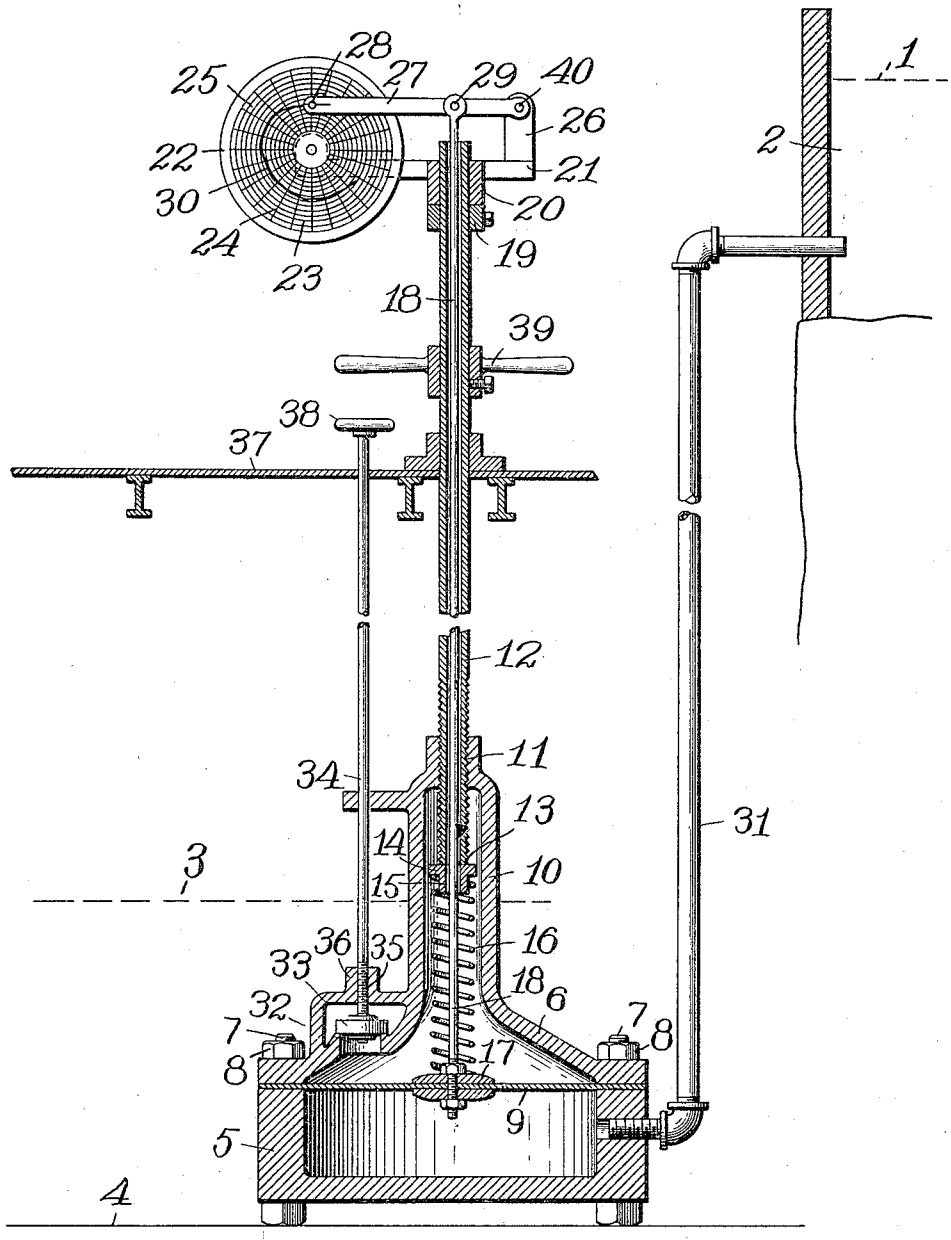
C. M. ALLEN.

HYDROSTATIC RECORDER.

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1,137,945. **Patented May 4, 1915.**



Witnesses

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HYDROSTATIC RECORDER.

1,137,945. Specification of Letters Patent. Patented May 4, 1915.

Application filed February 12, 1912. Serial No. 677,110.

To all whom it may concern:

Be it known that I, CHARLES M. ALLEN, a citizen of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in Hydrostatic Recorders, of which the following is a specification, accompanied by a drawing forming a part of the same.

My present invention relates to an apparatus for recording the variable pressure exerted by a column of water and it is particularly designed to record the variation in the net or differential pressure between two columns of water. This result I accomplish by the construction and arrangement of parts as hereinafter described and pointed out in the annexed claims.

In the accompanying drawing I have represented an apparatus embodying my invention, shown in vertical central sectional view, and applied to the purpose of recording the net or effective water pressure between a column of water supplied from the penstock leading to a water wheel and a column of water, or back water, in the raceway in which the wheel is located, thereby giving the net effective pressure as applied to the wheel.

Referring to the accompanying drawing, the broken line 1 indicates the height of water in the penstock 2 and the broken line 3 indicates the height of the column of back water, or water in the raceway. Resting upon the bottom 4 of the raceway is a cup shaped casing 5, having a cover 6 secured to the casing by bolts 7 and nuts 8. Between the cover 6 and the casing 5 is clamped a flexible diaphragm 9, capable of a slight rising and falling motion as pressure is applied to its under or upper sides. The cover 6 is provided with a concentric tubular extension 10, extending upwardly and having its upper end screw threaded at 11 to receive the screw threaded end of a tube 12. The lower end 13 of the tube 12 bears against a collar 14 having a hub 15. Centered upon the hub 15 is a spiral spring 16, having its lower end resting upon a washer 17 bearing upon the upper side of the diaphragm 9.

Attached to the center of the diaphragm 9 is a rod 18 which extends upwardly through the tube 12. The tube 12 carries near its upper end a collar 19, and supported upon the collar 19 and loosely held upon the upper end of the tube 12 is a hub 20 to which is attached a framework 21. The framework 21 supports a circular rotatable disk 22 which, in the operation of the machine, is rotated slowly by means of a clockwork, not shown. Upon the disk 22 is placed a graduated disk of paper 23, divided by radial lines 24 into twenty-four equal spaces. The paper disk 23 is also divided by a series of concentric circular lines 25. The clockwork is adjusted to rotate the disk 22 through one complete revolution during each twenty-four hours, so that one of the radial lines 24 will pass a given point at each hour of the day. The concentric circular lines 25 are equally spaced and serve to indicate, as hereinafter described, the difference or net pressure exerted upon opposite sides of the diaphragm 9.

Pivoted to a bracket 26 on the framework 21 is a lever 27 carrying in its free end a pencil 28. The lever 27 is pivotally connected at 29 with the rod 18, so that any rising or falling movement of the diaphragm 9 will be communicated through the rod 18 and lever 27 to the pencil 28, causing a line 30 to be marked upon the recording paper disk 23. By numbering the radial lines 24 to indicate the hours of the day and numbering the concentric circular lines 25 to indicate the differential pressure upon the diaphragm 9, a perfect record will be made for each hour of the day showing the net or effective pressure exerted upon the diaphragm. Pressure is exerted upon the under side of the diaphragm 9 by means of the column of water from the penstock 2 supplied through the pipe 31.

The cover 6 is provided with an opening 32 which may be closed, when desired, by a valve 33 carried upon a valve stem 34. The valve stem 34 is provided with a screw thread 35 which engages a screw threaded opening in a bracket 36. The valve stem 34 extends upward through a floor 37 of the wheel pit and is provided with a hand wheel 38, by which the valve 33 may be raised and lowered by the rotation of the valve stem. By raising the valve 33 water is admitted through the opening 32, thereby exerting a pressure upon the upper side of the diaphragm 9 due to the elevation of the water line 3. Attached to the tube 12 are handles 39, by which the tube 12 may be rotated in

order to vary the position of the collar 14 and thereby regulate the tension of the spring 16.

Any difference in the temperature of the rod 18 will, of course, produce an expansion or contraction of the rod, but any difference in the length of the rod is compensated for by a like expansion or contraction in the tube 12, which raises or lowers the framework 21 resting upon the collar 19 and, consequently, varies the position of the pivotal point 40 of the lever 27 to correspond with any variation in the position of the pivotal point 29. For example, if the rod 18 becomes expanded by heat so as to raise the pivotal point 29, the corresponding expansion of the tube 12 will likewise lift the framework 21 and raise to the same extent the pivotal point 40, causing the variation in the pivotal point 40 to counteract the variation in the pivotal point 29.

The tension of the spring 16 is adjusted to maintain the diaphragm 9 in a horizontal or central position under normal pressures upon the opposite sides of the diaphragm. When the spring 16 has been thus adjusted, any increase in the net pressure upon the under side of the diaphragm will raise the pencil 28 and cause the recording line to be marked upon the paper disk nearer its periphery, while an increase in the net pressure above the diaphragm will cause the pencil 28 to be moved toward the center of the disk. If it is desired to record any variation in the pressure of the column of water applied through the pipe 31 independently of any variation in the pressure applied above the diaphragm, the opening 32 is closed by the valve 33. When the valve 33 is closed, the pressure upon the upper side of the diaphragm will be constant and due to the body of water already contained within the cover 6, while any variation in the pressure applied to the under side of the diaphragm will produce a movement of the pencil 28.

For convenience in construction I mount the recording apparatus upon the top of the tube 12, which also serves as the means for adjusting the tension of the spring 16. For the purpose of compensating for variations in temperature, it is only necessary that the metallic support for the recording apparatus and the rod 18 should be substantially parallel and of substantially the same length and constructed of metal having a like coefficient of expansion. Instead of the paper disk ruled as above described, any of the known forms of recording mechanisms adapted to be used with a variable marker may be employed.

I claim,

1. In a hydrostatic recorder, a casing, a yielding diaphragm inclosed therein, there being openings into said casing from outside the recorder to conduct liquid under pressure from different sources to the opposite sides of said diaphragm, an adjustable spring applied to said diaphragm to balance the normal difference between the pressures on the opposite sides of the diaphragm, whereby various normal differences between said liquid pressures may be balanced by varying the adjustment of said spring, and means for adjusting said spring.

2. In a hydrostatic recorder, a yielding diaphragm, means for conducting liquid under pressure from different sources outside the recorder to the opposite sides of said diaphragm, means for recording the movements of said diaphragm under varying pressure in terms of pressure, and means for compensating said recording means for variations in temperature.

3. In a hydrostatic recorder, a yielding diaphragm, means for conducting liquid under pressure from different sources outside the recorder to the opposite sides of said diaphragm, means for applying an independent pressure to one side of said diaphragm to balance the normal excess of pressure on the opposite side of said diaphragm, and means for recording the movements of said diaphragm under varying differences in the pressures on the opposite sides of the diaphragm.

4. In a hydrostatic recorder, a casing, a yielding diaphragm inclosed therein, there being openings into said casing from outside the recorder for conducting liquid under pressure from different sources to the opposite sides of said diaphragm, a spring applied to one side of said diaphragm to balance the normal difference in the pressures on the two sides of the diaphragm, means for varying the tension of said spring, a recording mechanism comprising a pivoted lever, a rod attached to said diaphragm and pivotally connected with said lever, and a metallic support for said recording mechanism parallel with and substantially the length of said rod.

5. In a hydrostatic recorder, a casing, a yielding diaphragm inclosed therein and forming two chambers, there being an opening into one of said chambers to conduct fluid under pressure from a source outside the recorder to one side of said diaphragm and an opening leading from outside the recorder into the other chamber to permit the introduction of liquid to a predetermined height so as to exert a predetermined constant pressure on the other side of the diaphragm, and recording mechanism connected with the diaphragm to indicate differences in the pressures on the two sides of the diaphragm.

6. In a hydrostatic recorder, a casing, a yielding diaphragm inclosed therein and forming two chambers, there being an opening into one of said chambers from outside

the recorder to conduct liquid under pressure to one side of the diaphragm, and a valve controlled passage leading from outside the recorder to the other of said chambers to conduct liquid under pressure to the other side of the diaphragm, a spring applied to said diaphragm, and a recording mechanism controlled by the movements of said diaphragm.

7. In a hydrostatic recorder, the combination with a casing horizontally subdivided by a flexible diaphragm, of a pipe leading to the chamber below the diaphragm, said chamber having an opening above the diaphragm, means for controlling the opening into the chamber above the diaphragm, a rod extending from the diaphragm, a tube surrounding the rod and adjustably connected with the casing, recording means supported by the tube and rod, and a spring surrounding the rod between the diaphragm and the tube, the tube screw-threaded into the casing in position to create pressure upon the spring, this pressure being regulated by the position of one end of the tube in the casing.

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Witnesses:
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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."