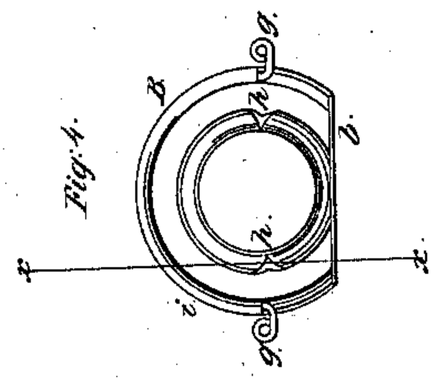
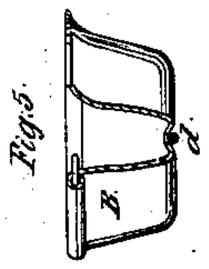
Sheet 1-2 Sheets.

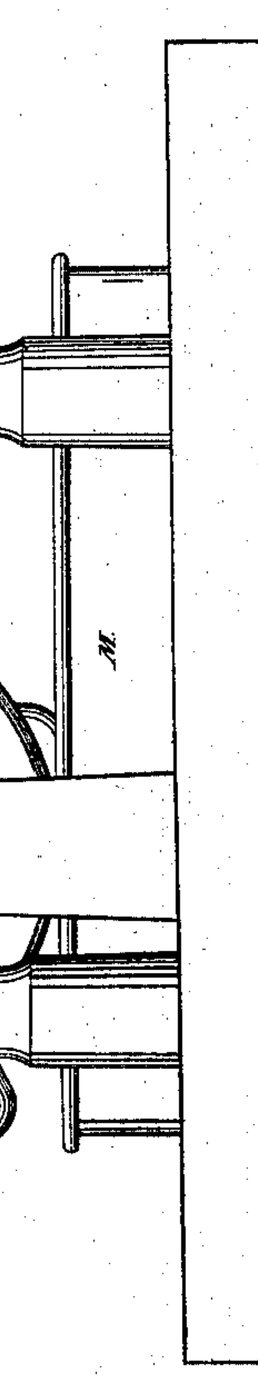
# A. H. Knapp,

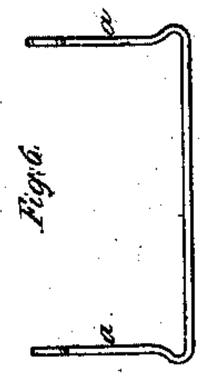
## Chain Pump,

No. 68,753. Patented Sep. 10, 1867.







Witnesses:
Thos. J. Parker
E. J. Brown.

Inventor:
A. H. Knapp.
By his atty.
J. S. Brown.

Sheet 2 - 2 Sheets.

# A. H. Knapp,

## Chain Pump,

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Fig. 3.

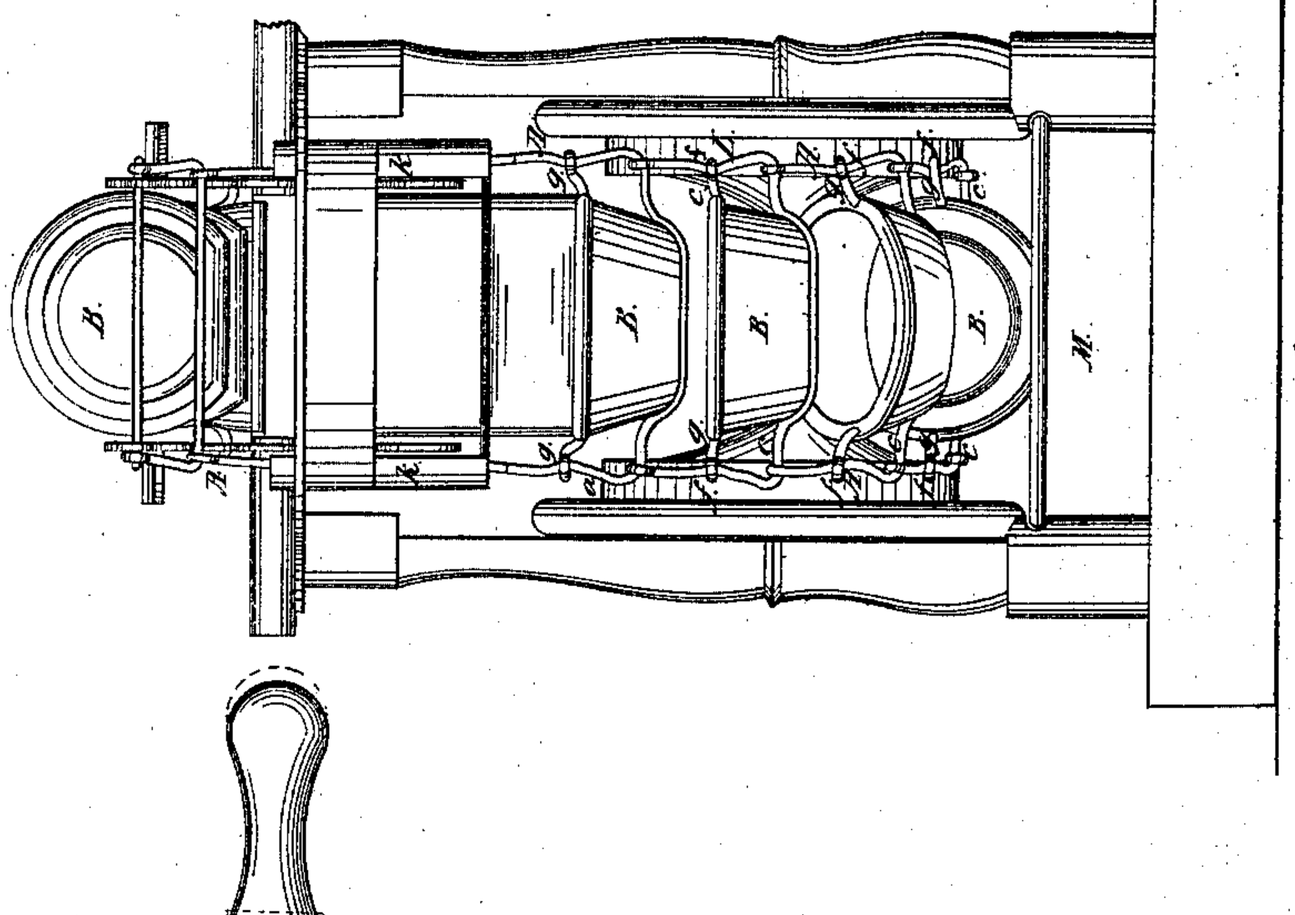
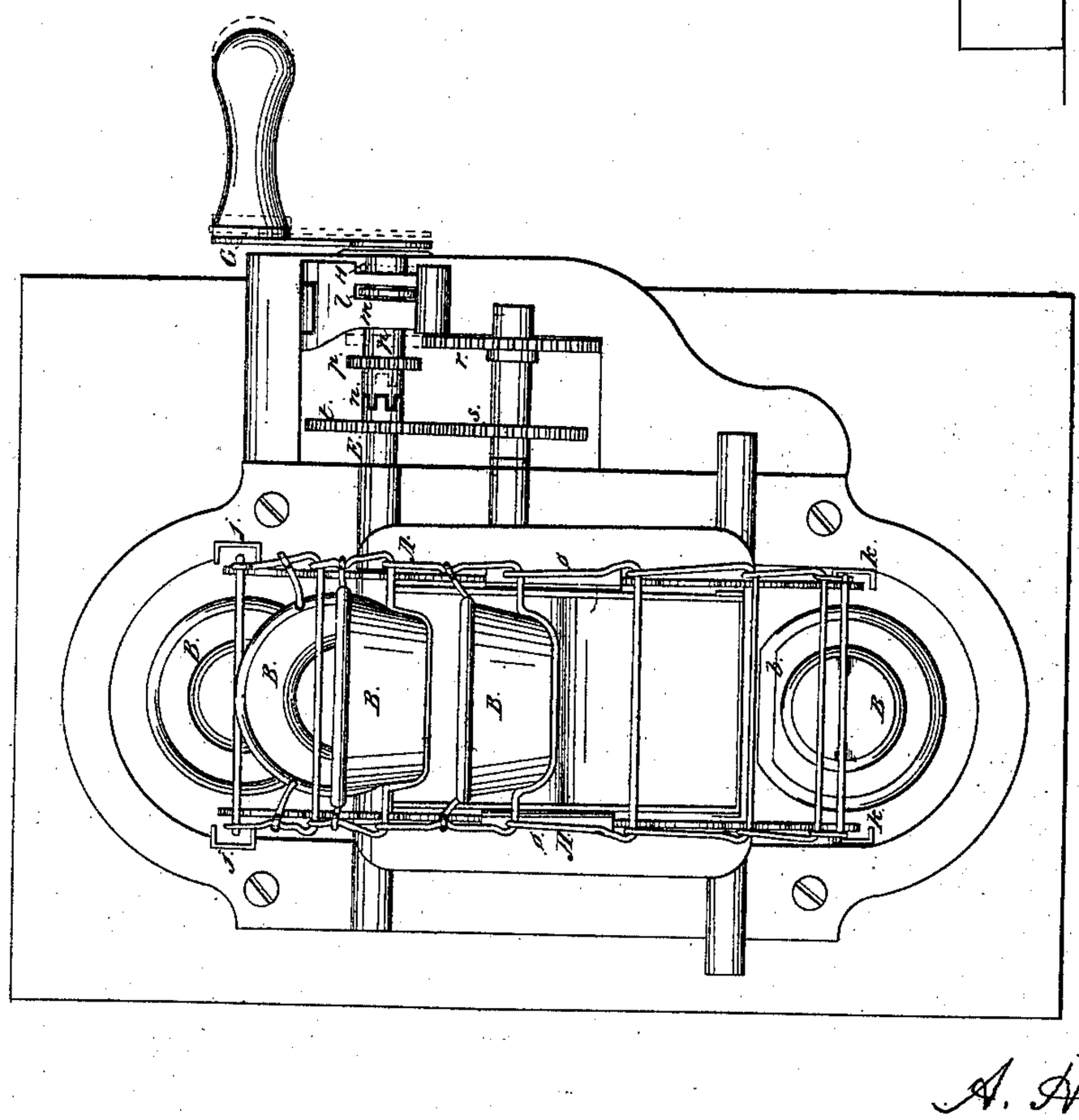



Fig. 2.

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J. S. Brown

# United States Patent Office.

A. H. KNAPP, OF NEWTON CENTRE, MASSACHUSETTS.

*Letters Patent No.* 68,753, *dated September* 10, 1867.

## IMPROVEMENT IN WATER-ELEVATORS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, A. H. KNAPP, of Newton Centre, in the county of Middlesex, and State of Massachusetts, have invented an improved Water-Elevator; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification—

Figure 1 being a side elevation of the apparatus.

Figure 2, a top view of the same.

Figure 3, a front elevation thereef.

Figure 4, a bottom view of one of the cups or buckets.

Figure 5, a vertical section of the same in a plane indicated by the line *x x*, fig. 4.

Figure 6, a view of one of the blank-links of the chain.

Figure 7, a view of one of the bucket-links of the chain.

Like letters designate corresponding parts in all of the figures.

The apparatus to which my improvements relate consists of an endless chain, to which a continuous forward motion is given, and upon which a number of cups or small buckets are secured and alternately carried down into the well to be filled with water, and raised out of the well to be emptied.

First, I employ two sprocket-wheels or pairs of sprocket-wheels, C D, on different parallel shafts, and situated at about equal heights, so that the chain A passes horizontally from one to the other, substantially as shown. The two pairs of wheels may be at any suitable distance apart, or about as near together as they can conveniently be placed. The discharge-reservoir or spout I is situated beneath and between them. The object of these two pairs of sprocket-wheels is to give the buckets or cups B B time to entirely discharge the water before they begin to descend, however fast the chain may be moving; and it is obvious that the object is perfectly attained by this means, whereas with one sprocket-wheel or pair of wheels the buckets or cups are turned downward so quickly, as they pass over the wheels, that much of the water is thrown over beyond the spout and wasted. Another advantage gained is that sprocket-wheels of much smaller diameter may be used than one pair could possibly be made, so that the cups may be tilted much more quickly as they come up, and hence waste little or no water when tilted, by dripping, as is the case with large wheels.

Second, instead of arranging the cup or buckets B B at uniform distances along the whole length of the chain, as heretofore, I arrange them all in two clusters or groups only, the two clusters being on opposite parts of the endless chain, so that one is descending while the other is ascending, down when the other is up, and filling when the other is emptying. All the intermediate parts of the chain are without buckets or "blank." It is intended that each cluster of buckets together shall hold an ordinary pailful, or as much as it is convenient to draw at once. Thus, if there are five cups or buckets in each cluster, and each cup or bucket holds two quarts, then the whole cluster will raise ten quarts at once. They are placed successively along the chain, as closely together as convenient, so that the whole cluster comes up very nearly at one time, and as soon as they are all discharged there is no further drawing, unless the next cluster is to be raised and discharged.

There are several important advantages in this arrangement of the cups or buckets in clusters or groups: first, the expense of construction is comparatively small, since, however deep the well may be, the only additional cost in increasing the depth is that of the additional length of chain, which is trifling, there being the same number of buckets in shallow as in deep wells; second, no unnecessary power is expended in raising the water, since all the water that is lifted at all from the well is discharged in the spout and obtained, whereas if buckets are arranged along the whole length of the chain there are always nearly half of them filled and partly raised, requiring much additional power, and must return again to the well without any benefit being derived from their contents, unless the chain is held by a ratchet, in which case the water becomes warm and stale if it remains long suspended in the air; third, the chain can be changed in length and adapted to the varying depth of water in the well without interfering with the arrangement of the cups or buckets in the least; fourth, there is not a continual violent agitation of the water in the well by the cups or buckets passing through it.

One pair of sprocket-wheels, D, is secured to the driving-shaft E. The crank G may be attached to this shaft direct; and this would be sufficient and proper for the strength of men, as I am enabled to make the

wheel D small enough for that purpose. But I provide a means of increasing the leverage of the crank to suit the strength of women and children. For this purpose the crank G is attached to a sleeve, H, which fits over the shaft E so that it may turn freely around and slide lengthwise on the shaft. There is a coupling, *n*, at the inner end of the sleeve, by which it is coupled to the shaft when in position shown by black lines in fig. 2, but uncoupled from the shaft when drawn out in the position indicated by red lines in the same figure. There is a disk, *l*, or its equivalent, on the sleeve, over which notches or slots in a latch, *m*, fit, so as to hold the sleeve either in its coupled or uncoupled position, as indicated in the drawings. On the sleeve is a pinion, *p*, which gears into a larger pinion or cog-wheel, *r*, on a side shaft, when the sleeve is in its uncoupled position, as indicated by red lines; and on the same side shaft is another cog-wheel, *s*, gearing back into a pinion, *t*, on the shaft E. Thus, when the sleeve is uncoupled from the shaft E the power is transmitted through the pinion and cog-wheels *p r s t* to the shaft E, and the diameters of the pinions and cog-wheels are so proportioned as to gain any degree of leverage desired. When the sleeve H is coupled to the shaft E the pinion *p* is ungeared from the pinion *r*, and the power is communicated directly from the sleeve to the shaft. As the chain ascends and engages with the first sprocket-wheel C, the angle assumed by the links thereof begins rapidly to change, so that the lower ends of the links, if left free, swing out considerably beyond the line of the ascending portion of the chain, and then is drawn in again. The effect of this is to produce somewhat violent agitations of the chain, spilling the water in the buckets and jarring the apparatus, as well as making it unpleasant to the hands in turning the crank. To obviate these disadvantages I place guides *k k* at the edges of the chain, just below where it engages with the sprocket-wheel C, and so locate or arrange them as to hold the chain out at the greatest distance which any part of the links assume in turning over the sprocket-wheels. The construction and arrangement may be as represented in the drawings, or in any other suitable manner. These guides completely obviate the disadvantages named, causing the chain to run steadily, and almost entirely preventing the spilling of any water. I locate similar guides *j j* to guide the descent of the chain from the sprocket-wheel D, and also equivalent supporting-guides *o o*, horizontally between the sprocket-wheels C D, substantially as represented. These guides also serve to secure the chain on the sprocket-wheels, so that it cannot be thrown off by sticks or other obstructions coming up in the buckets. The chain is made of links formed of pieces of wire, which are bent, as seen in figs. 6 and 7, so as to form a horizontal or cross-bar, and two vertical or side portions. The cross-bars of the links simply rest in notches *v v*, formed in the edges of the sprocket-wheels, as most clearly shown in fig. 1, while the side portions of the links pass outside of the wheels. The blank-links *a a*, or those to which no cups or buckets are attached, are formed as shown in fig. 6, the edges at the extremities of each link hinging to the curved bends at the angles of the adjacent link. The links *c c*, fig. 7, to which the cups or buckets are attached, are formed differently, as represented. The cross-bar has a depressed portion, *d*, which bends down around the bottom of the cup or bucket, fitting it so that the joints or hinges of adjacent links shall be nearly opposite to the centres of the buckets, as indicated.

There are important advantages in this arrangement of the cups or buckets: first, as the links to which they are attached turn on their sprocket-wheels, the axes of movement are at the joints of the links; hence, by having these axes nearly coincident with the centres of the buckets, the buckets turn with less side motion, and consequently more steadily; second, the buckets can be placed more closely together without one interfering with another as they turn round the wheels; third, it allows more room for the buckets to discharge their contents without being impeded by those immediately before them; fourth, the bends of the wires keep the buckets in place, so that they will not work sideways, and less friction is produced in the running of the chain. The bend *d* of the cross-bars fits into depressions or notches *h h*, fig. 4, in the bottoms of the cups or buckets, thus holding them steadily in place. The top of each cup or bucket is secured to its link by means of a guide-wire, *g*, which wires one half of the edge of the cup, as shown at *i*, fig. 4, and then extends outward radially and terminates in eyes which fasten around the side portions of the link, there being abrupt bends *f f* in those portions of the link to keep the guide-wires from slipping thereon, substantially as represented. The whole arrangement is easy of construction, simple, and cheap, as well as strong and durable. Where the guide-wires join to the links there would be an obstruction to the turning of the chain over the sprocket-wheels, but I obviate this by cutting away the edges of the wheels, as shown at *w w*, fig. 1. This leaves the movement of the chain entirely free. The inner edges of the buckets are flattened, as indicated most clearly in fig. 4. This enables the spout or receiver I to be extended more closely to the centres of the buckets, and the water to be discharged more copiously when the discharge commences. The cups being small and wired on one side, (the side liable to injury in the well,) may be made of zinc or galvanized sheet iron, and quite thin and light, and hence they are cheap, though strong and durable. The chain can be folded and packed separately for transportation, and the cups can be packed together in "nests." Whatever the weight of the cups, one cluster always balances the other on the chain. Since the buckets descend bottom upward into the water, they carry down air, and are buoyed up by their lightness. To keep all steady the chain passes around a wheel or drum, L, at the bottom of the well. It is mounted over a pan or basket, M, which is loaded with stones or other heavy substance to sink it in place, and hold all steady, so that it is not necessary to descend into the well to arrange or adjust any part.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The two sprocket-wheels or pairs of sprocket-wheels C D, situated on different shafts, at equal heights, and at sufficient distance apart to allow the water to be discharged between them into the reservoir or spout beneath, when arranged in relation to the buckets or cups in clusters, substantially as and for the purpose herein specified.

2. I also claim the arrangement of the buckets or cups in two clusters or groups on opposite parts of the

chain, the remaining portions of the chain being without buckets or cups, substantially as and for the purpose herein set forth.

3. I also claim the arrangement of side gearing *p r s t*, at the main shaft E, in combination with the coupling *n* and shifting device *l m*, or the equivalents thereof, for the purpose herein set forth.

4. I also claim the chain-guides *j k o*, separately or together, as arranged in relation to the chain and buckets or cups, substantially as and for the purposes herein specified.

5. I also claim the chain A, the wheels C D, and the cross-bars of the links, extending across and resting in notches *v v* of the wheels, all arranged as set forth.

6. I also claim the buckets or cups held by the bent links *c c*, and so arranged that their centres are nearly opposite to the joints between the links, substantially as and for the purpose herein specified.

7. I also claim the buckets or cups with notches or indentations in the bottoms, in combination with the bent links, for the purpose set forth.

8. I also claim the guide-wires or rods *g g*, which pass around and wire one-half of the edges of the several buckets or cups, and clasp the middles of the supporting links, the links being bent at the joints therewith, substantially as and for the purpose herein set forth.

9. I also claim the open spaces *w w*, in the edges of the wheels, intermediate between the chain-bearing notches *v v*, for the purpose herein set forth.

10. I also claim the suspended buckets or cups with flattened inner edges, as arranged upon the wheel or wheels, substantially as and for the purpose herein set forth.

The above specification of my improved water-elevator signed by me this first day of February, 1867.

A. H. KNAPP.

Witnesses:

F. L. KNAPP,

F. W. GROVER.