No. 654,872. Patented July 31, 1900.

E. F. CASSEL.

HYDRAULIC MOTOR.

(Application filed Feb. 28, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

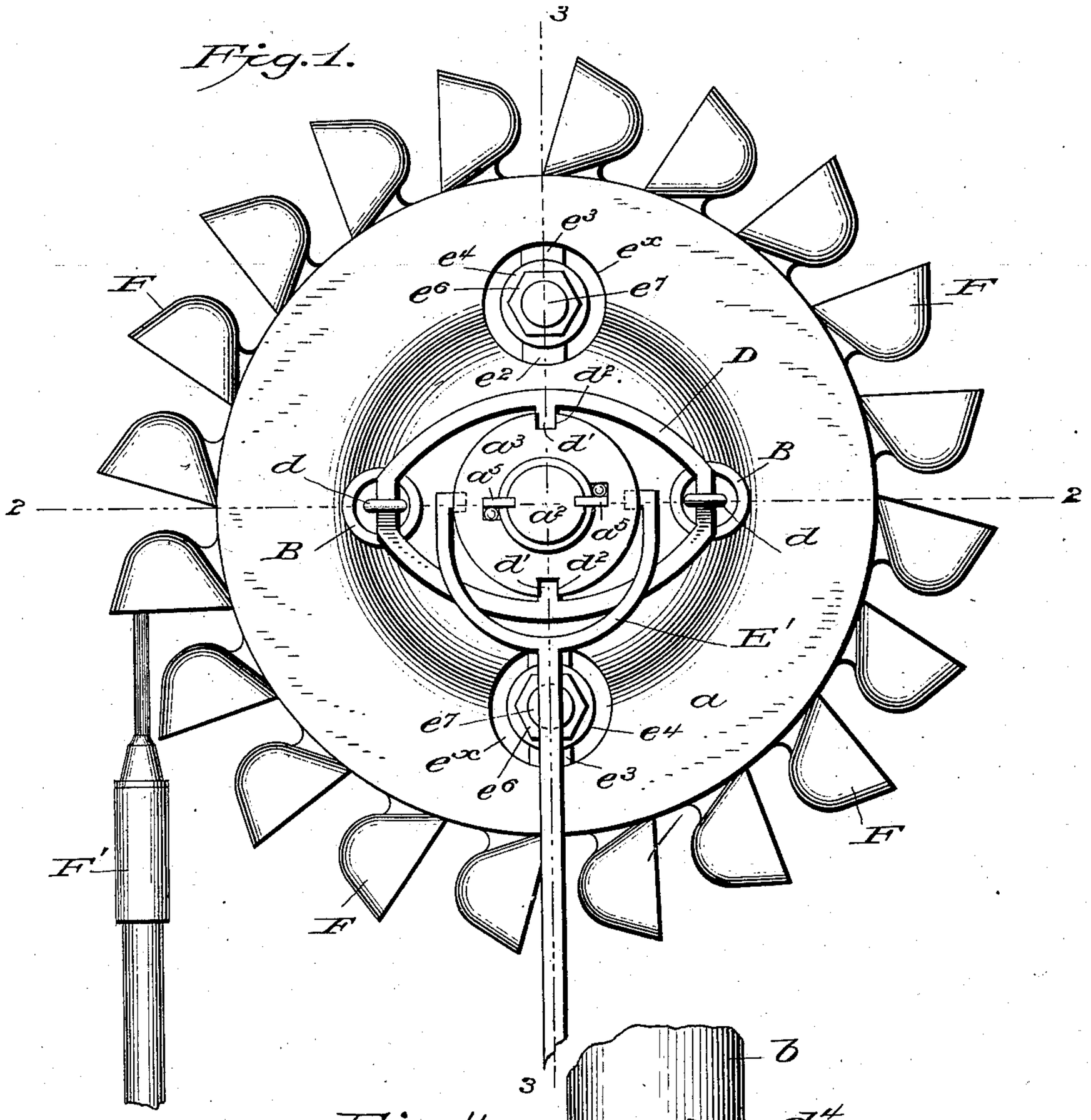
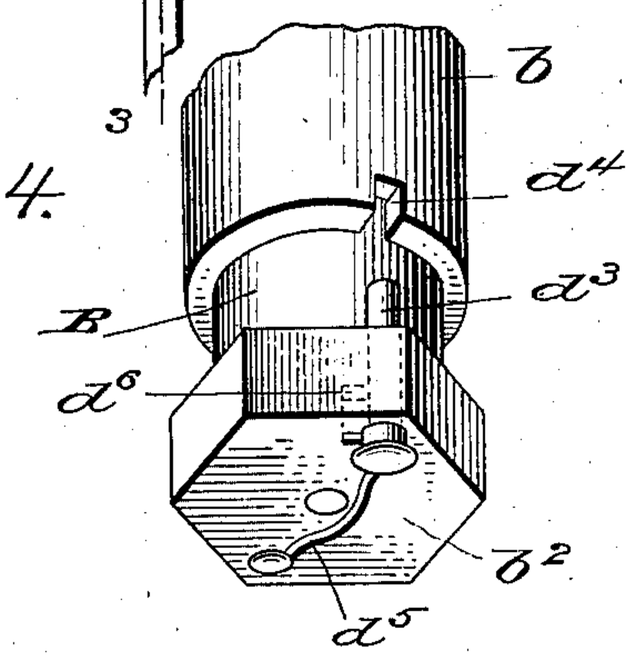


Fig. 4.



Witnesses
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3 Sheets—Sheet 2.

Fig. 2.

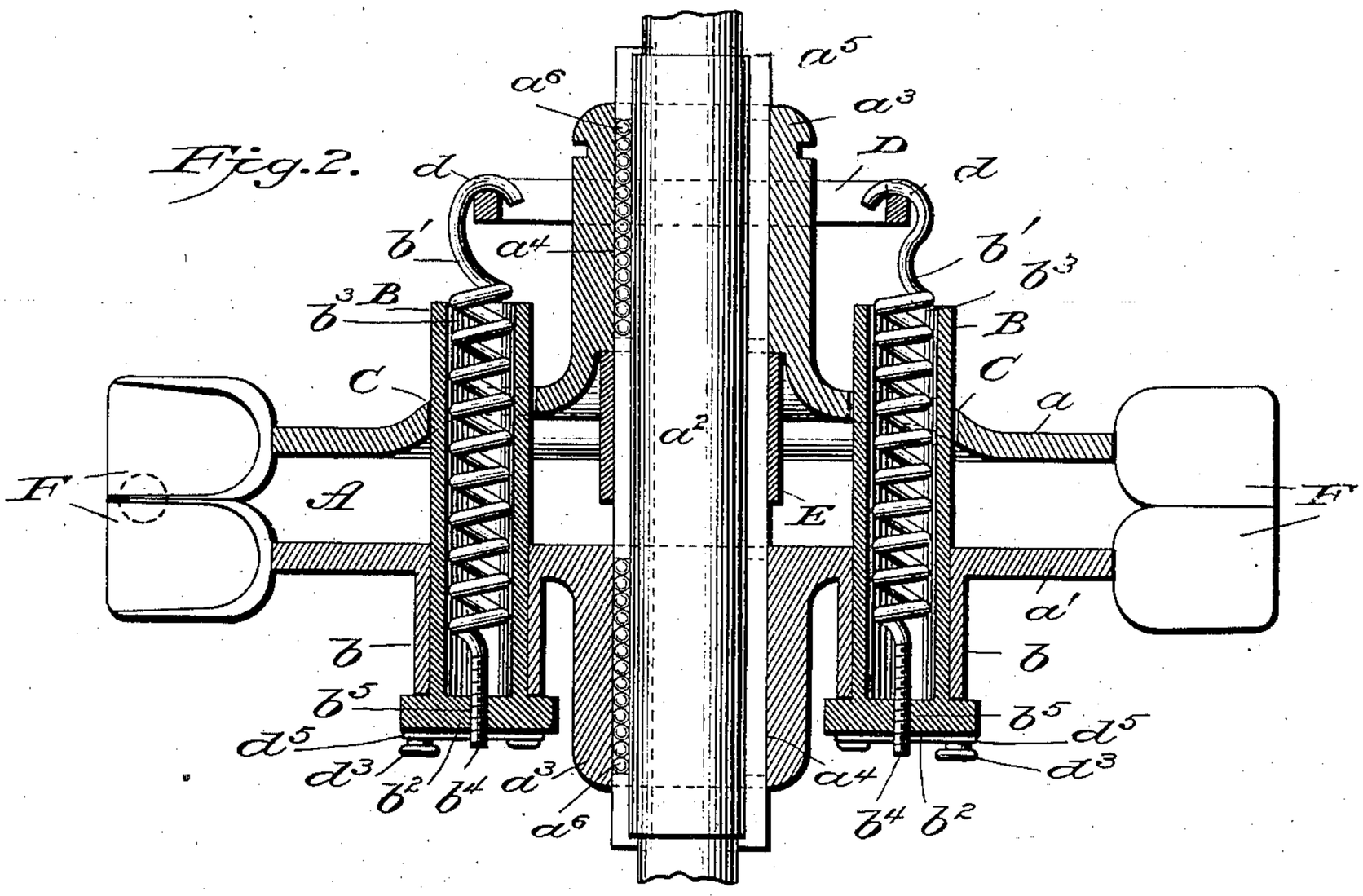

Fig. 3.

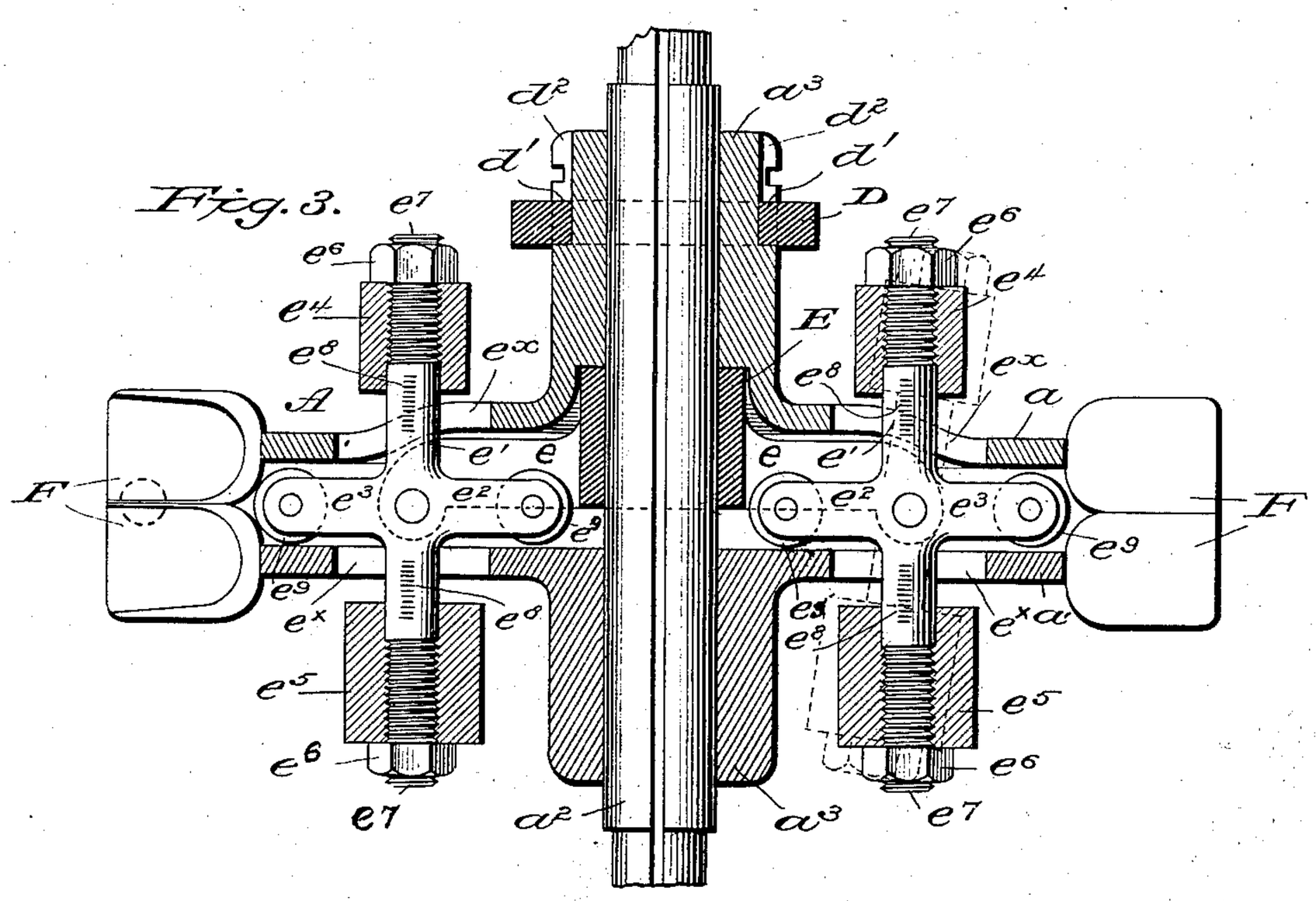

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Fig. 5.

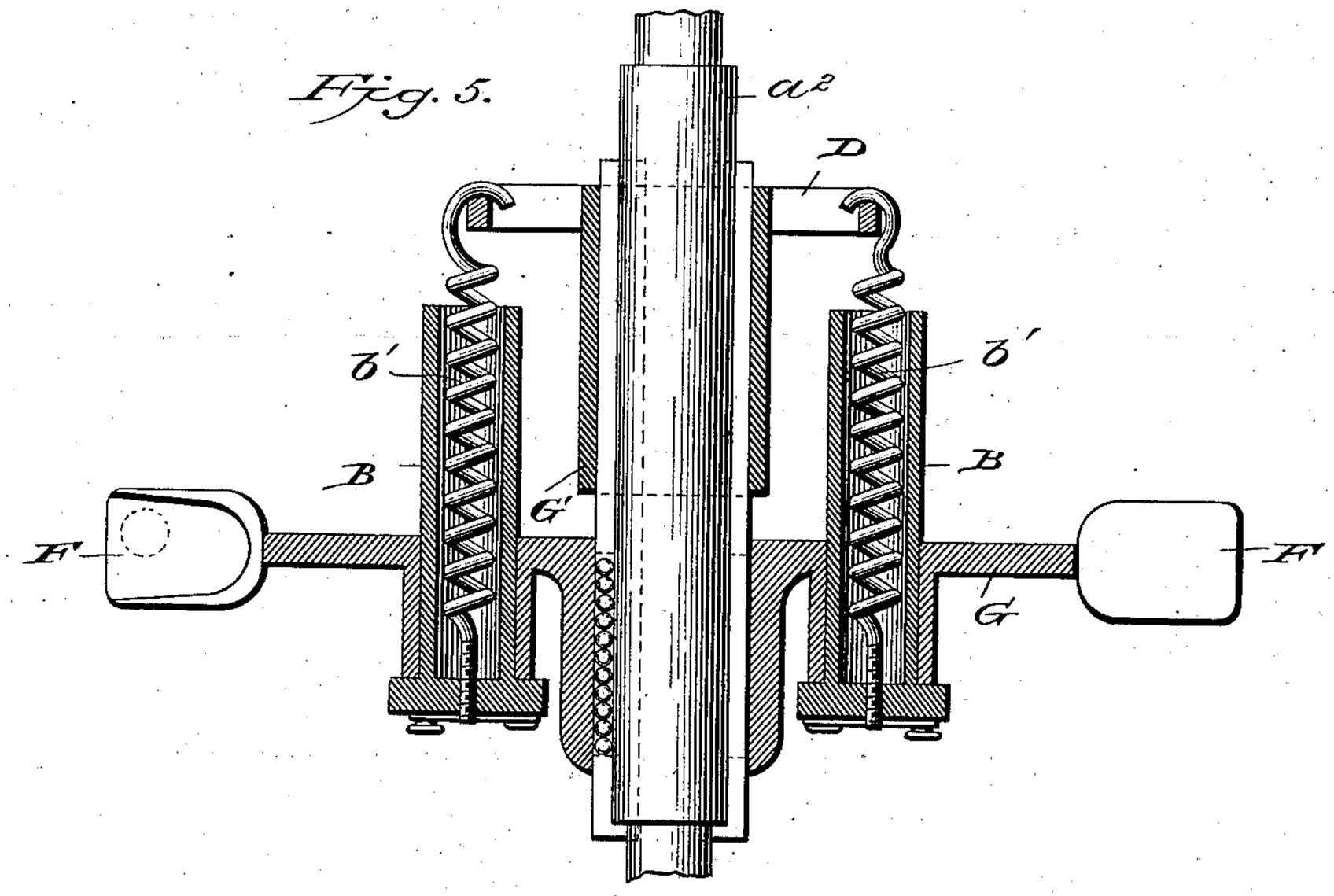
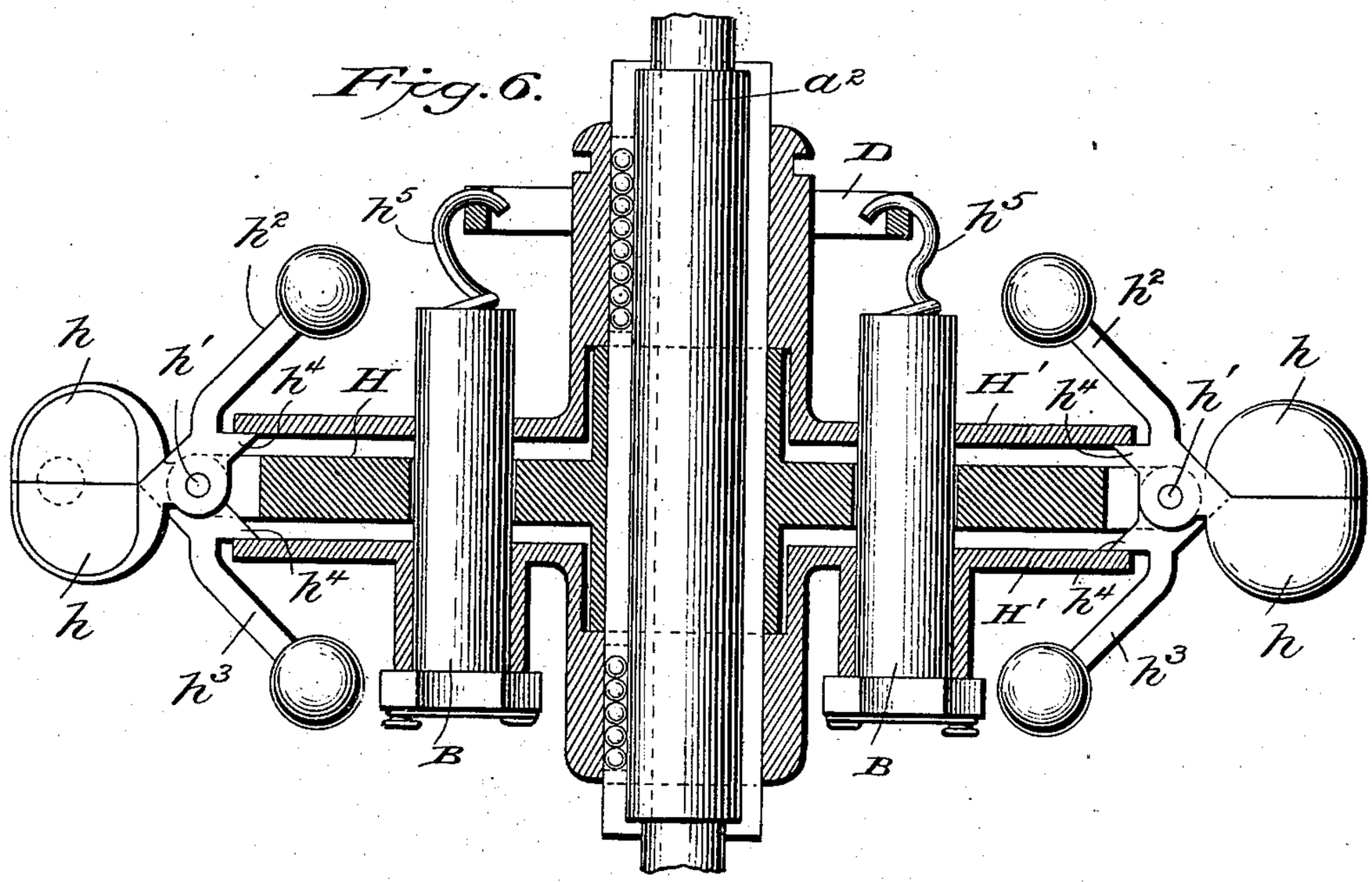


Fig. 6.



Witnesses
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UNITED STATES PATENT OFFICE.

ELMER F. CASSEL, OF SEATTLE, WASHINGTON.

HYDRAULIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 654,872, dated July 31, 1900.

Application filed February 28, 1900. Serial No. 6,821. (No model.)

To all whom it may concern:

Be it known that I, ELMER F. CASSEL, of Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Hydraulic Motors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to certain new and useful improvements in hydraulic motors; and it has for its object the production of simple and inexpensive means for automatically regulating the motor to a uniform speed of revolution under all conditions of load or force of water. Heretofore in motors of this character it has been customary to regulate the speed of the motor by altering the angle of the nozzle or feed with relation to the buckets, whereby a reduced volume of water acts against the latter, or else means have been provided for shutting off or reducing the flow from the nozzle. These methods, while approximately successful when employed with heads of from twenty to fifty pounds pressure, are dangerous and wholly impracticable for use where the water column is under high pressure. Under the latter conditions the pressure is frequently so great that the regulating means is necessarily slow-acting, and as a consequence before the column of water can be reduced the mechanism is racked and strained to such a degree as to make it short-lived. It is the object of my present invention to overcome these objections.

The invention will be hereinafter fully set forth, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a side view illustrating my improved motor. Fig. 2 is a sectional view on line 2 2, Fig. 1. Fig. 3 is a similar view on line 3 3, Fig. 1. Fig. 4 is a detail. Figs. 5 and 6 are views of slight modifications.

Referring to the drawings, A designates a wheel-body made up of two sections a a', keyed to a shaft a^2. The hub a^3 of each of said sections is provided with grooves a^4 to receive the keys a^5, antifriction-balls a^6 being also secured in said grooves, whereby the sections a a' will move freely upon the shaft a^2 with a minimum degree of friction. The section a' is provided with sleeves or bosses b, preferably cast integral therewith and serving as bearings or supports for sleeves B, which latter contain the springs b', serving to normally hold the two sections of the wheel together. The sleeves B are provided with closed ends b^2, formed in the shape of a nut, and open ends b^3, which project through suitable openings C in section a. Each spring b' is provided with a threaded extension b^4, which works in a threaded aperture b^5 of the closed end of sleeve B. The free ends of said springs are provided with hooks d, which engage a yoke D at opposite points. Said yoke is preferably of approximate ring shape and provided with inwardly-projecting pins or lugs d', fitting in grooves d^2 of one of the hubs a^3. The tension of springs b' is regulated by turning the sleeves B. Said sleeves are held as against turning by locking-pins d^3, which are arranged to engage recesses d^4, formed in the ends of bosses b. Each pin d^3 is normally held in engagement with recesses d^4 by means of springs d^5, secured at one end to said sleeve, the free end of said spring being looped around the head of said pin or otherwise secured thereto. When said pins are raised out of contact with recesses d^4, the same are held as against the action of the springs by means of lugs d^6, which engage the end faces of sleeves B.

To the shaft a^2 is keyed or otherwise secured a hub E, having brackets e, in which are pivoted arms or levers e'. Said arms or levers are passed through coincident slots $e^\times$ of the sections a a' and provided with approximately right-angular arms or extensions e^2 e^3, which are located between said sections. Antifriction-wheels e^9 are mounted in said arms or extensions and bear against the inner faces of said sections. On the opposite ends of arms or levers e' are adjustably mounted weights e^4 e^5, the latter being of sufficient weight to overcome any centrifugal force which may be developed by the former at any point within their radius of action. Said weights are held in position on arms or levers e' and also adjusted on the latter by means of nuts e^6, working on the threaded portions e^7 of said arms

or levers. If desired, a graduated scale e^8 may be placed on levers e' for guidance in the adjustment of said weights.

On the periphery of each section of the motor are formed buckets F, and water is directed thereagainst from a pipe or nozzle F'.

The operation is as follows: A jet of water being directed against the buckets causes the wheel-body to rotate, the centrifugal force exerted thereby causing the weights e^5 to overcome the weights e^4, the former moving away from the shaft and the latter toward the shaft. This movement of the weights results in the rocking of levers e' and causes the extensions e^2 e^3 thereof to respectively engage sections a a' of the motor, whereby said sections are separated against the action of the springs b'. By this means the buckets of the two sections are separated, thereby permitting the jet of water to pass between the same, either in whole or in part, instead of impinging directly thereagainst, resulting in a corresponding decrease of power. A decrease in the speed of revolution of the motor will cause a decrease in the centrifugal force of the weighted levers, whereupon the pressure of the springs b' will bring the sections together as against the pressure of said levers, whereby the gap between the buckets is diminished or entirely closed.

If desired, a lever E' may be connected to one of the sections of the motor-body and arranged to operate a cut-off valve in the water-supply in the event of accident, such as the parting of the springs or other cause, which may separate the sections to an abnormal extent. It is also obvious that weights e^4 and the portions of levers e' supporting the same may be entirely dispensed with without departing from the spirit of my invention, or, if desired, weights e^4 e^5 may be mounted upon independent levers.

While the preferred form of my motor is as above set forth, yet I find good results can be obtained with the form illustrated in Fig. 5. In this form the motor-body is composed of but one section G and does not differ either in construction or operation from the form heretofore described, save that hub G' is elongated to receive the yoke D in lieu of hub a^3. In operation the centrifugal force acting upon the weighted levers causes the buckets to move out of the line of impact. This construction does not respond to changes as quickly as the preferred form, but, as before stated, is nevertheless thoroughly practicable and reliable.

In Fig. 6 I have shown a second modification. In this form the motor-body is formed in sections H H'. The buckets h are pivotally mounted at h' on the main section H and provided with arms or levers h^2 h^3, having weighted ends. The latter levers are provided with lugs h^4, which are in engagement with the sections H'. In practice the centrifugal force causes the ends of levers h^2 h^3 to separate, resulting in a corresponding separation of the buckets. As the centrifugal force decreases the ends of said levers are brought together by means of springs h^5, acting on sections H'. In this form of my invention the buckets serve as the differential weights on the levers h^2 h^3.

The advantages of my invention are apparent to those skilled in the art to which it appertains, and it will be particularly observed that I have produced a hydraulic motor which is simple and inexpensive in construction and one in which a uniform speed of rotation will be maintained under all conditions of load or force of water. An important advantage lies in the arrangement of the weights by which the centrifugal power is applied to separate the sections. Supposing the heavier weight to be one pound and the lighter one a half-pound, it is apparent that the initial velocity required to move the heavier one would be approximately the same required to move a half-pound weight when mounted alone upon the lever. It will be observed, however, that as soon as the heavier overcomes the lighter the latter approaches the shaft as the former leaves the same, thereby decreasing the radius of revolution of the former with a corresponding decrease in centrifugal force tending to resist the spread of the heavier weight, whereby the efficient power of the latter is greatly increased. It will be observed that while I have illustrated the levers as on a horizontal plane for the purpose of more clearly demonstrating the same, yet in practice it is preferable to mount said levers on an incline, as shown in dotted lines, Fig. 3, for the reason that the centrifugal force of the heavier weight increases in greater proportion as it approaches the diametrical center than it does in leaving said center, and hence there is a greater scope to the governing action.

I claim as my invention—

1. A hydraulic motor comprising a shaft, a motor-body mounted thereon, and weighted members pivotally supported by said shaft and arranged to automatically vary the relative positions of said body on said shaft, said members being operated by the centrifugal force developed in the rotation of said shaft, as set forth.

2. A hydraulic motor comprising a motor-body provided with buckets, and differentially-weighted members arranged to move said buckets out of the line of impact, said members being put into operation by the centrifugal force developed in the rotation of said motor, as set forth.

3. A hydraulic motor comprising a motor-body carrying buckets, arms or members carried by said motor, and movable weights mounted on said arms or members, whereby said buckets will be moved out of the line of impact by the centrifugal force developed in the rotation of said motor, as set forth.

4. A hydraulic motor comprising a body formed in sections and carrying buckets,

weighted levers arranged to be operated by the centrifugal force developed in the rotation of said body and extending between said sections, and means for holding said sections normally together, as set forth.

5. A hydraulic motor comprising a body formed in sections, levers mounted between said sections and arranged to be operated by the centrifugal force developed in the rotation of said body, said levers having differentially-weighted ends, and means for holding said sections normally together.

6. A hydraulic motor comprising a shaft, a motor-body formed in sections and mounted on said shaft, a hub keyed to said shaft, levers mounted in said hub and arranged to be operated by the centrifugal force developed in the rotation of said body, said levers engaging said sections, said levers having differentially-weighted ends, and means for holding said sections normally together, as set forth.

7. A hydraulic motor comprising a shaft, a motor-body formed in sections and mounted on said shaft, a hub keyed to said shaft, levers mounted in said hub and arranged to be operated by the centrifugal force developed in the rotation of said body, said levers having differentially-weighted ends, arms or members extending from said levers between said sections, and means for holding said sections normally together.

8. A hydraulic motor comprising a shaft, a motor-body formed in sections and mounted on said shaft, a hub keyed to said shaft and having brackets, levers mounted in said brackets and arranged to be operated by the centrifugal force developed in the rotation of said body, said levers having differentially-weighted ends, arms or members formed with said levers and extending between said sections, antifriction-rollers mounted in the ends of said arms or members, and means for holding said sections normally together, substantially as set forth.

9. A hydraulic motor comprising a shaft, a motor-body formed in sections and mounted on said shaft, a hub keyed to said shaft, levers mounted in said hub and arranged to be operated by the centrifugal force developed in the rotation of said body, said levers engaging said sections, weights adjustably secured on said lever, and means for holding said sections normally together, substantially as set forth.

10. A hydraulic motor comprising a shaft, a motor-body formed in sections and mounted on said shaft, a hub keyed to said shaft, levers mounted in said hub and arranged to be operated by the centrifugal force developed in the rotation of said body, said levers engaging said sections, weights adjustably mounted upon said levers, means for holding said weights in any adjusted position, and means for holding said sections normally together, substantially as set forth.

11. A hydraulic motor comprising a shaft, a motor-body formed in sections and mounted on said shaft, a hub keyed to said shaft, levers mounted in said hub and arranged to be operated by the centrifugal force developed in the rotation of said body, said levers having opposite threaded ends, said levers engaging said sections, weights adjustably mounted on said levers, nuts working on said threaded ends, and means for holding said sections normally together, substantially as set forth.

12. A hydraulic motor comprising a shaft, a motor-body mounted on said shaft and formed in sections, each of said sections being provided with opposite coincident slots, a hub keyed to said shaft, levers mounted in said hub and arranged to be operated by the centrifugal force developed in the rotation of said body, said levers being extended through said slots, and having arms or extensions engaging said sections, differential weights mounted on the ends of said levers, and means for holding said sections normally together, substantially as set forth.

13. A hydraulic motor comprising a motor-body formed in sections and provided with buckets, weighted levers arranged to be operated by the centrifugal force developed in the rotation of said motor-body, said levers having angular portions extending between said sections, and means for holding said sections normally together, as set forth.

14. A hydraulic motor comprising a shaft, a motor-body mounted thereon and carrying buckets, sleeves carried by said motor-body, coil-springs secured within said sleeves, a yoke engaged by said springs, and weighted levers connected and arranged to be operated by the centrifugal force developed in the rotation of said motor-body and designed to move said buckets out of the line of impact and against the action of said springs, substantially as set forth.

15. A hydraulic motor comprising a shaft, a motor-body mounted thereon and carrying buckets, sleeves carried by said motor-body, a yoke, coil-springs secured within said sleeves and having hooked ends engaging said yoke, means for adjusting the tension of said springs, and weighted levers connected and arranged to be operated by the centrifugal force developed in the rotation of said motor-body and designed to move said buckets out of the line of impact and against the action of said springs, substantially as set forth.

16. A hydraulic motor comprising a shaft, a motor-body formed in sections and carrying buckets, sleeves carried by one of said sections, a yoke carried by the other section, springs secured within said sleeves and engaging said yoke, and means for automatically separating said sections, whereby said buckets are moved out of the line of impact, substantially as set forth.

17. A hydraulic motor comprising a shaft, a motor-body formed in sections and carry-

ing buckets, bosses formed in one of said sections, elongated sleeves mounted in said bosses and projecting through coincident openings in the opposite section, a yoke carried by the latter, coil-springs secured in said sleeves and engaging said yoke, and means for automatically separating said sections, whereby said buckets are moved out of the line of impact, substantially as set forth.

18. A hydraulic motor comprising a shaft, a motor-body formed in sections, a ring-like yoke having lugs or pins engaging the hub of one of said sections, springs carried by the other section and engaging said yoke, and means for automatically separating said sections, whereby said buckets are moved out of the line of impact, substantially as set forth.

19. A hydraulic motor comprising a shaft, a motor-body formed in sections and carrying buckets, sleeves carried by one of said sections, a yoke carried by the other section, coil-springs carried by said sleeves, means for adjusting the tension of said springs, and means for automatically separating said sections, whereby said buckets are moved out of the line of impact, substantially as set forth.

20. A hydraulic motor comprising a shaft, a motor-body formed in sections and carrying buckets, sleeves loosely mounted in one of said sections, springs located in said sleeves and having threaded ends engaging the latter, a yoke engaged by the free ends of said springs, and means for automatically separating said sections, whereby said buckets are moved out of the line of impact, substantially as set forth.

21. A hydraulic motor comprising a shaft, a motor-body formed in sections and carrying buckets, sleeves mounted in one of said sections and having closed ends provided with threaded apertures, coil-springs located in said sleeves and having threaded ends in engagement with said apertures, a yoke engaged by the free ends of said springs, and means for automatically separating said sections, whereby said buckets are moved out of the line of impact, substantially as set forth.

22. A hydraulic motor comprising a shaft, a motor-body formed in sections and carrying buckets, one of said sections having bosses formed therewith provided with recesses in their ends, sleeves mounted in said bosses and having a nut-like closed end provided with a threaded aperture, a pin carried by said sleeve, a spring arranged to normally hold said pin in engagement with one of said recesses, means for holding said pin as against the action of said spring, springs located in said sleeves and having threaded ends in engagement with the apertures thereof, a yoke engaged by said springs, and means for automatically separating said sections, and moving said buckets out of the line of impact, substantially as set forth.

23. A hydraulic motor comprising a motor-body carrying buckets, differential weights mounted to rotate with said body in such manner that an increase in the radius of action of the controlling-weights will result in a decrease in the radius of action of the resisting-weights and means operated by said weights, whereby said buckets will be moved out of the line of impact, as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ELMER F. CASSEL.

Witnesses:
GRAFTON L. MCGILL,
WM. S. HODGES.