L. W. MERRIAM.

CHAIN MOTOR.

APPLICATION FILED JULY 30, 1908.

**920,361.** Patented May 4, 1909.

3 SHEETS—SHEET 1.

Fig. 1.

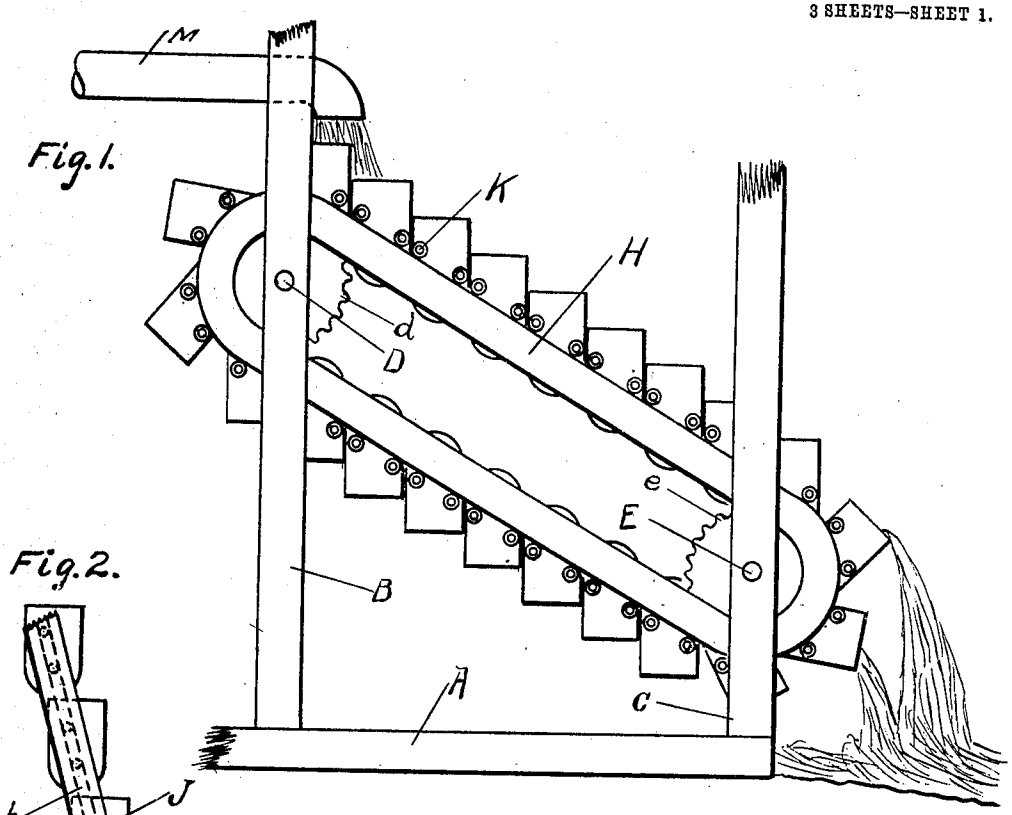



Fig. 2.




Fig. 4.



Fig. 5.



Fig. 6.

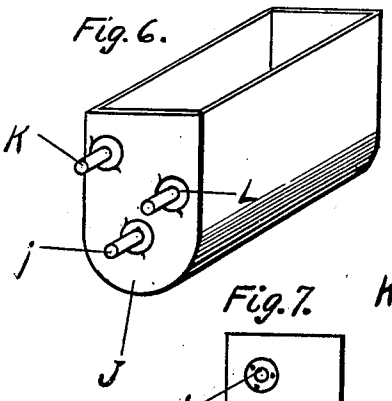



Fig. 3.

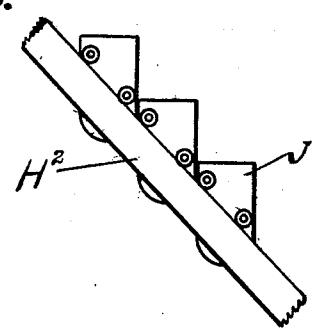



Fig. 7.

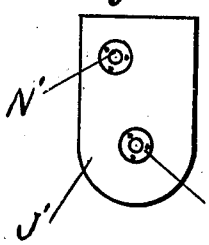
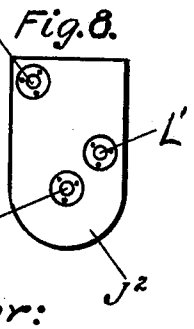



Fig. 8.




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3 SHEETS—SHEET 2.

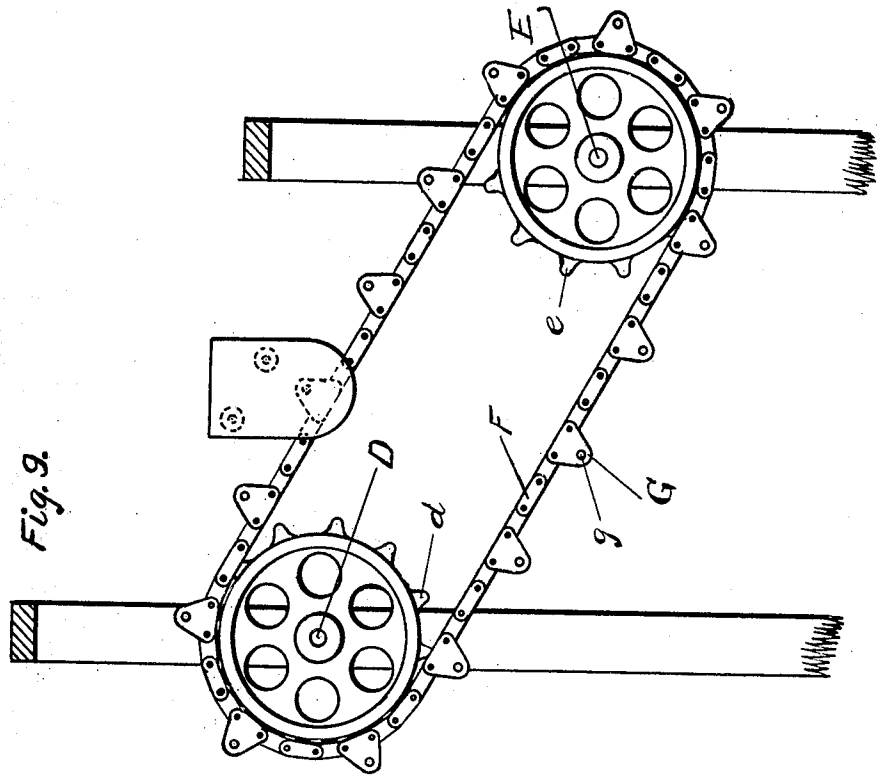



Fig. 9.

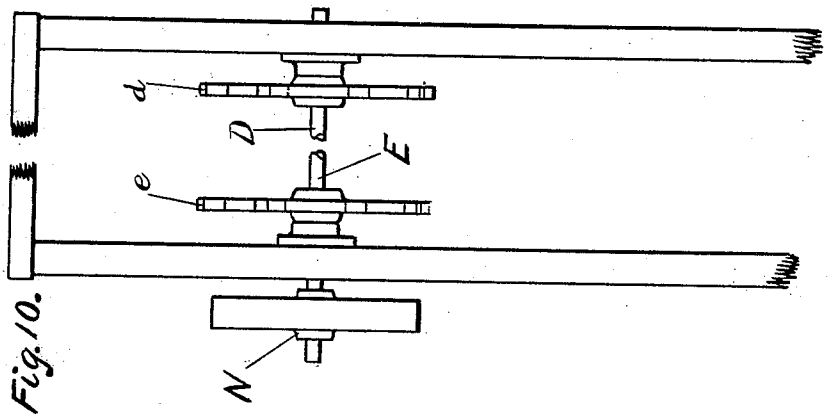



Fig. 10.

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3 SHEETS—SHEET 3.

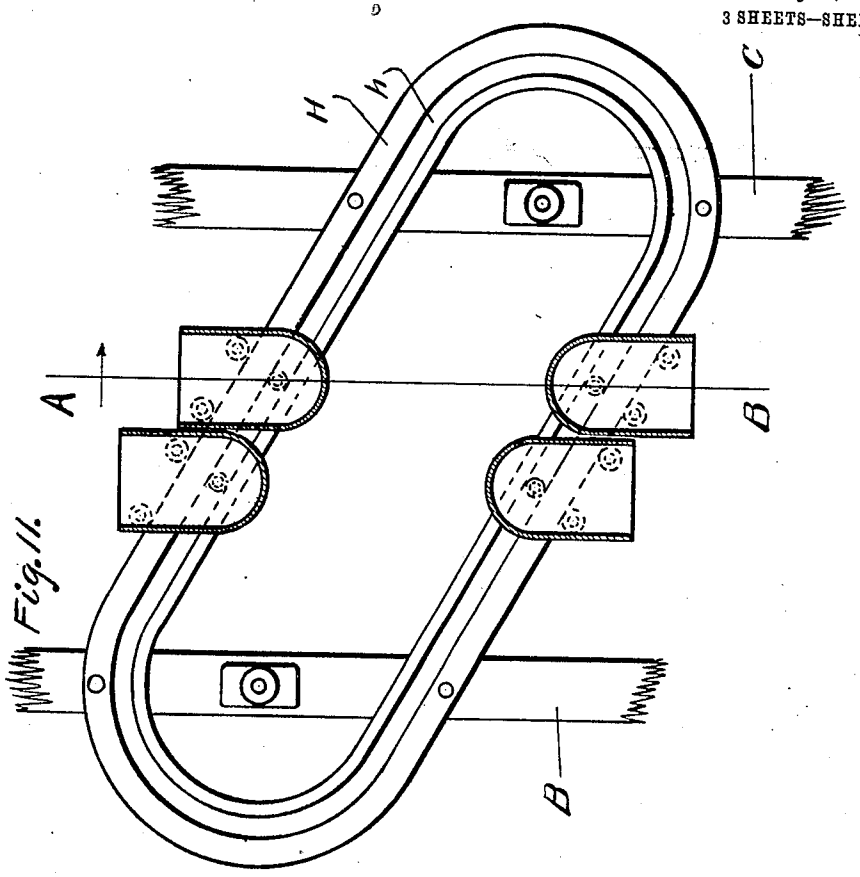



Fig. 11.

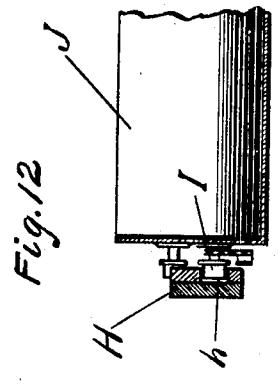



Fig. 12

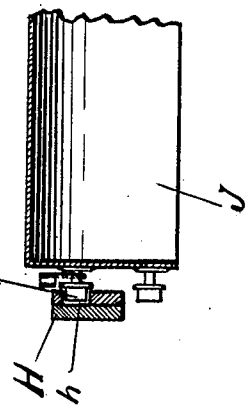



Fig. 13

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# UNITED STATES PATENT OFFICE.

LYMAN W. MERRIAM, OF FITCHBURG, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO FRED S. HUNTLEY, OF FITCHBURG, MASSACHUSETTS.

## CHAIN-MOTOR.

No. 920,361. Specification of Letters Patent. Patented May 4, 1909.

Application filed July 30, 1908. Serial No. 446,077.

*To all whom it may concern:*

Be it known that I, LYMAN W. MERRIAM, a citizen of the United States, residing at Fitchburg, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Chain-Motors; and I do hereby declare that the following is a full, clear, and exact description of the same.

This invention relates to hydraulics and particularly to power transmitting means operated through the medium of water conducted from a stream and discharged into suitable buckets connected to flexible members adapted to operate in conjunction with rotating members including shafts for communicating motion to pulleys, sprocket wheels, or the like.

An object of this invention is to provide novel guides, chains and buckets in operative relation to one another, the said buckets being filled with water near the top of the guides and discharging the water at the bottom of the guides, the said buckets being moved longitudinally of the guides by reason of the weight of the contents thereof.

A further object of this invention is to provide novel means for adapting the apparatus to different degrees of inclinations, in order that the apparatus may be operated regardless of the angle of descent of the stream.

A still further object of this invention is to provide a series of traveling buckets mounted in such relation to the guide as to minimize the friction between the contacting parts of the apparatus, and to that end the contacting parts are provided with anti-friction rollers.

With the foregoing and other objects in view, the invention consists in the details of construction and in the arrangement and combination of parts to be hereinafter more fully set forth and claimed.

In describing the invention in detail, reference will be had to the accompanying drawings forming part of this specification wherein like characters denote corresponding parts in the several views, in which—

Figure 1, is a view in elevation of an apparatus embodying the invention showing a conduit discharging into the buckets; Fig. 2, shows a slightly modified construction for adapting the buckets for use where the incline is more abrupt than that illustrated in Fig. 1; Fig. 3, illustrates a modified arrangement of the parts adapted for an incline intermediate those shown in Figs. 1 and 2; Fig. 4, is an end view of an anti-friction roller; Fig. 5, illustrates a side elevation thereof; Fig. 6, is a perspective view of one of the buckets; Fig. 7, illustrates an end view of the bucket used in the modification shown in Fig. 2; Fig. 8, illustrates an end view of a bucket to be employed in the modification shown in Fig. 3; Fig. 9, is a detail view showing one of the sprocket chains and the wheels to which it is applied, the said sprocket chains being provided with one of a series of buckets; Fig. 10, is a view in elevation showing a section of a frame with the sprocket wheels mounted on a shaft journaled in the frame, said shaft being provided with a power wheel; Fig. 11, is an enlarged detail view of one of the guides for the buckets; Fig. 12, is a transverse sectional view of the top run of one of the guides showing a fragment of a bucket; and Fig. 13, is a sectional view of the bottom run of one of the guides.

In these drawings I have shown a frame having the sills A, and the posts B and C, the said posts having bearings for the shafts D and E, respectively.

The shaft D, is provided with sprocket wheels *d*, *d*, and the shaft E, is provided with sprocket wheels *e*, *e*. The sprocket chain F, is run over a pair of sprocket wheels *d*, *e*, and said sprocket chain is provided with a series of ears G, which have apertures *g*. The chain F, and its intimate parts is duplicated on the opposite side of the frame.

The posts B and C, are connected by a combined track and guide H, having its inner face provided with a groove *h*, in which the anti-friction rollers I, on the buckets J, can travel. The anti-friction rollers I, are mounted on trunnions *j*, projecting from the ends of the buckets and said trunnions extend through the apertures *g*, on the ears G, hence as the chain F, is moved, the anti-friction rollers travel in the grooves *h* of the guides H, and cause the buckets to follow the contour of the grooves which are parallel to the edges of the guides, one guide being stationed on each side of the frame. The ends of the buckets are also provided with studs K and L, shown in Fig. 6, and said studs are provided with anti-friction rollers *k* and *l*, which are in such relation to each other as to travel on the outer edges of the guides while the anti-friction rollers which are on the

trunnions $j$, are traveling in the grooves of the guides.

The conduit or flume M, conducts water from a stream or other suitable source and discharges directly into the buckets J, and as said buckets are filled with water, the weight of the contents causes the said buckets to gravitate and hence they communicate motion to the chain and the chain in turn communicates motion to the sprocket wheels and shafts. The power thus developed may be utilized in any suitable manner as for instance a pulley N, may be applied to the shaft D, on either end of said shaft or any other suitable means for transmitting power may be utilized.

From an inspection of Fig. 1, it will be observed that the buckets remain in an approximately upright position after they are filled with water until the said buckets have traveled to the ends of the top runs of the guides and as said guides have curved ends, and grooves, the buckets are carried around the ends of the guides and the water is discharged therefrom as illustrated. The buckets are then carried up the lower runs and are again brought under the discharge end of the conduit or flume M, and are again filled and the operation is repeated, it being understood, of course, that the weight of the water contained in the buckets is sufficient to drive the machinery.

In the modification shown in Fig. 7, the buckets J′, have two studs N′, O, both of which travel in slots P, in the guides H′. This form is used when the guides have very abrupt pitches, but in ordinary use two studs will not be required. In this form a sprocket chain similar to the sprocket chain shown in Fig. 9, will be employed and otherwise the construction of the apparatus will be the same as that heretofore disclosed.

In the modification shown in Figs. 3 and 8, the guides $H^2$, are the same as the guides H, shown in Fig. 1, but the buckets $J^2$, have the studs K′ and L′, arranged at an angle to the trunnions $j'$, differing from that of the studs K and L, with relation to the trunnion $j$. This changed relation of the studs with relation to the trunnions is made for the purpose of utilizing the buckets in connection with guides of different pitches.

In operation, the buckets assume an upright position and as they travel they present their open mouths under the discharge opening of the conduit or pipe and become filled with water, and the weight of the water, as heretofore stated, causes the buckets to travel with relation to the guides and the contents of the buckets is automatically discharged therefrom as the said buckets travel around the curved ends of the guides and as the said buckets travel up the incline on the under run of the guides, the said buckets are inverted. However, as the upper ends of the guides are curved, the buckets travel around the curved ends and are again brought to an upright position in order that their open mouths may receive the water discharged from the pipe or conduit.

I claim—

1. In a hydraulic motor, a frame, shafts journaled therein, sprocket wheels on the shafts, sprocket chains operating over the sprocket wheels, ears on the sprocket chains, guides secured to the frame, slots in the guides, buckets, trunnions on the buckets extending through the ears of the chain and projecting into the slots of the guides, anti-friction rollers on the trunnions adapted to travel in the slots of the guides, and studs adapted to engage the edges of the guides, said studs projecting from the buckets at an angle to each other corresponding to the angle of incline of the guides.

2. In a hydraulic motor, a frame, shafts journaled therein, sprocket wheels on the shafts, chains having apertured ears running over the sprocket wheels, buckets having trunnions extending through the apertures of the ears, anti-friction rollers mounted on the trunnions, guides having slots in which the anti-friction rollers travel, studs projecting from the buckets at an angle to each other corresponding to the angle of incline of the guides, anti-friction rollers on the studs adapted to travel on the outer edges of the inclines and means for supplying water to the buckets.

3. In a hydraulic motor, a frame, shafts journaled therein, sprocket wheels on the shafts, chains having apertured ears running over the sprocket wheels, buckets having trunnions extending through the apertures of the ears, anti-friction rollers mounted on the trunnions, curved guides having slots in which the anti-friction rollers travel, studs projecting from the buckets at an angle to each other corresponding to the angle of incline of the guides, anti-friction rollers on the studs adapted to travel on the outer edges of the inclines, and means for supplying water to the buckets.

4. In a hydraulic motor, a frame, shafts journaled thereon, rotating members mounted on the shafts, flexible means for connecting the rotating members, buckets having trunnions connected to the flexible means for connecting the rotating members, anti-friction rollers on the trunnions, guides having slots in which the anti-friction rollers travel, studs projecting from the ends of the bucket, and anti-friction rollers on the studs adapted to travel on the outer edges of the guides.

5. In a hydraulic motor, a frame having inclined guides, said guides having slots in their inner surfaces, buckets having trunnions extending into and actuated by the slots, flexible devices to which the buckets are connected, rotating means over which the

flexible connections are run, and studs projecting from the buckets at angles to each other corresponding to the angle of incline of the guides said studs engaging and being guided by the edges of the guides.

6. In a hydraulic motor, a frame, guides thereon having slots in their inner surfaces, buckets having trunnions projecting into and guided by the slots, studs projecting from the buckets, anti-friction rollers on the studs adapted to travel on the outer edges of the guides, rotating members, means for supplying liquid to the buckets, said studs being arranged to cause them to gravitate down the guides, means for communicating movement of the buckets to the rotating members, thereby returning the empty buckets to the tops of the guides.

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