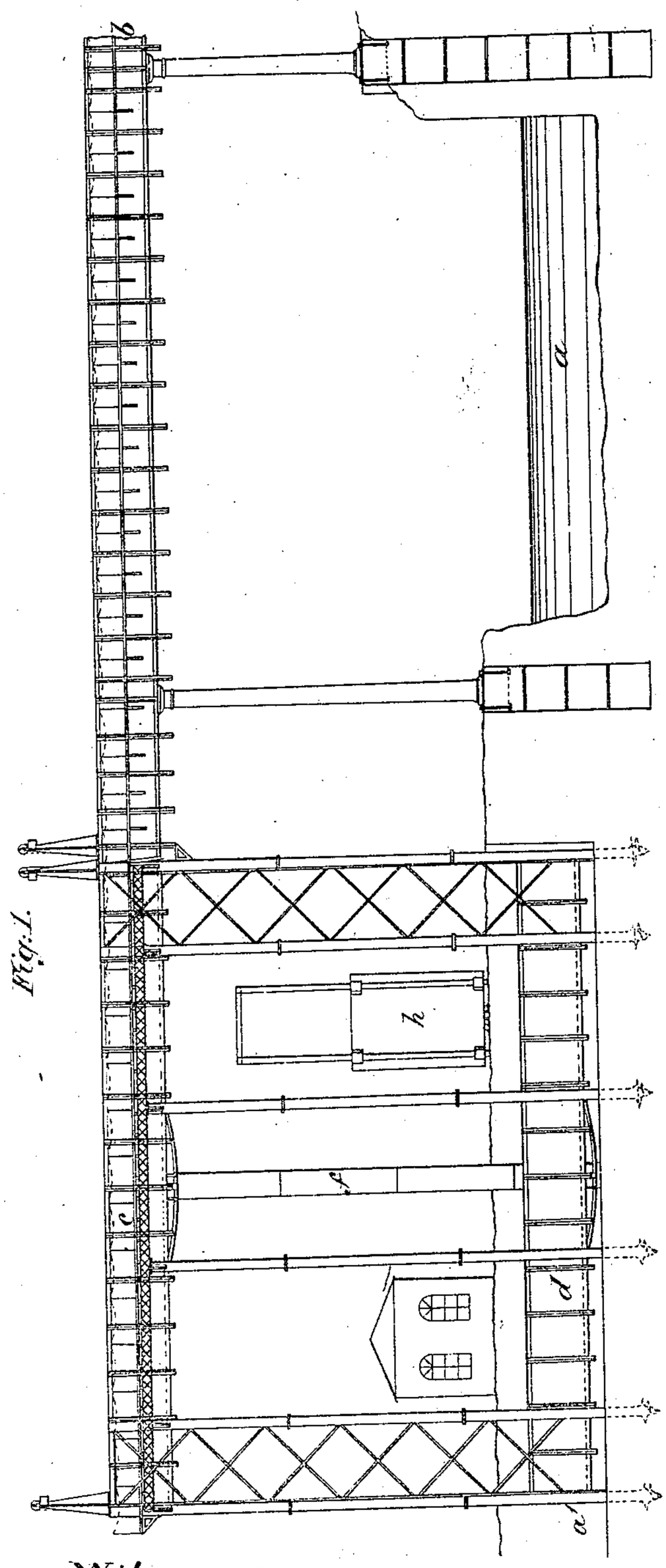

Fig: 1.

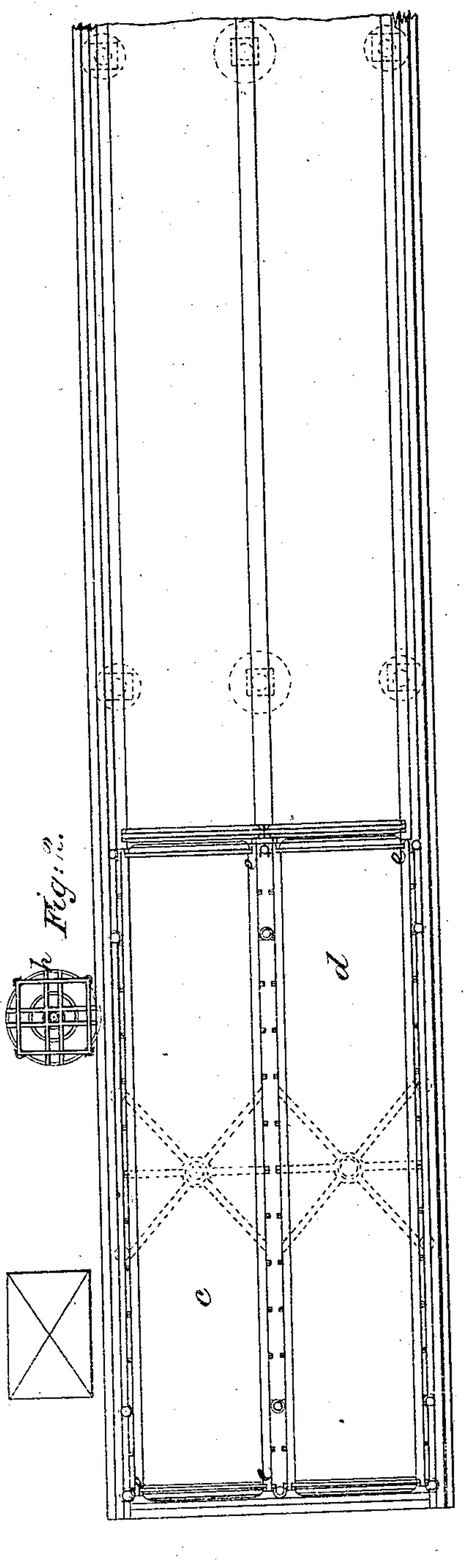

Fig: 2.

Witnesses.

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Fig: 3.

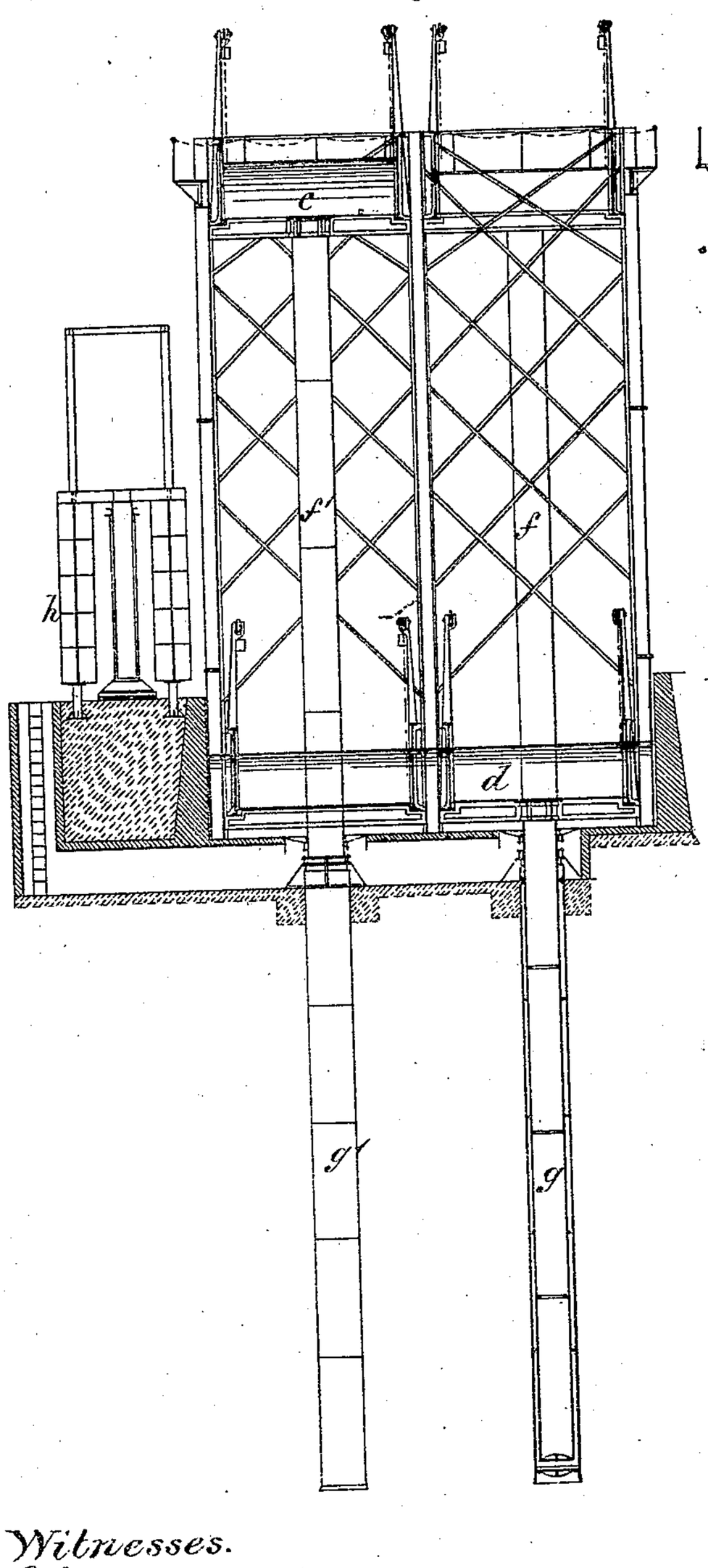
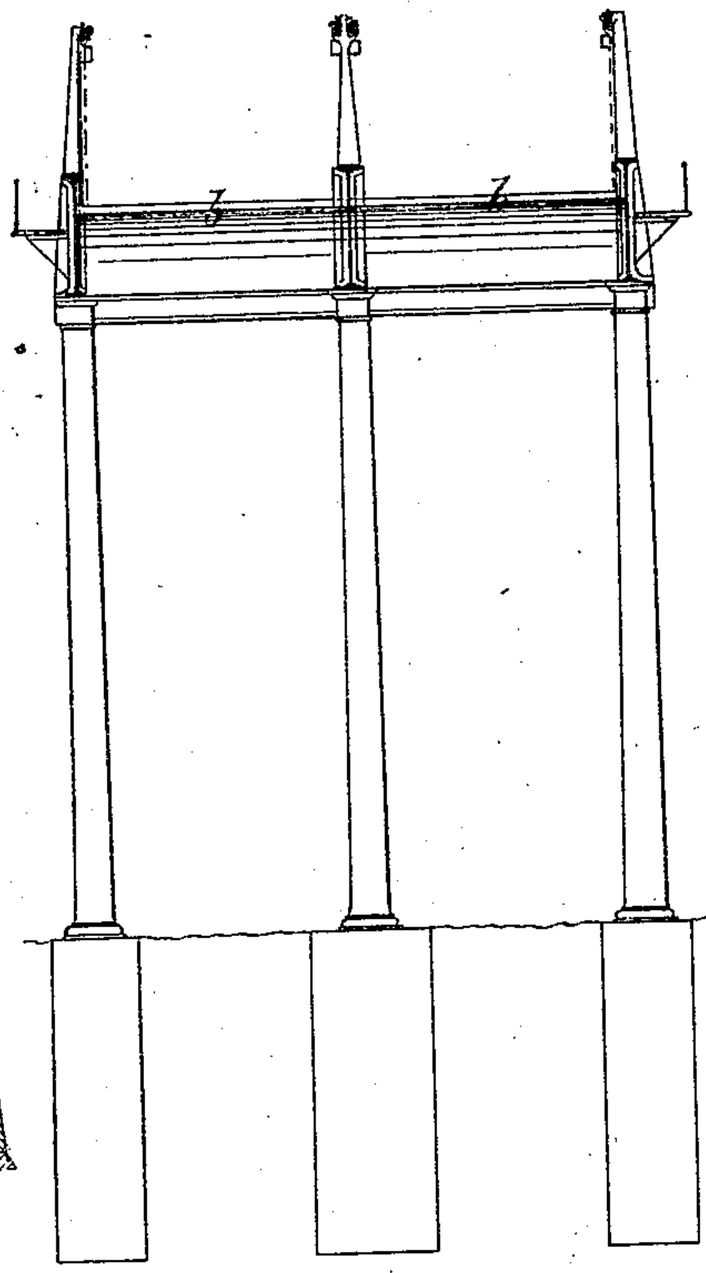


Fig: 4.



Witnesses.

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Fig. 7.

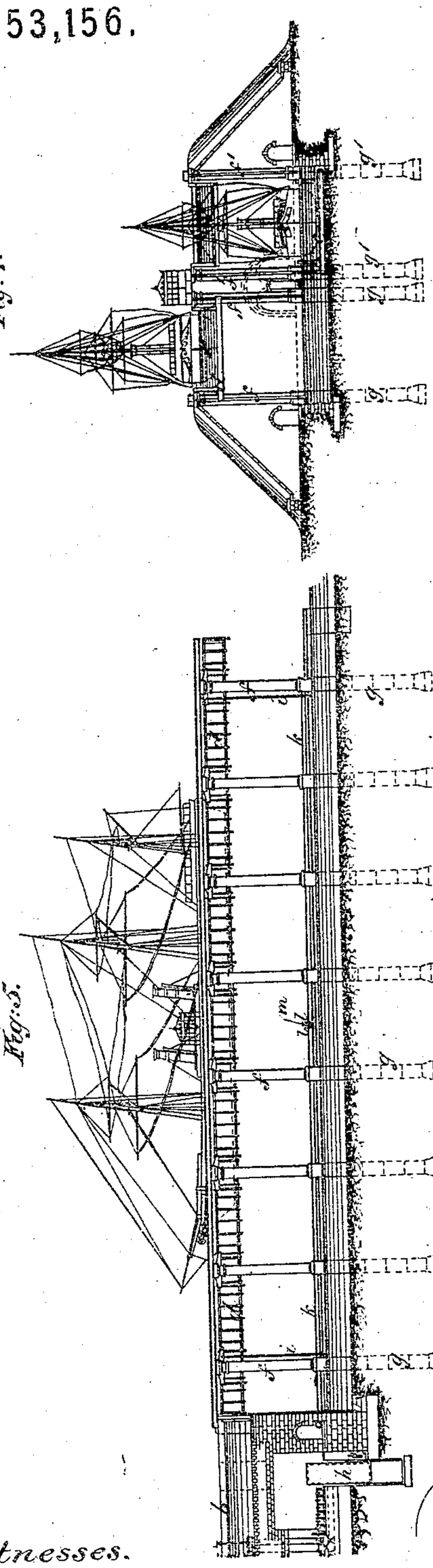


Fig. 9.

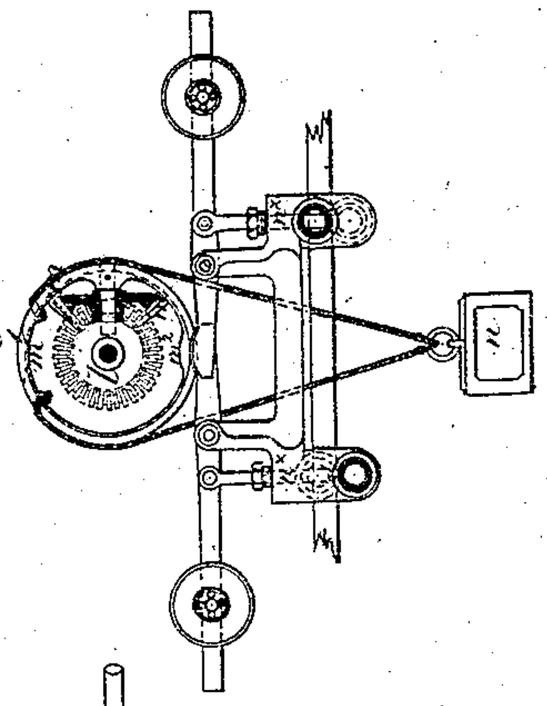


Fig. 8.

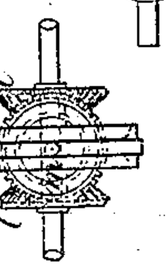
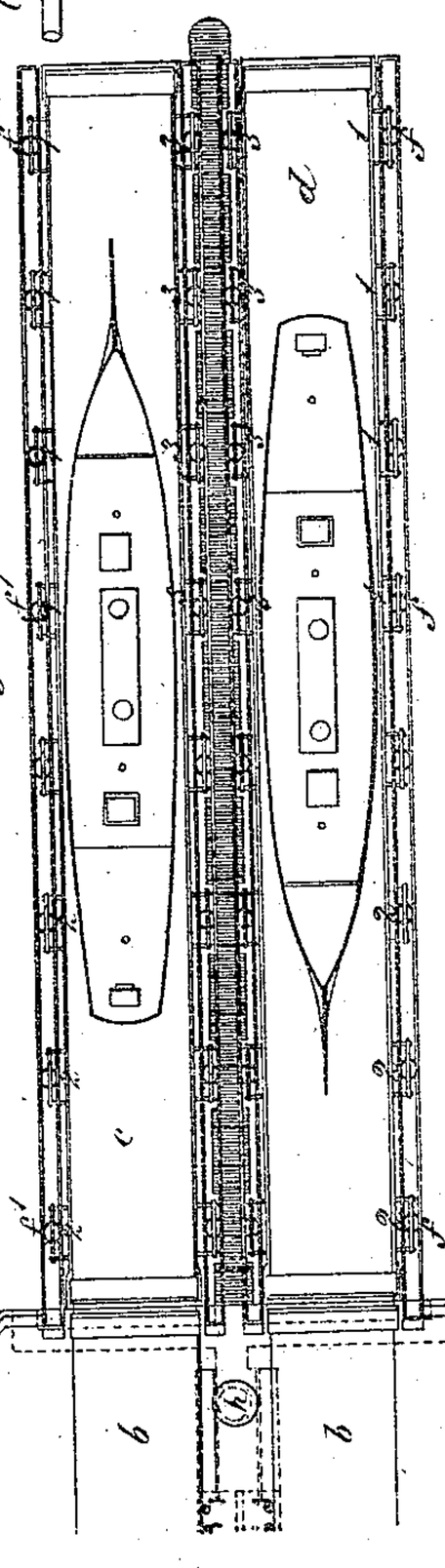


Fig. 5.

Fig. 6.



Witnesses.

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Inventor.

Edwin Clark

UNITED STATES PATENT OFFICE

EDWIN CLARK, OF LONDON, ENGLAND.

IMPROVEMENT IN HYDRAULIC CANAL-LIFTS.

Specification forming part of Letters Patent No. **153,156**, dated July 21, 1874; application filed April 24, 1873.

To all whom it may concern:

Be it known that I, EDWIN CLARK, of 5 Westminster Chambers, Victoria street, London, in the county of Middlesex, England, civil engineer, a subject of the Queen of Great Britain, have invented or discovered new and useful Improvements in Machinery for Raising and Lowering Ships and Vessels; and I, the said EDWIN CLARK, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof—that is to say:

This invention has for its object improvements in machinery for raising and lowering ships and vessels.

In order to pass ships and vessels from one level to another, in place of constructing locks, as is now usual, I form a large tank of sufficient capacity to admit of the ship or vessel being floated into it, and I lift or lower the tank, with the ship or vessel floating within it, from the one level to the other.

The lifting and lowering gear consists of an hydraulic ram or rams. The ends of the tank are fitted with gates, or are otherwise arranged, so that they can open to pass the ship or vessel and close behind it, and the ends of the upper and lower water-courses are also provided with gates, so that they may be made to communicate freely with the tank when it has been brought to the proper level.

It is preferred, in order to economize power and time, to employ two tanks, one ascending when the other descends, and the ram or rams which support one tank are caused to communicate with the ram or rams which support the other, so that the water discharged from the cylinder or cylinders of one set of rams enters the cylinder or cylinders of the other set. Thus the tanks are made to balance each other, and when equally loaded they have no tendency to move.

The power to work the apparatus may be derived in great part from loading the descending tank with water somewhat more deeply than the ascending tank; but means are also provided for admitting water from an accumulator to either set of rams when it is required.

Where a series or number of rams are employed to support a ship or vessel in a tank, as above described, I apply automatic controlling apparatus in such manner that some of the rams at one end or side of the series control others at the other end or side, and so I insure that the tank or platform shall be kept approximately horizontal.

Apparatus in connection with the rams at one end or side, as they ascend and descend, causes a beveled wheel to rotate, and similar apparatus in connection with the rams at the other end or side acts similarly upon another beveled wheel, rotating it, however, in the opposite direction. Between these wheels is a third, which, when there is any inequality in the motion of the first two wheels, is carried round and gives motion to cams which act upon water-taps, cutting off the supply of water to, or allowing the water to escape from, the cylinders of the rams which are too high.

In order that my said invention may be most fully understood, and readily carried into effect, I will proceed to describe the drawings hereunto annexed.

Figure 1 is an elevation, Fig. 2 a plan, and Figs. 3 and 4 are transverse sections, of machinery adapted to pass small vessels, such as canal-barges, between two navigable channels, at an upper and a lower level.

a is the lower channel, and *b* is the upper channel, which, in the case represented by the drawings, is continued by an iron aqueduct across the lower channel. It is fitted with lock-gates near its open end. *c* and *d* are two similar tanks, each of a size to allow of a canal-barge being floated into it. Each tank is provided with gates at one end. These tanks can be moved up and down vertically between the guides *e e* through a distance equal to the difference of level of the two navigations. The bottoms of the tanks are very stiffly constructed, and each is rigidly fixed upon the top of a hydraulic ram. These rams are marked *f* and *f'*, and their cylinders *g* and *g'* are sunk in the ground and firmly supported by a bed of concrete. The cylinders *g* and *g'* are connected by a pipe with a stop-valve upon it. Each of them is also provided with an outlet-valve, and they can also be put into communication, when necessary, with an accumulator, *h*, into which water is pumped at a pressure

adequate to raise the rams. The tanks c and *d*, when down, are received into artificial channels in communication with the channel *d*. Gates may be provided to these channels. When the tanks *c* and *d* are in their upper positions they coincide with upper channels *b*, and ordinary precautions are taken to make a sufficiently water-tight joint between the two. When one of the tanks is thus raised, the other being in its lower position, gates at the end of the channel *b* and at the end of the raised tank are opened, and a barge is floated either into or out from the tank. This having been done, and the gates shut, communication is opened between the cylinders *g* and *g'*. The upper trough, with the barge which may be within it, then commences to descend, and the lower trough to rise, things being so arranged that the water-level in the upper trough shall stand somewhat higher than it does in the lower. The movement continues until the descending tank has reached the water in the channel *a'*, and at this time the tanks are brought to rest, and the communication between the cylinders *g* and *g'* is closed. The ascending tank is afterward raised the short distance necessary to bring it to its place by means of the accumulator. The descent of the other tank is completed by opening the outlet-valve of the cylinder of the descending ram. In some cases the channel *a'* may be run dry before receiving the descending tank, and then there will be little, if any, work to be done from the accumulator. When the weights to be moved are greater than admit advantageously of the use of a single ram, I employ a series of rams in connection with each tank, and I apply self-acting controlling apparatus to insure that all the rams of each series shall rise and fall in unison.

Fig. 5 is an elevation. Fig. 6 is a plan, and Fig. 7 is an end view.

a and *b* are the upper and lower water-courses. *c* and *d* are the two ship-tanks. *f f f* and *f' f' f'* are the rams by which these tanks are supported, respectively. *g g g* and *g' g' g'* are the ram-cylinders. *h* is an accumulator. *i i* are racks, which rise and fall with the rams at the two ends of the series. In so doing, they drive spur-wheels upon the axes *k k*, which have upon them two beveled pinions, *l l*, forming part of the controlling apparatus. This apparatus is shown to a larger scale in Figs. 8 and 9. So long as the rams move at the same speed and in the same direction the beveled pinions *l l* rotate at the same speed, but in opposite directions. Between the pinions *l* is a similar pinion, *m*, carried by a wheel, m^1, which is free to rotate concentrically with the pinions *l*. *n* is a weight tending to hold the wheel m^1 in the position in which it is shown, and it remains in this position so long as the rams move at the same speed; but if the speeds become different, the wheel m^1 commences to rotate, and the cams m^2 m^2 upon it open one or other of the safety-valves $n^\times$ $n^\times$. In a similar manner they are made to close other valves not represented in the drawings. The rams supporting each tank are divided into three sets, which in Fig. 5 are marked 1, 2, and 3, respectively. The cylinders of each set are connected, by pipes, with the cylinders of the corresponding set belonging to the other tank, and the cams of the controlling apparatus act to close the valves on the connecting-pipes of such of the rams as commence to overrun the others, and to open the safety-valves of such of the rams as may stand at too high a level.

There are two similar controlling mechanisms to each trough—one for the sets 1 and 2, and the other for the sets 2 and 3. Similar self-controlling apparatus is also advantageously employed when ships are lifted by hydraulic power upon pontons or grids.

The series of rams is divided into three sets, in the manner already described, and each set is worked from a separate accumulator, or it may be by pumps directly supplying the ram-cylinder, in which case the cams of the controlling apparatus may act upon the throttle-valve of the steam-engine, or the cams may open relief-valves to allow the excess of water pumped by either of the engines to run to waste.

Having thus described the nature of my said invention, and the manner of performing the same, I would have it understood that I claim—

1. The combination, substantially as set forth, of the tank, the gates thereof, the upright hydraulic cylinder with its ram, and the upper and lower gated channels.

2. The combination, substantially as set forth, of the two tanks, the respective gates thereof, the respective hydraulic cylinders thereof with their rams, the respective upper and lower gated channels, and the pipes connecting the cylinders of the two tanks, so that the weight of one tank is counterbalanced in whole or in part by that of the other.

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