P. L. Fox & G. P. Herthel, Jr.

Hydraulic Engine for Drawbridges.

No. 55,844. Patented Jun. 26, 1866.

Fig. 3.

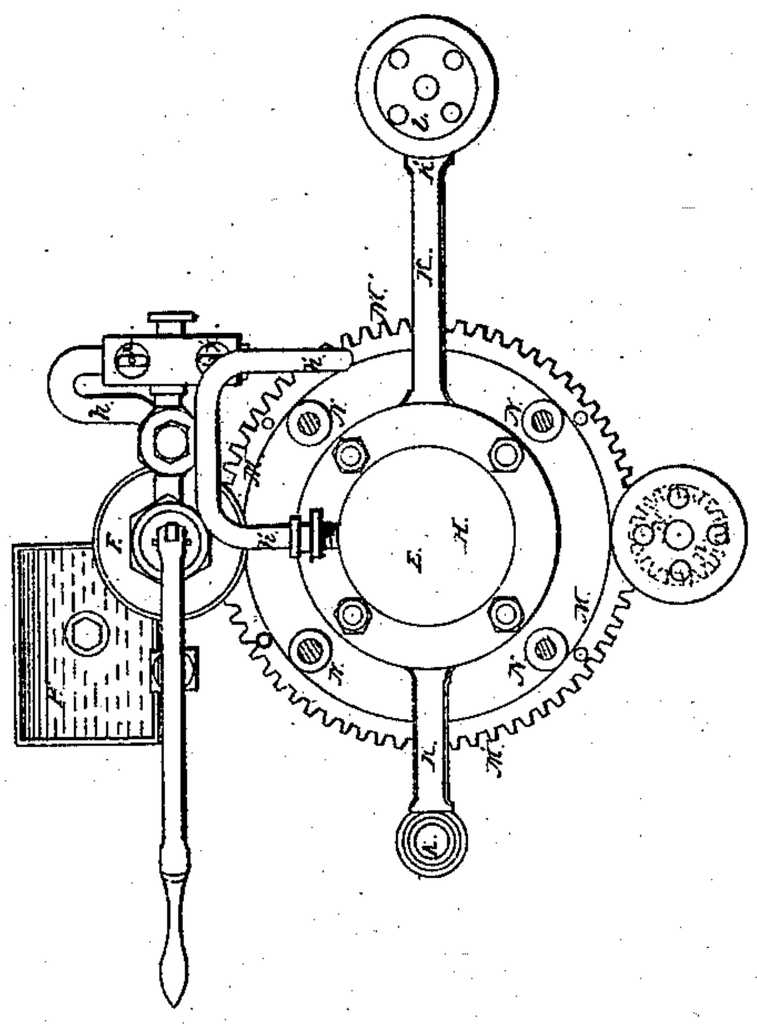


Fig. 2.

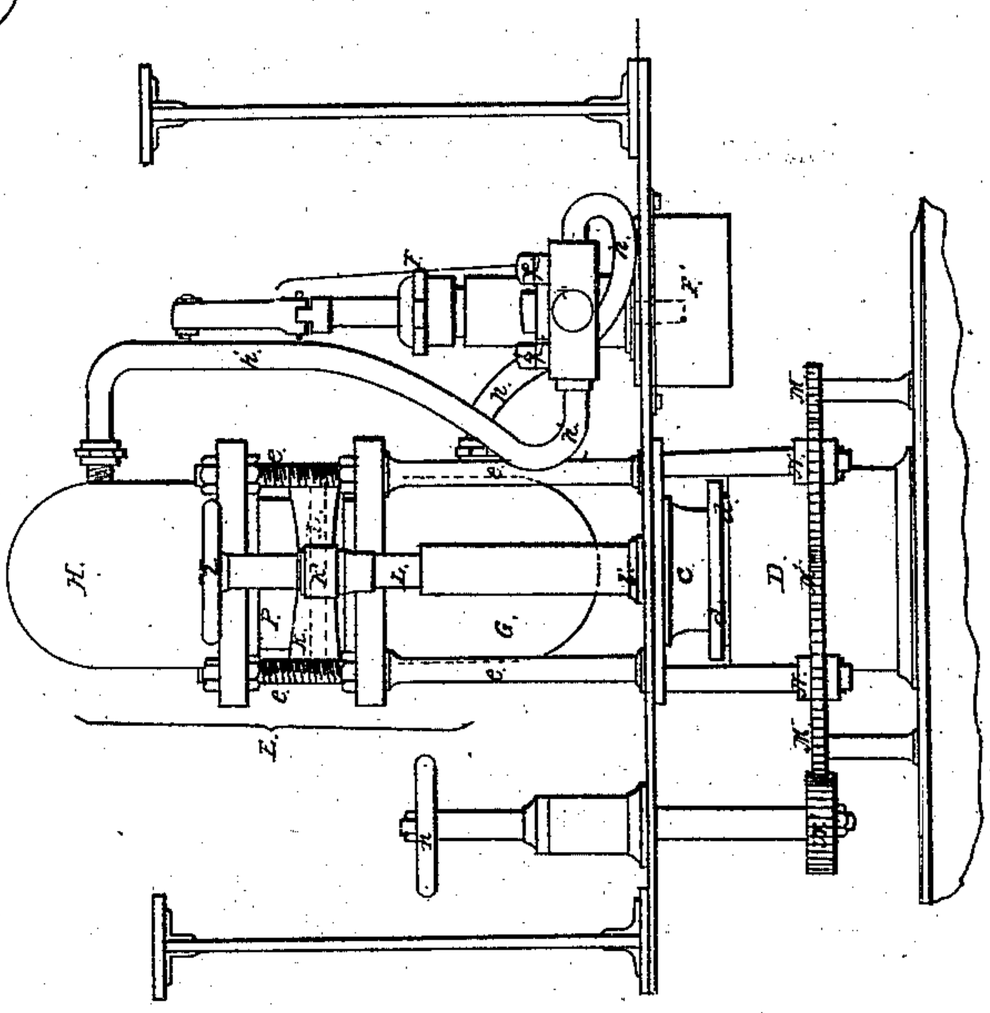
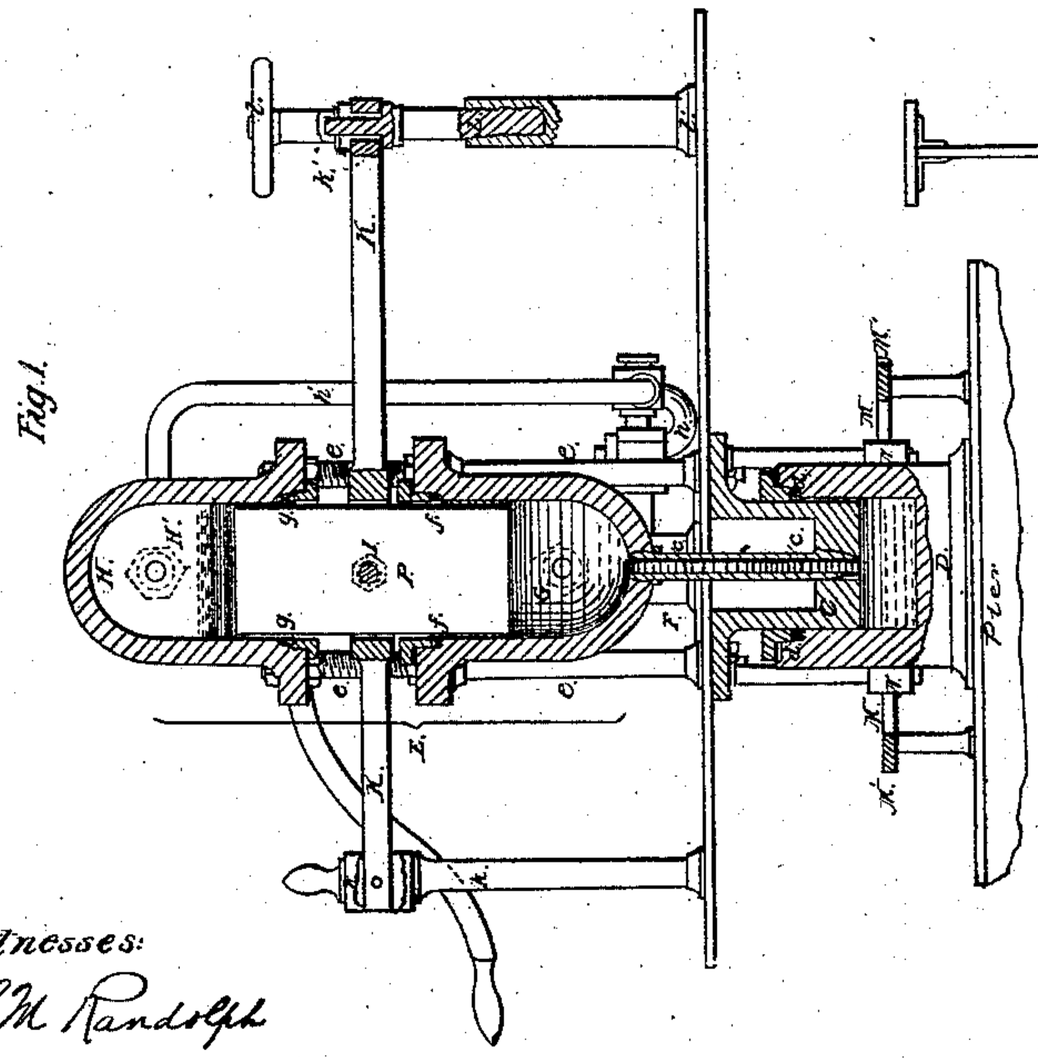


Fig. 1.



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UNITED STATES PATENT OFFICE.

PHILIP L. FOX AND GEORGE P. HERTHEL, JR., OF ST. LOUIS, MISSOURI.

HYDRAULIC SPINDLE AND TURNING APPARATUS FOR DRAW-BRIDGES.

Specification forming part of Letters Patent No. **55,844**, dated June 26, 1866.

To all whom it may concern:

Be it known that we, PHILIP L. FOX and GEORGE P. HERTHEL, Jr., of the city and county of St. Louis, State of Missouri, have invented a new and Improved Mode of Arranging and Manipulating Draw or Turning Bridges and Turn-Tables; and we do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

Of said drawings, Figure 1 is a transverse sectional elevation through the center of the spindle of the bridge or turn-table, and showing the interior arrangement of the parts. Here horizontal blue lines represent the non-compressible medium. Fig. 2 is an end elevation of the apparatus. The pump F, with its feed-reservoir F′, the pipes *h* and *h′*, and the valve-cocks *x* and *x′*, for opening or closing the connection between the pump F and the cylinders G and H, are here more fully shown. Such of these parts as are minor details are hereinafter not mentioned. Fig. 3 is a top plan, with the floor partially removed. In the feed-reservoir F′ blue lines, as before in Fig. 1, indicate the non-compressible fluid. The detail parts *x* and *x′* and F′ are here again shown in such manner that from Figs. 2 and 3 their arrangement and operation can be plainly seen.

The nature of our invention consists in arranging the pivot of a turning bridge or railroad or other turning table as a hydraulic ram, for the purposes, first, by supporting the pivot, and through it the weight of the part of the structure which turns on a non-compressible fluid, to reduce the friction which usually concentrates here to a minimum; secondly, to enable the operator to elevate the structure on this pivot as the moving plunger of the hydraulic ram, thus raising the structure above its other supports, causing it to swing clear of obstructions.

For the purpose, however, of accomplishing this raising and easy turning of the structure in a profitable and expeditious manner, the nature of our invention consists, moreover, in counterbalancing the weight of the turning structure either by counterpressing-weights, or by the action of some elastic medium, in such manner that, preparatory to the operation of turning, the operator applies only a small extra effort in a small space of time to effect the raising of the structure by the combined action of such extra effort of the operator and the constant effort of the counter-balance.

As by the action of external influences, the point of attack or impact of which is above the body of the pivot, the structure would be subject to lateral motion, like tipping, which would cause strain, and consequently friction, in the motion of the pivot, the nature of our invention consists, further, in applying a metal or other strong ring-surface secured to the pier-foundation, and this for a bearing of friction-rollers secured to the structure to be turned, thus taking the side pressures on this ring, and securing as much as possible against friction. A vice-versa arrangement of the foregoing parts is expressly included in the nature of our invention. And this ring is, furthermore, on its surface, where the friction-rollers do not touch, to be toothed for a connection with gear-wheels, in the manner and for the purpose usual in the turning arrangements of similar structures.

The nature of our invention is such that it may be applied in all cases where, by power, heavy bodies are to be turned, which at other times are at rest, and are then sustained or checked by supports or checks outside the turning or stationary pivot; and we hereby affirm that, although in the following but one method of effecting the purposes which are in the nature of our invention may be described, other methods can be easily suggested for the purposes aforesaid, and that such other methods have claim to use only through the importance and correctness of the purposes and objects to be accomplished as aforesaid; but that they have no claim to novelty.

To enable those skilled in the art to make and use our said improved arrangement of turning and raising bridges or other heavy bodies, we will describe one complete arrangement, such as will accomplish the purposes on a very large and heavy draw-bridge.

We secure to the body of, for instance, a bridge, the pivot-ram C, made in the manner usual, of cast or wrought iron or steel, and fitting into and raising and turning in the cylindrical base-piece D, which is supported firmly

by the masonry of the pier. If it be more convenient, the ram may rest on the pier, and the cylinder be attached to the bridge above. These parts C and D form the ram proper.

Connecting with the space between the plunger C and its cylinder D is a pipe, *c*, which passes up to connect at its other end conveniently either with the counterbalancing apparatus E, or, in case weights be used, to effect the counter-balance with a pump, F. Through this pipe, which must be able to resist great pressure, fluid is forced under and around the plunger O, raising it and the turning bridge, and supplying the surface upon which the plunger revolves.

To prevent the escape of the non-compressible fluid, there will be a packing of leather or other suitable material *d*.

In case air or other elastic medium be used as a counter-balance, the arrangement of the parts will be as shown in Fig. 1, where E is composed of two strong cylinders, G and H, placed directly over another, their open ends receiving the plunger P. The cylinders G and H rest on the floor of the bridge, and they are securely prevented from moving apart by strong bolt-rods *e*. Both G and H are packed fluid-tight at *f* and *g*, respectively, in the usual manner. In the vessel G, surrounding and below the plunger P, is fluid, which can be supplied by the pump F, there being a connecting-pipe, *h*, for this purpose. The volume of fluid in G connects by means of the pipe *c* with that of the main cylinder D. Now, if the diameter of the plunger P be the same as that of the pivot-ram C, then, when the plunger P is forced downward, the pivot C raises an equal distance, and the whole turning structure is raised this same distance, which is the object to be accomplished. The descent of the plunger P is made by the action of an elastic medium in the cylinder H and by that of the pump F, as hereinafter to be particularly described. The cylinder H contains in its upper part some elastic medium—for instance, air—and as under heavy pressures it would be difficult to maintain an air-tight packing at *g*, this medium is excluded from this packing by a non-compressible fluid, which is supplied to the cylinder H, by means of the pump F, through the pipe *h'*. The pump F is constructed and arranged conveniently to the other connecting parts and in the manner usual for high pressures and for forcing non-compressible fluids. The pressure of the elastic medium H' in H is, then, such that it, as nearly as practicable, counterbalances, by its action on the plunger P, the weight of all the parts to be turned, which is transmitted through the pivot-ram C and the non-compressible fluid against the end of the plunger which is in the cylinder G. The pump F is, for convenience, so arranged that it may be further used to supply and replenish the elastic medium H' in H; or a separate pump may be used for this purpose, which need not vary from the pump F in construction.

Through the plunger P passes the shaft I. This is operated upon by the lever K, which has its fulcrum at *k*, and which is acted upon by the screw L, which itself may be turned by a hand-wheel, *l*, or a simple lever. The end of the screw being secured in the bridge-floor at *l'*, when the screw is turned the nut end *k'* of the lever K is raised or lowered, and thus the shaft I is raised or lowered, which, in turn, raises or lowers the plunger P; but, as above explained, a motion of the plunger P acts upon the fluid under it in the vessel G, and thus upon the turning portions of the bridge.

As the weight of the structure is supposed to be balanced by the elastic medium H' in H, the exercise of force needed to effect a raising or lowering of the weight in question is small and the time during which the force need be applied is also small. Thus, upon momentary notice the whole structure to be raised is raised by the application of man-power at *l* on the screw L.

It is to be remarked that during the descent of the plunger P the elastic medium continues its pressure, and as the distance through which the plunger moves is but small, the variation of the counterbalancing-pressure is small, and hence the increase of the necessary power applied at *l* but slight.

The nature of the above operation does not demand the use of any particular noncompressible fluid, but water, common lubricating-oil, rock-oil, or petroleum, or any other similar substance, may be used. A counterbalancing-weight may be the plunger P, or stone or iron piled on it.

The advantages which we claim to be derived from this combined arrangement are as follows: However much a bridge-truss may deflect downwardly, owing to various influences after its erection, the bearing of all parts may here be very accurately adjusted to such sagging down by altering the position of the plunger P with respect to the cylinders G and H. When a draw-bridge or turn-table is closed so that trains or vehicles may pass it, the same rests, generally, not only on the central pier or spindle, but also upon abutment-piers at the end of each span. In order to adjust this rest of the ends of the trusses upon such end piers to the sagging of the bridge and to its necessities for turning complicated arrangements are necessary. Such arrangements require the operator, before opening the draw or turning the table, to pass to these ends of the structure and lower them, which requires time, and thus causes a delay which may be dangerous. Moreover, where such complicated arrangements for supporting the ends of a draw-bridge or turn-table are not used, through the action of the weight of the parts when they are swung beyond these supports the ends of the trusses deflect, and in this deflected position they must be forced upon the supports in closing, making this an operation requiring power and time; and, furthermore, through this action of raising and permitting the sagging of trusses their rigidity is de-

stroyed and it becomes difficult to swing open the draw-bridge, causing here, too, dangerous delay.

We claim, therefore, that by bodily raising the parts to be turned the opening of the draw-bridge or turn-table may be instantaneously effected and without the exertion of undue power if counterbalancing arrangements have been made. In case that a counter-balance of great power be not necessary, simple weights piled on the plunger P may act effectively, and when the shape of the draw-bridge or turn-table is such that a high point above the pivot-pier is obtained, as in case of a suspension draw-bridge or table a column of fluid be the same mercury, water, or any other, can be used similarly. In all cases, as the weight is taken on a single point, the size of the pier is reduced to a minimum.

Whenever the weight to be turned presents great surface to the action of wind and other external influences, and this surface is at a height above the spindle C, the exertion of these forces causes friction in the spindle C. To prevent this we construct the ring-surface M, firmly secured to the foundation of the pier. Friction-rollers N, secured to the structure above, bear against this surface M. Thus each friction-roller, as the structure is turned, bears during the whole rotation against the ring-surface M, which thus takes the lateral thrust. The outer surface of the ring-surface M may be used conveniently for gearing which is usually employed in turning such structure. In the drawings such an arrangement is shown. The rack M′ being stationary, the gear-wheel N′, if turned by the hand-wheel *n*, will turn the bridge-structure.

In small structures it will not be necessary to construct an extra ring-surface, M. In this case the friction-rollers N will bear on the outer surface of the base-cylinder D. The turning parts will then be operated by man-power directly applied.

The general position of the counterbalancing apparatus and force-pump and such parts of the turning apparatus as the operator should have access to can be outside both roadways of a bridge or in the pier thereof. The fluid pressing equal in all directions, it will be immaterial whether these parts are on the turning structure or on the supporting-base.

Having thus described our invention aforesaid, what we claim, and desire to secure by Letters Patent, is—

1. The application of fluid-pressure to the pivot of turning bodies when used to raise the same and diminish the frictional resistance to the turning motion, substantially as described and shown.

2. The counter-balance, when operating in connection with such fluid-pressure in raising the structure to be turned, substantially as shown and described.

3. The combination and arrangement of the pivot C and cylinder D, in conjunction with the counterbalancing apparatus E and the pump F, all acting substantially as and for the purposes shown and described.

4. The ring-surface M, the friction-rollers N, the gearing N′, when used in combination, substantially as and for the purposes set forth.

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