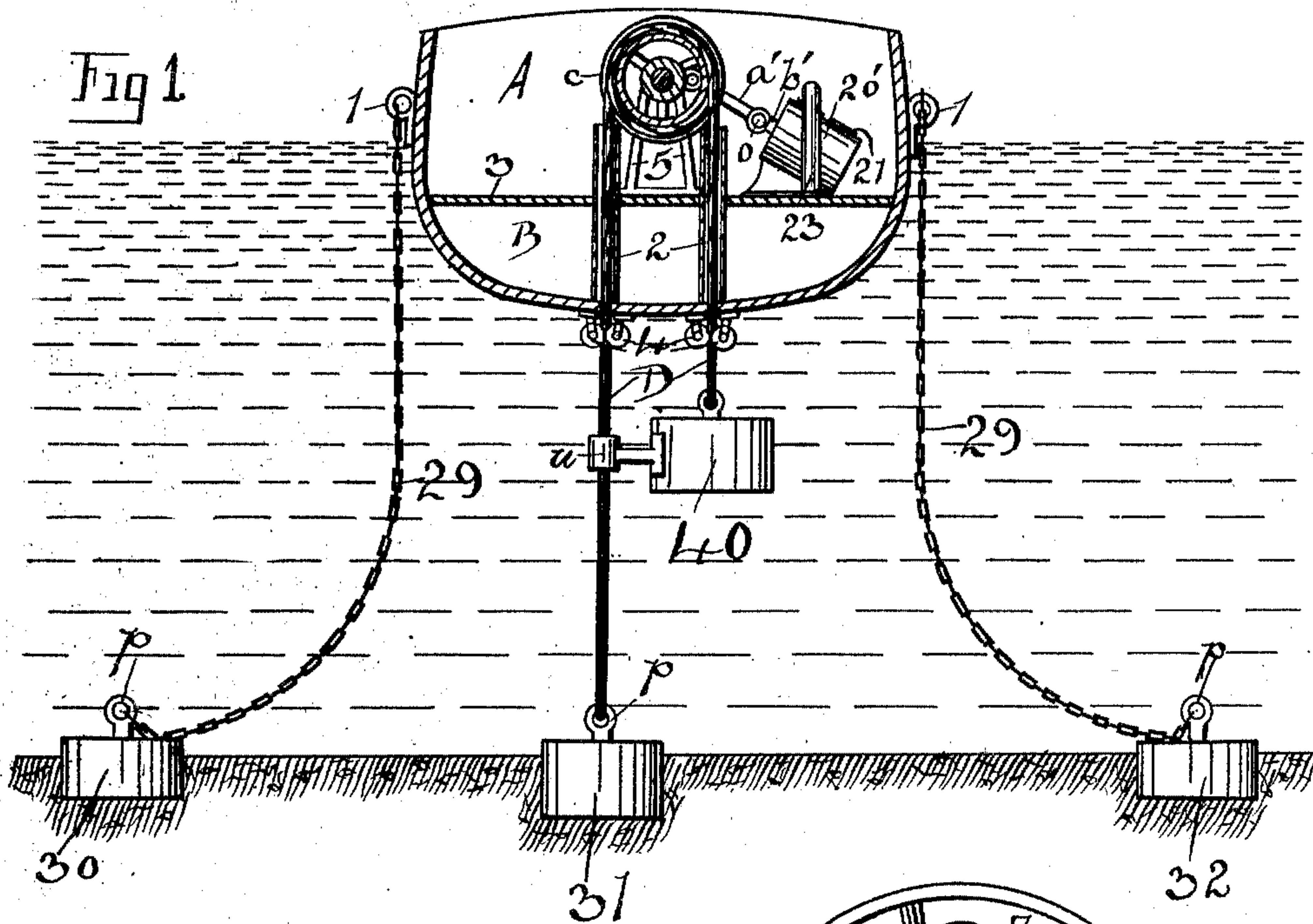


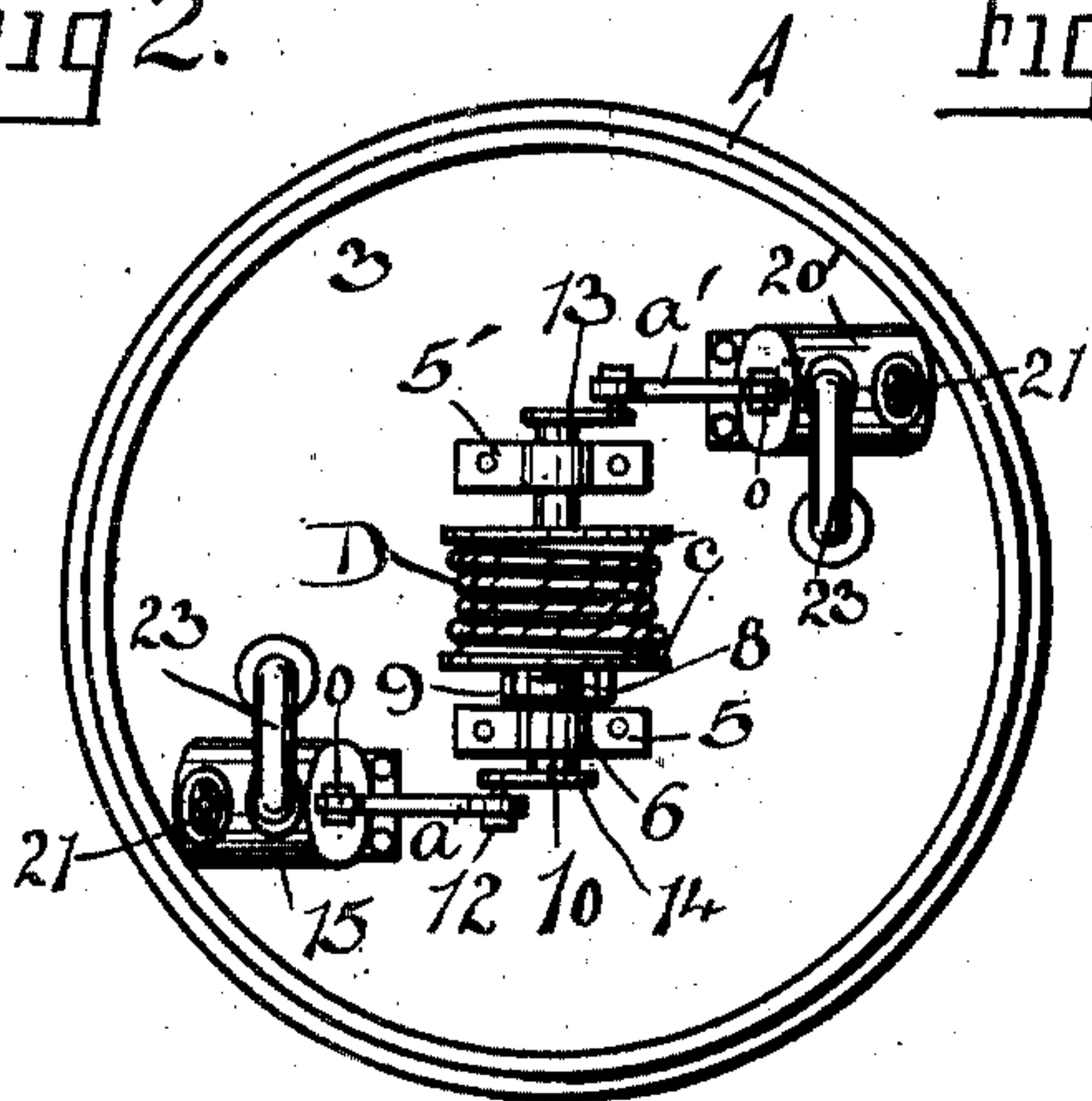
No. 817,317.

PATENTED APR. 10, 1906.

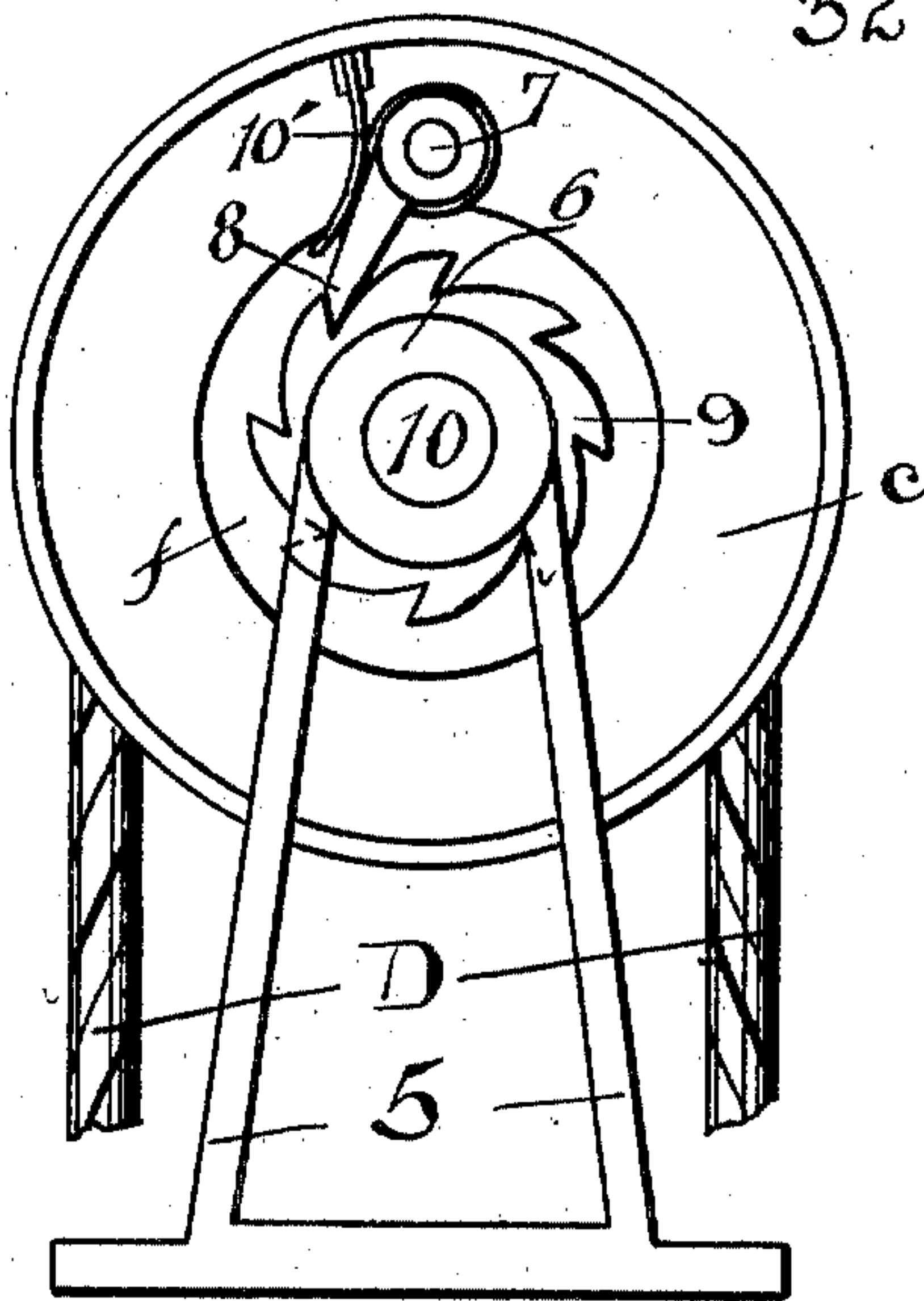
G. W. HAZEL.  
TIDE AND WAVE MOTOR.  
APPLICATION FILED AUG. 9, 1904.



**Fig 2.**



**Fig 3.**



WITNESSES:  
H. I. Sues  
Marion S. Poehle.

George W. Hazel  
George W. Sues  
BY *[Signature]* Attorney



# UNITED STATES PATENT OFFICE.

GEORGE W. HAZEL, OF AURORA, ILLINOIS.

## TIDE AND WAVE MOTOR.

No. 817,317.

Specification of Letters Patent.

Patented April 10, 1906.

Application filed August 9, 1904. Serial No. 220,110.

*To all whom it may concern:*

Be it known that I, GEORGE W. HAZEL, a citizen of the United States, and a resident of Aurora, in the county of Kane and State of Illinois, have invented a new and novel Improvement in Tide and Wave Motors, of which the following is a specification.

The aim of my invention is to construct a buoyant member which is confined in being anchored by means of suitable slack chain cables or hawsers, so that the buoyant body or member may rise and fall in obedience to the action of wind, waves, the tide, and swells, and this rising-and-falling movement is utilized to actuate a shaft to operate an air-compressor to compress the air which is stored within a suitable tank of the vessel, as will be described more fully hereinafter.

In the accompanying drawings I have shown in Figure 1 a sectional view with portions removed of a tide and wave motor embodying my invention. Fig. 2 shows a top view of a buoyant body as used in my invention, while Fig. 3 discloses an enlarged detached detail of one of the brackets and disclosing the arrangement of the pawl and ratchet as used in my invention.

In carrying out the aim of my invention I use a suitable buoyant body A of any suitable conformation, though the same in Fig. 2, in order to more freely respond to the action of the water, is shown as round. This buoyant body by means of the flooring 3 provides the lower air-chamber B, through which pass the tubes 2 2, forming wells through which passes a suitable operating-cable D, as shown in Fig. 1.

At suitable points the buoyant body is provided with the rollers 4, between which the operating-cable passes. At suitable points within this buoyant vessel are the standards 5 and 5', which support a suitable driving-shaft 10, provided at the ends with the cranks 13 and 14, secured to the pitmen *a* and *a'*, fastened by means of the pins *o* to suitable piston-stems *b'*, as shown in Fig. 1, forming part of the air-compressors 15 and 20', these air-compressors being provided with the intake-valves 21 and the usual valved exit-pipes 23, which empty into the tank B. This driving-shaft 10 carries a suitable hub *f*, and upon this hub is held the drum *c*, about which is wound the operating-cable D. This drum *c* rotates about the shaft 10, which shaft is provided with the ratchet-wheel 9, in engagement with the

pawl 8, secured to a pin 7, held within the drum *c*, as shown in Fig. 3, so that by this arrangement the shaft 10 may be revolved in one direction, the pawl 8 preventing the shaft rotating in an opposite direction. A spring 10' insures the pawl working in engagement with the ratchet 9.

The operating-cable D, which works upon the drum *c*, is anchored below to the anchor 31, provided with the ear *p*, and after passing over the drum is continued downward and provided with the counter poise or weight 40, as shown, so that this operating-cable is drawn tense at all times by means of this counterweight 40.

Secured to the ears 1 of the buoyant body are the slack chains 29, secured to the ears *p* of the anchors 30 and 32, as shown in Fig. 1.

Now in the construction as disclosed when the buoyant body is raised the pawl 8, secured to the drum *c*, will engage and operate said shaft 10 by means of the ratchet 9. As soon as the buoyant body recedes and goes downward the weight 40 will take up the slack within the cable D to rotate the drum *c*, which then freely rotates over the hub *f*. From this it will be seen that during the upward movement of the vessel the shaft is rotated in one direction, during which the compressors 15 and 20' are actuated. The counterweight 40 is carried upward and downward, owing to the movement of the buoyant vessel in obedience to the action of the water, and while moving in one direction the drum *c* rides dead over the shaft 10, though while traveling in the opposite direction the shaft 10 is engaged by the drum to be rotated, and this rotation of the shaft 10 is utilized to operate the air-compressors 15 and 20'. The weight 40 is provided with a bracket *u*, through which the cable D passes.

In this construction by virtue of the slack chains 29 the upward movement of the buoyant body is converted into motive force; but any side or lateral movement is also converted and stored into motive power, as the slack chains 29 permit the body to move laterally a suitable distance.

The compressed air stored within the tank B may be used directly at the vessel or be piped to any suitable point, and so, also, could the movement of this shaft 10 be used to wind a spring-motor or operate any other suitable appliance.

While I have shown but one of the driving-shafts 10 and one cable B, it is of course un-



derstood that such a vessel could use a plurality of cables to operate a plurality of shafts and connected air-compressors.

Having thus described my said invention, what I claim as new, and desire to secure by United States Letters Patent, is—

The combination with a round buoyant body provided with a lower air-chamber, open-ended tubes passing through said body, a suitably-supported crank-shaft carried by said body, air-pumps communicating with said chamber secured to said cranks, a drum

upon said shaft, a cable passing over said drum, both ends of said cable being carried downward through said tubes, one end of said cable being anchored below, and a weight secured to the remaining end of said cable.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE W. HAZEL.

Witnesses:

GEORGE W. SUES,  
MAMIE S. POEHL.