(No Model.) 2 Sheets—Sheet 1.

F. M. BOOKWALTER & W. W. TYLER.

WATER WHEEL.

No. 525,440. Patented Sept. 4, 1894.

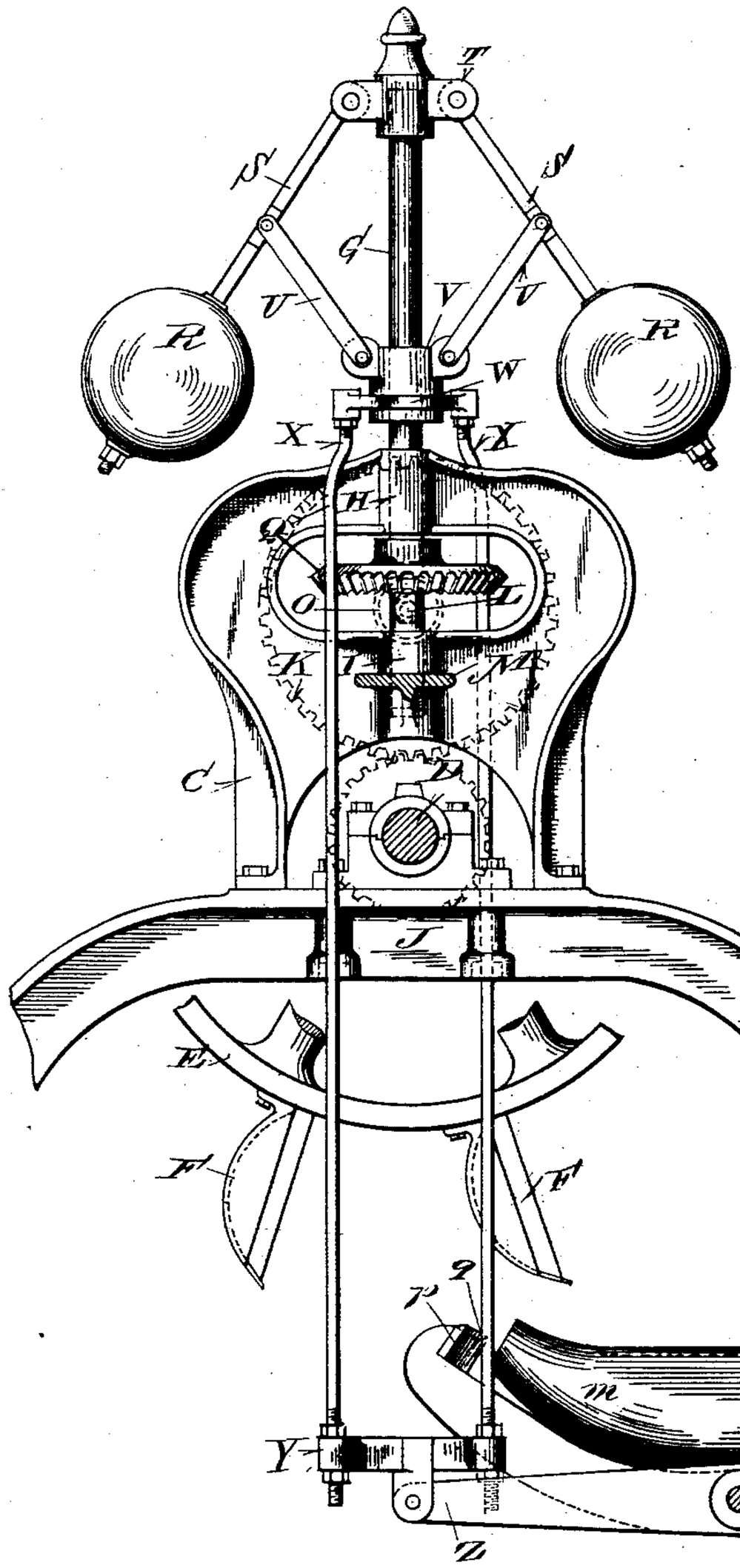

Fig. 1.

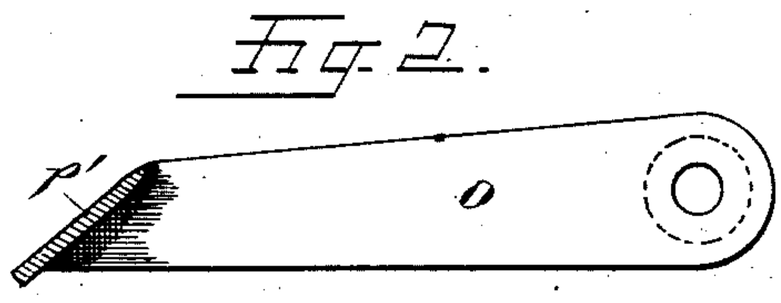

Fig. 2.

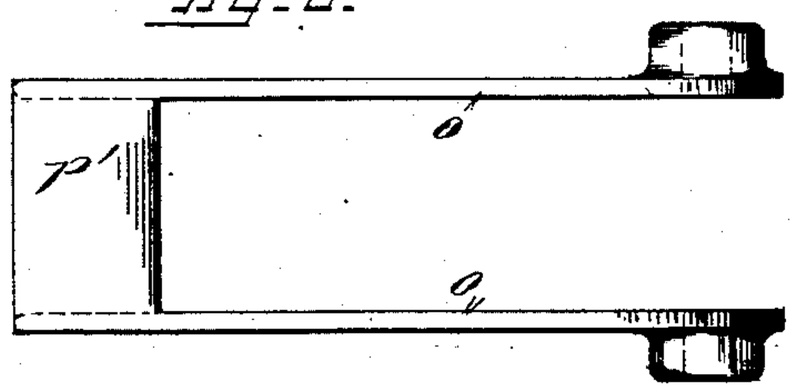

Fig. 3.

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(No Model.) 2 Sheets—Sheet 2.

F. M. BOOKWALTER & W. W. TYLER.

WATER WHEEL.

No. 525,440. Patented Sept. 4, 1894.

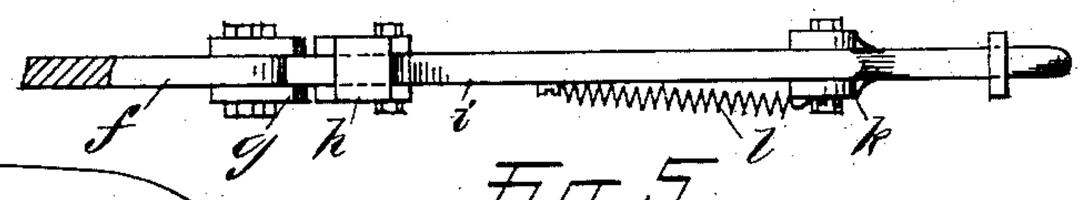

Fig. 5.

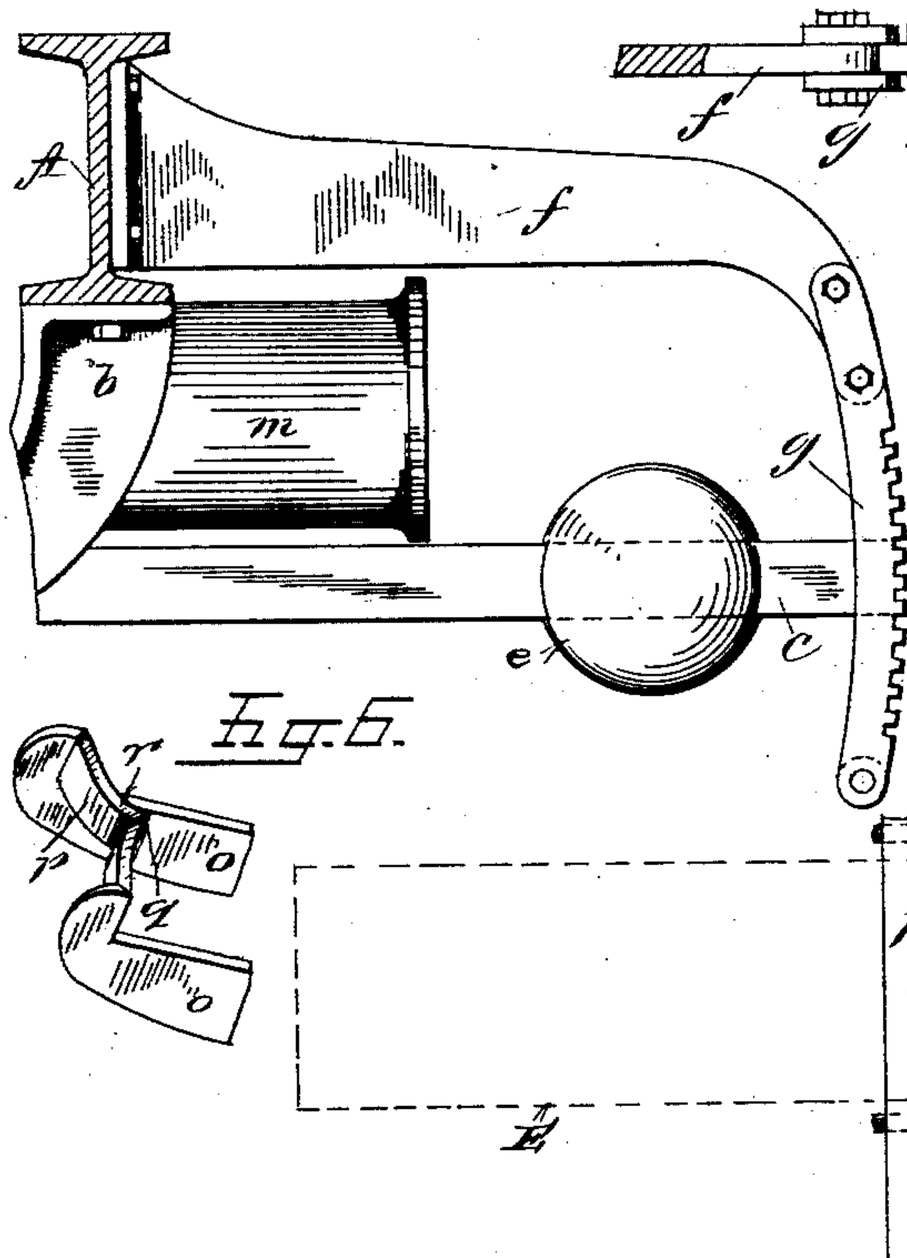

Fig. 4.

Fig. 6.

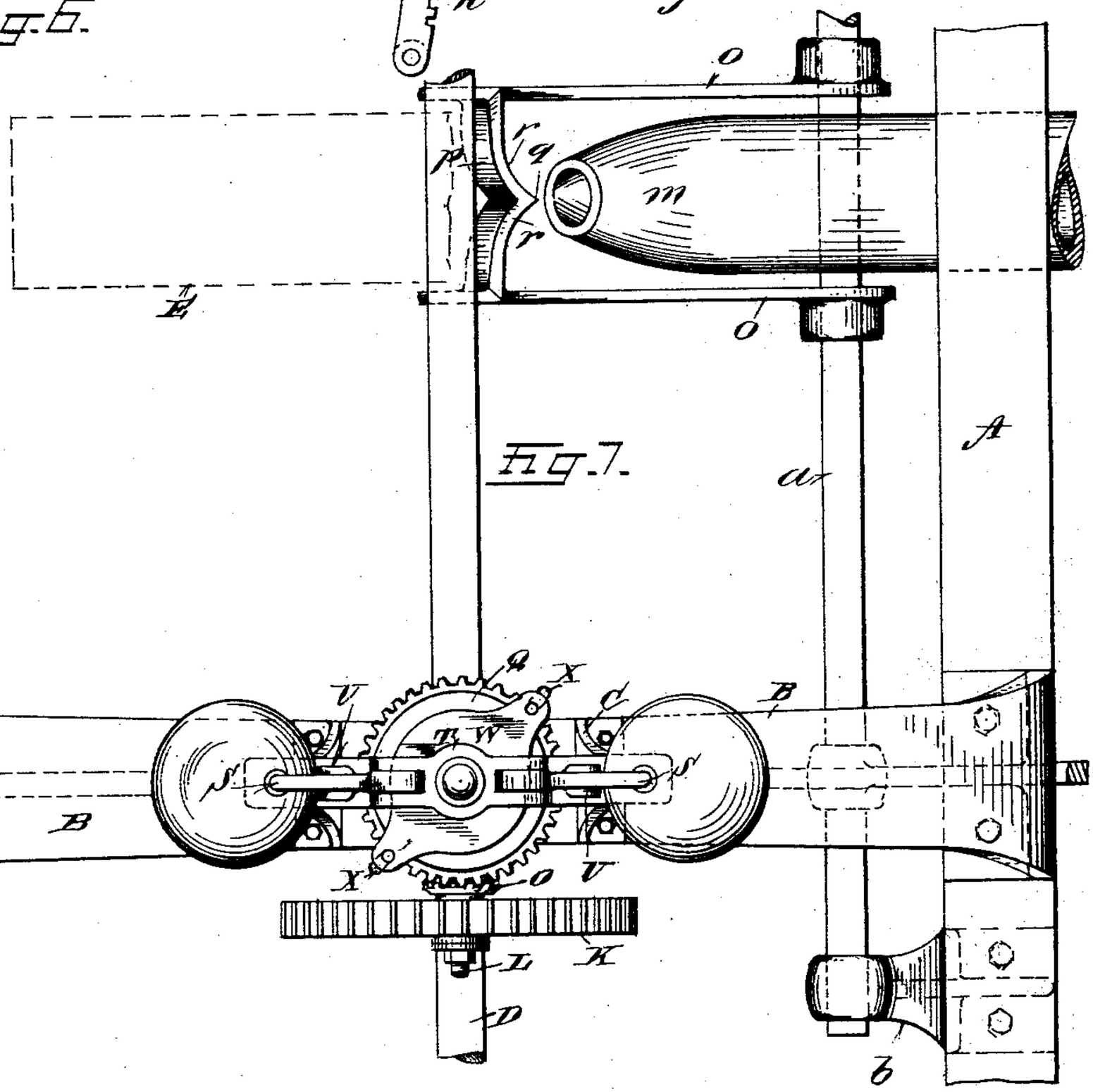

Fig. 7.

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UNITED STATES PATENT OFFICE.

FRANCIS M. BOOKWALTER AND WILLIAM W. TYLER, OF SPRINGFIELD, OHIO, ASSIGNORS TO THE JAMES LEFFEL & COMPANY, OF SAME PLACE.

WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 525,440, dated September 4, 1894.

Application filed February 5, 1894. Serial No. 499,104. (No model.)

To all whom it may concern:

Be it known that we, FRANCIS M. BOOKWALTER and WILLIAM W. TYLER, citizens of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Water-Wheels, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in that class of water wheels known as the hurdy gurdy wheels, and the object of the present invention is to control the amount of water which shall pass into the buckets of the wheel from the nozzle which directs the water to them. In accomplishing this result we divert more or less of the stream out of the path which leads to the buckets, so that the diverted portion of the stream shall pass aside of the buckets or outside of them, whereby only so much of the whole stream shall actually enter the buckets, as, first, may be determined upon under the existing conditions or, secondly, as the varying load of the wheel may require in maintaining the wheel at substantially a uniform speed, the stream diverter being adjusted by hand in the former case and being adjusted automatically in the latter case, more or less across the path of the stream so as to divert more or less of the stream.

In the accompanying drawings on which like reference letters indicate corresponding parts: Figure 1, represents a side elevation, with parts in section, of our invention; Fig. 2, a detailed sectional view of one form of the diverter; Fig. 3, a plan view thereof; Fig. 4, a side elevation of the hand adjusting mechanism for setting and holding the diverter; Fig. 5, a plan view of a portion thereof; Fig. 6, a perspective view of a portion of the diverter, and Fig. 7, a plan view of the apparatus with a few of the parts broken away.

Upon suitably supported sills, A, is bolted or secured a bridge B carrying a yoke C. One end of the wheel shaft D is mounted in bearings carried by the bridge B and the other end in bearings supported by a suitable pillar, not shown. On this shaft is mounted and secured the hurdy gurdy wheel proper E, having a suitable number of buckets F of any approved type.

A governor shaft G is mounted in bearings H and I of the yoke C, and receives rotary motion from the wheel shaft D through a pinion J, on the latter, meshing with a gear wheel K on a short shaft L mounted in a suitable bearing M carried by the yoke C; and a beveled pinion O, on the shaft L, meshes with a bevel gear wheel Q on the governor shaft G.

The usual governor balls are connected by the arms S to the shaft G through brackets T; while by links U, a collar V is reciprocated on the shaft G by the centrifugal action of the governor balls.

A yoke W carried by the sliding collar V has connected to it two rods X, one extending down on one side of the yoke C and the other on the other side of it, and so arranged as to clear the several gear wheels and pinions. These rods connect with a lower yoke Y pivoted to an arm Z on the rock-shaft *a*, which latter is mounted in brackets *b* carried by the sill A.

The arm Z has a rear extension *c* provided with a weight *e*, thereby forming a counterbalance for the devices which are borne or supported by the rock-shaft *a*, at its other side through their connection with the arm Z. Thus the work of the governor in manipulating the diverter, as will presently appear, is confined to the actual exertion of overcoming the friction and moving the diverter into and out of the stream, the counterbalance equalizing the gravitating tendency of the parts in so far as they bear down on the arm Z, and hence tend to affect the free movement of the diverter by the governor. In this manner the governor is rendered more sensitive, and hence the diverter is made to more readily pass into and out of the stream with variations in the load or variations in the force of the stream, should the latter occur. This is the automatic arrangement for manipulating the diverter. Should, however, it be desired to adjust the diverter and maintain it in a fixed position with respect to the nozzle and the stream, then the devices shown in Figs. 4 and 5 are employed, in which an arm *f* extends from the sill A and carries a rack-bar

g, which is engaged by a detent h, fitted to an extension i of a counterbalance bar c, and operated by a pitman j and thumb latch k, a spring l being employed to maintain the detent in engagement with the rack-bar. Thus the diverter can be adjusted and held in the desired position.

The letter m designates the nozzle which is located so as to direct its issuing stream into the successive buckets as they pass into the path of the stream by the rotation of the wheel, receiving impulse and reactionary effects from the stream in the ordinary manner, or in such manner as the particular buckets used may effect. We have shown two forms of diverters. One is illustrated in Figs. 1, 6 and 7, in which its arms o are fitted upon the rock-shaft a, and connected by the cross piece p, which forms the diverter proper. These arms are curved, as seen in Fig. 1 and this cross piece is also curved to form a sharp apex q, and curved receding faces r. When the diverter is adjusted into the path of the stream of water the latter strikes the apex q and is divided and thence diverted by the faces r, thus passing to both sides of the path of the wheel and missing the buckets, while the remainder of the stream is unaffected and goes on to and into the buckets, but with less effect in the development in the speed and power than when more or all of the stream passes to the buckets.

From Fig. 6, it will be seen that the upper surface of the bar p is beveled, so that the edge next to the stream is higher than the edge from the stream. This is done to form a sharp corner between the forward side of the bar p and the top of the bar p to prevent the water from hanging on the upper surface of the bar p. Thus the stream is cut more sharply and cleanly by this acute angle of the two surfaces, and the resistance of the entrance of the diverter into the stream is lessened.

Referring to Figs. 2 and 3 it will be seen that the cross-bar p' is set at such an angle that it will divert the intercepted part of the stream downward or away from the wheel instead of from the sides of the wheel. The upper edge of the bar p' is beveled at both sides so as to leave a sharp edge beyond which the undiverted portion of the stream will pass. Thus the stream is cut in a clean and decided manner in either form.

We believe ourselves to be the first to divert more or less of the stream issuing from a nozzle by an adjustable or variable diverter which can be placed, by hand or automatically, more or less in the path of such stream, and we wish to be understood as laying a broad claim to a nozzle and such a diverter in combination with a water wheel whose speed and power are varied by the position of the diverter with respect to the nozzle.

While we have described and shown means which will divert the water to the extent that the diverted portion will entirely clear the buckets, still the diverter might be so modified as to allow some or all of the diverted portion of water to still enter the buckets but at a less effective part of them, that is a part which would produce less rotative effect.

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

1. In a water wheel, the combination with the wheel proper and its buckets, of a nozzle located to deliver its stream of water into the buckets, a water diverter between the discharge end of the nozzle and the wheel, and movable toward and from a line between the nozzle center and the bucket centers, and means combined with said diverter to adjust the same to and from said line and to maintain it more or less in the stream issued by the nozzle, to control the amount of the stream which enters the buckets, substantially as described.

2. In a water wheel, the combination with a wheel proper and its buckets, of a nozzle arranged to direct the stream of water into the buckets, a water-diverter located between the discharge end of the nozzle and the wheel, a governor mechanism operated through the wheel proper and connected to the diverter, whereby the diverter is automatically adjusted into and out of the stream so as to divert more or less of it from its path and hence away from the buckets after the stream leaves the nozzle.

3. In a water wheel, the combination with a wheel proper and its buckets, of a nozzle arranged to direct the stream of water into the buckets, a water diverter located between the discharge end of the nozzle and the buckets, a governor operated through the wheel proper, a traveling collar operated by the governor balls, and rods connected to said collar and to the diverter, whereby the diverter acts to divert more or less of the stream after it issues out of the nozzle from the path of the stream and hence from the buckets.

4. In a water wheel, the combination with a wheel proper and its buckets, of a nozzle arranged to direct a stream of water into the buckets, a movable water-diverter having an apex and one or more surfaces leading therefrom to divert the water so that the diverted portion will not enter the wheel buckets at all, and means to adjust the said movable diverter more or less into the stream and to maintain it to the different adjusted positions, whereby a part of the stream will enter the buckets and a part will not enter the buckets.

5. In a water wheel, the combination with the wheel proper and its buckets, of a nozzle arranged to direct a stream of water into the buckets, a pivoted water diverter having an apex with diverting surfaces at each side of it to divert the water to each side of the wheel, and governor mechanism connected to the diverter to operate it.

6. In a water wheel, the combination with

a nozzle and a water diverter, a rock-shaft which carries it, a governor mechanism connected with the diverter and adapted to move it into and out of the path of the stream issuing from the nozzle, and a counterbalance to effect the equipoise of the mechanism, said counterbalance being located on the opposite side of the rock-shaft from that occupied by the diverter.

7. In a water wheel, the combination with a nozzle, of a water diverter having an apex and two curved surfaces extending laterally from the apex and adapted to divert the water to each side of the wheel.

8. In a water wheel, the combination with a nozzle, of a pivoted water diverter consisting of two arms extending along side of the nozzle, and a diverter proper mounted on the arms and composed of two curved surfaces and a central apex.

In testimony whereof we affix our signatures in presence of two witnesses.

FRANCIS M. BOOKWALTER.
WILLIAM W. TYLER.

Witnesses:
OLIVER H. MILLER,
W. M. MCNAIR.