W. L. R. EMMET.

FLYWHEEL.

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1,365,473.

Patented Jan. 11, 1921.

Fig.1.

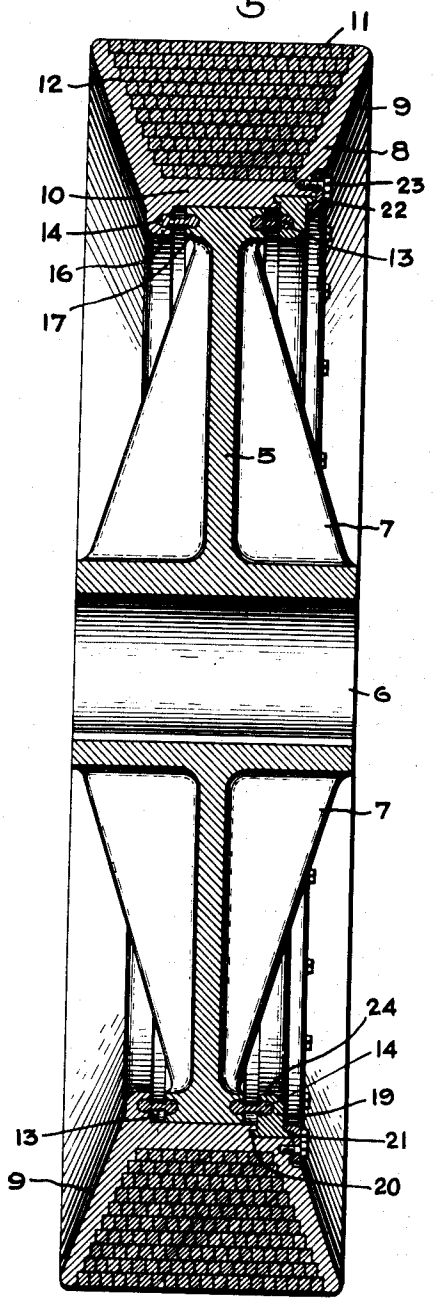


Fig.2.

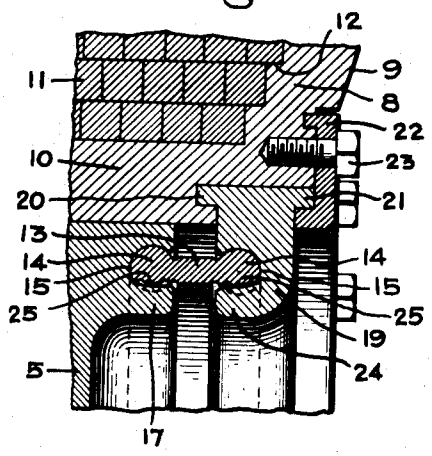


Fig.3.

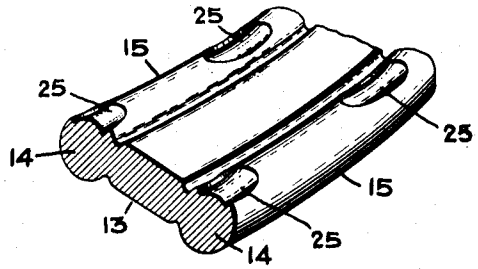
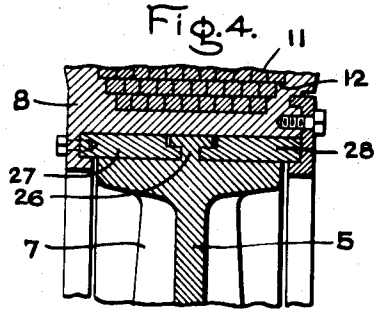


Fig.4.



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UNITED STATES PATENT OFFICE.

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FLYWHEEL.

1,365,473. Specification of Letters Patent. Patented Jan. 11, 1921.

Application filed November 19, 1918. Serial No. 263,129.

To all whom it may concern:

Be it known that I, WILLIAM L. R. EMMET, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Fly-wheels, of which the following is a specification.

The present invention relates to fly-wheels, and especially to those of relatively large size designed to operate at high peripheral speeds. More specifically my invention relates to fly-wheels for stabilizing gyroscopes used on board large vessels, such as battleships, for example.

Fly-wheels as commonly made are composed of a heavy rim and an integral or rigidly connected web or spokes carried by a hub to receive the driving shaft.

Where speeds high enough to cause appreciable elastic elongation of the rim are desired such constructions become impracticable or undesirable because of strains imposed upon the inner parts by the elastic elongation of the rim under the strain of centrifugal force.

The object of my invention is to provide a fly-wheel of improved construction, and for a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and claims appended thereto.

In the accompanying drawing Figure 1 is an axial section of my improved fly-wheel, Figs. 2 and 3 are enlarged details of the means for attaching the rim of the web, the latter figure being an inverted view, and Fig. 4 is a sectional detail view of a modification.

Referring to Fig. 1, 5 indicates the web of the wheel, 6 the shaft opening, 7 reinforcing ribs on the sides of the web, and 8 the rim. As an illustration but not as a limitation, my invention is described in connection with a fly-wheel which is fourteen feet in diameter, has a shaft speed of 750 R. P. M. and a peripheral speed of 550 feet per second. In such a fly-wheel the metal would be stressed to about 32,000 lbs. per square inch at the periphery. It is to be noted that the rim instead of being made integral with the web or rigidly united as is the usual construction is made of a separate piece. Further that the rim, as will appear more fully later, is made self-supporting so that strains therein are not transmitted to the web and hub. Between the rim and web are means for transmitting torque from one to the other, said means also being of such character that they permit the rim to enlarge slightly due to centrifugal stresses, independently of the web and at the same time prevent the transmission of such stresses from the rim to the web and hub.

The rim 8 is made of a good grade of cast steel and instead of being solid is substantially V-shaped in cross-section with flaring sides 9 and a bottom wall 10 whose inner surface initially makes a sliding fit with the periphery of the web and whose outer face is turned concentric with the inner and is adapted to receive the lower turns of the flat wire 11 with which the rim is wound. It is desirable to make the inner portion of the rim narrower than the outer because a more favorable distribution of the metal is thereby obtained. The rim thus formed can be easily cast without flaws because the section of the metal at any one point is not large. Such a rim, however, is not self-sustaining at the required speeds neither is it heavy enough for the purpose. I obtain the necessary strength and weight by winding it with some strong wire, such as steel, for example, under suitable tension. In some cases, however, I may make the rim of a forging or two or more forgings.

The sides 9 of the rim are provided with shoulders or steps 12 to receive the wire and it will be noted that the axial length of the layers successively increases toward the periphery. The rim is wound with steel wire of square or rectangular section, the turns in each layer being in contact with adjacent turns in the same layer and also with adjacent turns in the next layer. In this manner the maximum amount of wire can be applied for a given space. The wire is wound on the rim, under a moderate initial tension, say 15,000 lbs. per square inch for example, and the cast steel rim is stressed to about the same amount. The engagement of the web with the inner surface of the rim prevents the latter from collapsing due to the compression carried by the wire. This engagement is however not necessary to the success of the construction. In winding the wire, the inner end is first suitably fastened to the wall 10 and the wheel revolved, there being a suitable tension device acting on the

wire. The outer end can be secured in any convenient manner, as for example, by upsetting it in a tapered slot in one of the sides 9 and afterward welding the end.

A rim constructed in the manner set forth is self sustaining, but it will enlarge slightly when subjected to heavy centrifugal forces when in operation. To permit of this and at the same time prevent the stresses incident thereto from being transmitted to the web and hub, a special form of connecting means is provided. On each side of the web is an expansion ring 13 which is dumb-bell shape in cross-section. That is to say, the extremities 14 of the rings are enlarged and the surfaces thereof are turned to form cylindrical surfaces 15. Each extremity is seated in an annular socket of a section corresponding to the edge of the ring. The rim and web each have two such sockets. The left-hand socket of the rim is formed by cutting away the metal thereof, and one wall, such as lip 16, is rolled over under heavy pressure to complete the socket and secure the expansion ring in place, or the lip may be so shaped that the ring can be sprung into place without rolling or such springing into place can be facilitated by heat expansion. A similar socket is formed in the adjacent face of the web and is similarly secured by lip 17. The other side of the web is provided with a similar socket and the right-hand ring is put into place in the same manner. The right-hand socket in the rim is formed in a separate detachable piece 19 which is attached to the rim in any convenient and suitable manner. For example, the piece is provided with an annular tongue or projection 20 which is fitted into a groove in the rim and a second annular tongue or projection 21 which is engaged by a removable side plate 22, the latter being held in place by a plurality of bolts 23. After the enlarged end of the expansion ring is mounted in the piece 19 and the latter secured to the rim, the lip 24 is rolled into place to form the remainder of the socket.

The rounded ends of the expansion rings being seated in similarly shaped sockets permit the parts to move slightly one on the other, and in this manner the rim and the web are permitted to take their respective positions due to centrifugal force without causing the stresses in one member to be transmitted to the other.

Where it is necessary to transmit large torque between the rim and web while at the same time permitting the rounded ends of the rings to roll slightly in their sockets, torque transmitting means can be provided. To this end the rounded edges of the rings can be provided with recesses as indicated at 25, and when the lips of the socket are rolled into place, the metal thereof enters said recesses and prevents relatively circumferential movement of one part on the other, without however, interfering with the slight rolling action of the ring extremity in its socket.

Fig. 4 shows another application of the principle. In this case the inner member of the wheel is provided with a T-shaped projection 26. The yielding connection between said inner member and the rim 8 comprises two rings 27 and 28, the inner edges of which enter the grooves on opposite sides of the projection. The outer edges of the rings are secured to the rim by suitable clamps. When the rim enlarges due to elastic elongation the outer edges of the rings move outward, the inner edges acting as pivots. In this connection it is to be noted that the movement is very small. In addition to functioning as above described the rings 27 and 28 also serve to support the rim while it is being wound with wire under tension.

In accordance with the provisions of the Patent Statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In a fly-wheel, the combination of a member adapted to be mounted on a driving shaft, a rim member which is self-supporting, and pivoted means for uniting the members which transmits torque from one to the other and also prevents a large proportion of the centrifugal strains in one member from being transmitted to the other.

2. In a fly-wheel, the combination of a member adapted to be mounted on a driving shaft, a rim member which is self-supporting, and a ring connecting said members which transmits torque from one to the other without transmitting from one to the other any large proportion of the centrifugal strains or elastic elongation resulting therefrom, said ring being pivotally supported.

3. In a fly-wheel, the combination of a member adapted to be mounted on a driving shaft, a rim member which is self-supporting, and a ring having enlarged extremities which are seated in sockets carried by the two members, said ring transmitting torque and yielding in a direction perpendicular to the axis of the wheel to compensate for the effects of centrifugal strains.

4. In a fly-wheel, the combination of a central member adapted to be mounted on a driving shaft, a rim member which surrounds the central member, and a pair of

rings one on each side of the central member, one extremity of each ring being pivotally supported in a member thereby permitting it to yield in a direction perpendicular to the axis of the wheel and to prevent a large proportion of the centrifugal strains in one member from being transmitted to the other.

5. In a fly-wheel, the combination of a central member adapted to be mounted on a driving shaft, an element which is wound with wire under tension so as to form a self-supporting member, and means for transmitting torque from one member to the other which yields in a direction perpendicular to the wheel axis to prevent centrifugal strains from being transmitted from one member to the other.

6. In a fly-wheel, the combination of a central member adapted to be mounted on a driving shaft, an element which surrounds the first and is wound with wire under tension to make it a self-supporting member, a ring located on each side of the central member which is provided with enlarged extremities which are seated in sockets in said members, said rings transmitting torque from one member to the other and both yielding in a direction perpendicular to the wheel axis to prevent the transmission of centrifugal strains from one member to the other.

7. In a fly wheel, the combination of a member adapted to be mounted on a driving shaft, a rim member which is self-supporting, and rings which are pivotally supported on the members for connecting them.

8. A fly wheel comprising a hub, a web portion, a hollow rim portion mounted on said web portion, radially yieldable means connecting said portions, and convolutions of wire within said rim portion.

9. In a fly wheel, the combination with a hub and a web, of a rim mounted on said web, and means for resiliently holding said rim against expansion away from said web, said means comprising a ring-like member having one edge engaging said rim and the other edge engaging said web.

10. In a fly wheel, a hub, a web integral therewith, a rim mounted on said web, and means for resiliently locking said rim to said web comprising a plurality of circular bands, each band having one edge engaging said rim and the other edge engaging said web.

11. In a fly wheel, a hub, a web, a rim mounted on said web, a ring-like member on each side of said web connecting the same with said rim, said rings being adapted to permit radial expansion of the rim and to prevent lateral displacement thereof.

In witness whereof, I have hereunto set my hand this 18th day of November, 1918.

WILLIAM L. R. EMMET.