A. M. KRUGER.

DERRICK BULL WHEEL.

APPLICATION FILED AUG. 2, 1910.

979,173.

Patented Dec. 20, 1910.

2 SHEETS—SHEET 1.

FIG. 1

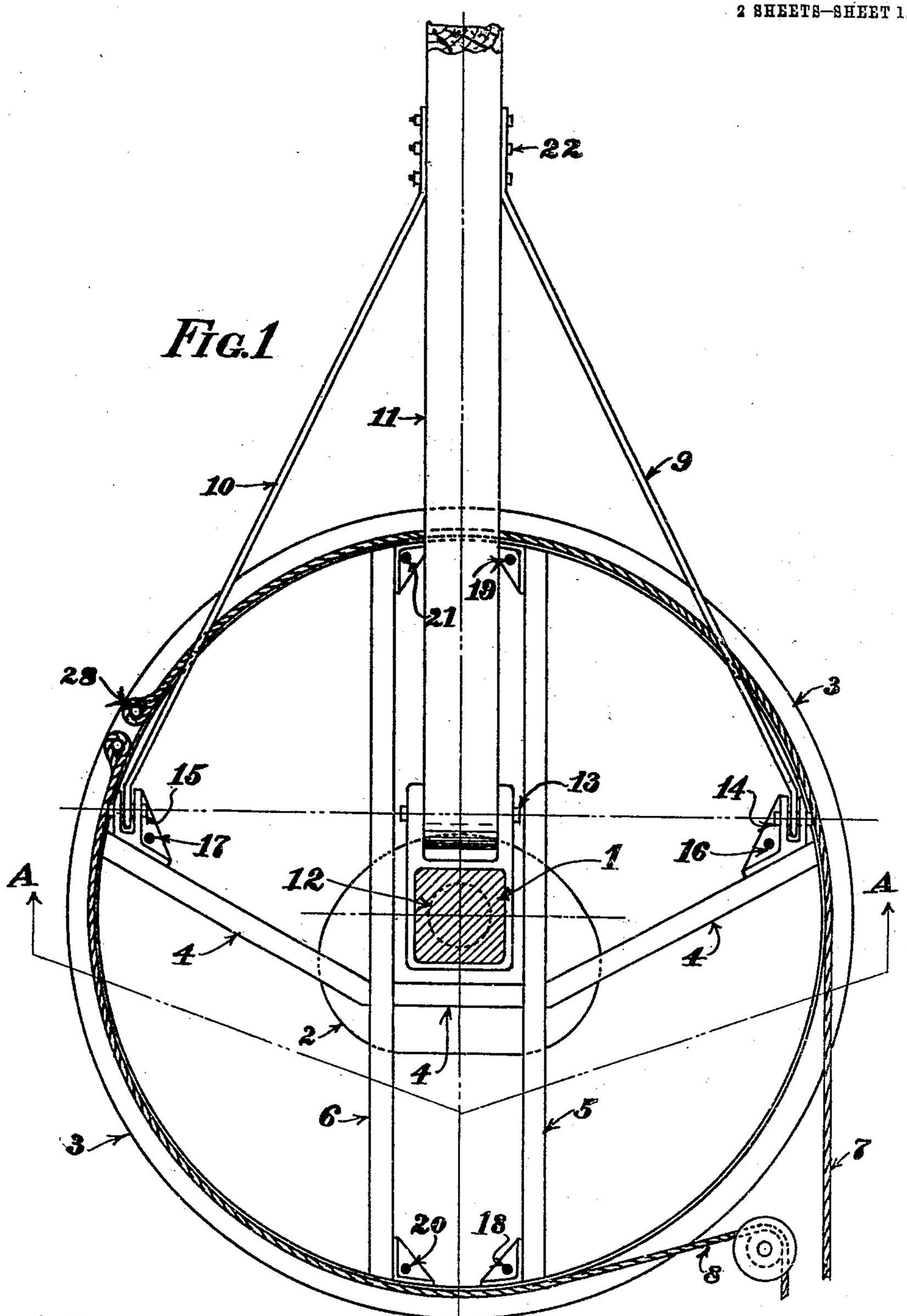

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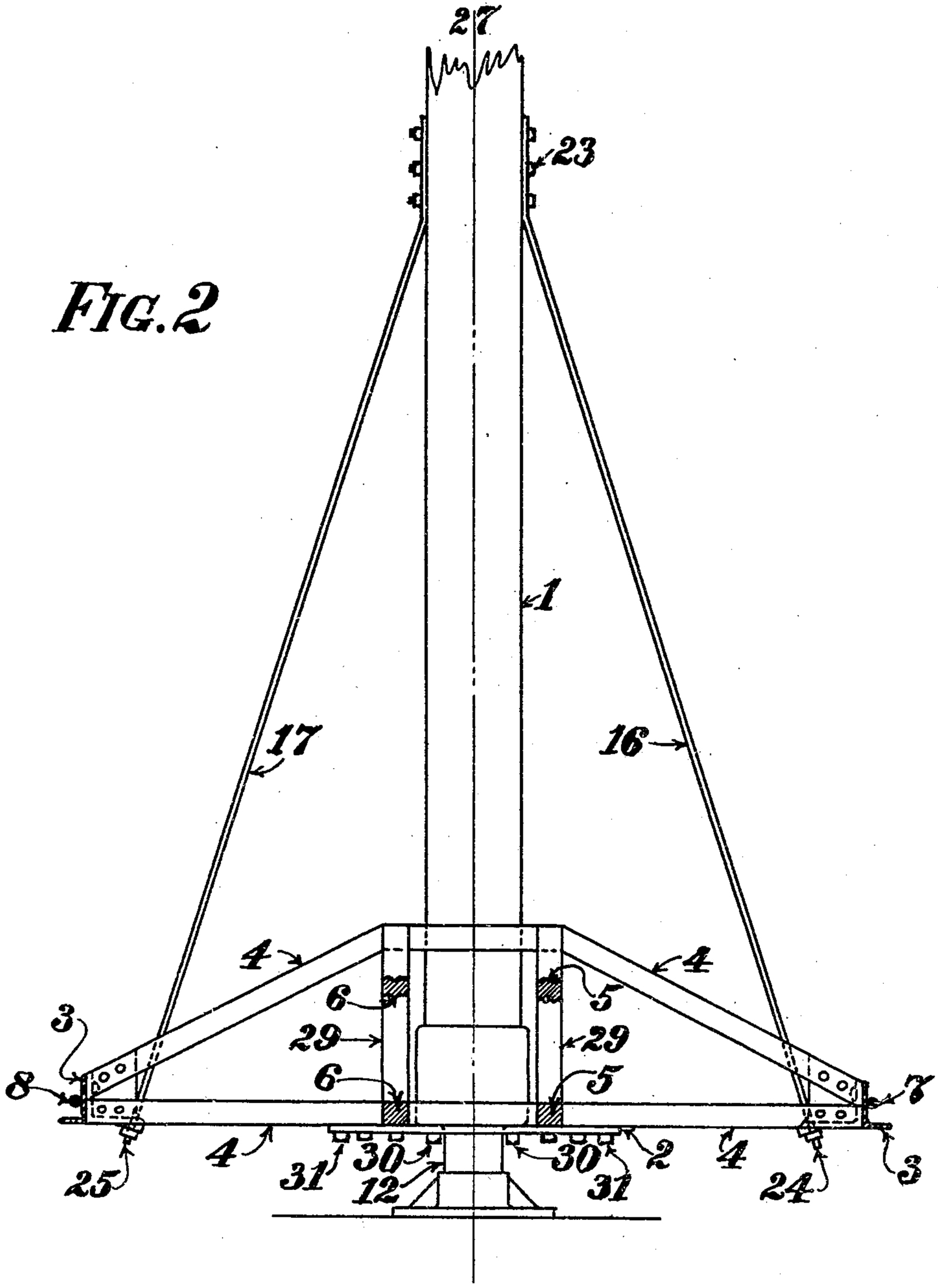
FIG. 2



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UNITED STATES PATENT OFFICE.

ALBERT M. KRUGER, OF DULUTH, MINNESOTA.

DERRICK BULL-WHEEL.

979,173. Specification of Letters Patent. **Patented Dec. 20, 1910.**

Application filed August 2, 1910. Serial No. 575,114.

To all whom it may concern:

Be it known that I, ALBERT M. KRUGER, a citizen of the United States, residing at Duluth, in the county of St. Louis and State of Minnesota, have invented a new and useful Improvement in Derrick Bull-Wheels, of which the following is a specification.

My invention relates to the bull wheel fastened to the lower end of a derrick for swinging the latter about its pivot by means of ropes having one end fastened on an engine drum and the other end wrapped around said wheel.

My invention relates in particular to that style of bull wheel having tie rods extending from points near the circumference of the bull wheel to a point on the boom some distance from the bull wheel; and my invention relates especially to the parts of a bull wheel arranged to brace the wheel against buckling and tipping out of a horizontal plane.

The objects of my invention are, first, to provide bracing in the bull wheel which will make it rigid in a direction perpendicular to the plane of its diameters so that it cannot change its shape under the action of a force lifting at one point of its circumference, but will tend to tip it as a unit under the action of such a force, second, to provide suitable members to resist such tipping of the wheel as a unit, third, to arrange the parts necessary to stiffen the wheel and to hold it in position, in such a manner that a wheel which fits one size of mast will fit other sizes of mast without altering any parts, in other words, will be interchangeable on different sizes of derricks, and fourth, to reduce the bending in the mast due to the side thrust of the bull wheel braces used to prevent the wheel from tipping. I attain these objects by the arrangement illustrated in the accompanying drawings.

Figure 1 is a top or plan view of a derrick bull wheel, a section of the mast being taken some distance above the bull wheel. The mast appears in section at 1, and the lower portion of the boom at 11. Fig. 2 is a sectional elevation close to the mast, along the line A A in Fig. 1, and looking in the direction of the arrows at A and A.

The pivot about which the whole machine swings is 12. On this pivot is the plate 2, forming the center of the bull wheel. The plate 2 is held against the pivot and bottom of the mast so that the bull wheel remains central on the center of the mast, but this attachment does not keep the wheel from tipping in case a lifting load is applied at one point of the rim, as for instance at the point 24. The center plate 2, is kept from any horizontal sliding movement in regard to the center line of the mast by means of the cap screws 30, screwed through the plate 2, into the shoulders of the mast bottom casting around the upper part of the pivot 12, in which casting the mast timber is set.

The rim of the bull wheel is shown at 3, and serves to hold the ropes 7 and 8, by pulling on which the derrick boom is caused to swing either to the right or to the left. The boom 11, is hinged on the pin 13.

9 and 10 are rods fastened to the bull wheel with the hinge pins 14 and 15 respectively and to the boom with the bolts 22. The pins 13, 14 and 15 are in one line so that the boom 11, and the rods 9 and 10, have a common hinge line when the outer end of the boom is raised or lowered. The rim 3, of the bull wheel is kept in a circumferential position about the center of the mast 1, by means of the braces marked 4, 5 and 6, and the bull wheel is held perpendicular to the center line of the mast 26—27, by means of the rods 16 and 17, respectively fastened to the bull wheel at 24 and 25 and to the mast at 23. Similar rods shown in section at 18, 19, 20 and 21, keep the bull wheel at right angles to the mast against lifting on the rim at the back or front of the derrick (calling front the direction in which the boom extends from the mast bottom).

In my arrangement of the girders 4, 4, 4, 4, and 5 and 6, a vertical sectional elevation parallel to the center line of the boom, would show the girders 5 and 6 to be of a form similar to the form in which girder 4, 4, 4, 4, appears in Fig. 2, the upper members of girders 5 and 6 being inclined downward from a point near the mast till the outer ends reach the level of the bull wheel rim 3, near the rods 18, 19, 20, and 21. The pieces marked 29, 29, are struts under the bend points of the upper inclined members of the girders 4, 4, 4, 4, and 5, and 6. These struts are riveted at their upper and lower ends to the girders 4, 4, 4, 4, and 5, and 6, and serve to hold the girders connected and in their spread shape near the mast.

In Fig. 1, the rods 16, 17, 18, 19, 20, and 21, are shown to be located in small angle-shaped pieces. These angle-shaped pieces are riveted to the ends of the girders 4, 4, 4, 4, and 5, and 6, respectively, and to the rim 3, of the bull wheel; and by being so riveted to the girders and the rim they form rigid connections between the girders and the rim.

The action of such a bull wheel is as follows. The ends, not shown, of the ropes 7 and 8 are fastened on suitable engine drums capable of exerting a pull on one or the other of the ropes 7 and 8. Suppose the engine is exerting a tension on the rope 7. This rope being fastened to the bull wheel (as indicated at 28), tends to draw the point 28 and consequently the bull wheel 3, around in a clockwise direction (referring to the plan view Fig. 1). The hinge pin 14 being secured to the bull wheel, also tends to rotate in a clockwise direction and hence the rod 9, exerts a pull on the boom tending to cause the latter to swing in a clockwise direction. Thus the function of the bull wheel 3, and the rod 9, is to cause the boom to swing as long as any of the rope 7, is wound on the rim 3, by dragging at a point of the boom some distance from the hinge, without any undue strain coming on the hinge pin 13. If the outer end of the boom is lowered so as to be at the same elevation as the hinge 13, the bull wheel 3, the rod 9, and the boom 11, are approximately in one horizontal plane and the pull of the rope 7 is transmitted to the boom in a horizontal plane, the girder 4 (at the side where pin 14 is), acting simply as the spoke of any ordinary wheel having pressure at the rim; and there is no force tending to warp the wheel or the rim of the wheel out of its proper horizontal plane. Now if the outer end of the boom is raised so that the boom 11, stands at some angle to the horizontal, then the rod 9, will also be inclined to the horizontal and a pull in this rod 9, can be resolved into two components at right angles to each other, one vertical and the other horizontal. The horizontal component acts in the plane of the wheel and is taken care of by the horizontal spokes and rim of the wheel. However, the vertical component of a stress in the rod 9, when the latter is at an oblique angle to the ground, exerts an uplift on the rim 3, of the wheel at the hinge 14.

I attain the first and second objects of my invention by the arrangement of the parts of the bull wheel which carry the vertical component of a force in the rod 9, just described. These parts are shown most clearly in Fig. 2. The parts 4, 4, 4, 4 form a girder extending from side to side of the bull wheel and are fastened by means of screws shown at 31, 31, in Fig. 2, to the center plate 2, which plate is resting against the bottom of the mast so that the girder cannot rise bodily by any force lifting on it, but can only tip, permitting one end to rise while the other lowers a corresponding amount. Thus, a force tending to raise the bull wheel at the pin 14, (Fig. 1), tends to raise the end of the girder 4, 4, 4, 4, (Fig. 2) at the side of the wheel where the rope 7, is shown in cross section, and to lower the end of this girder at the side of the wheel where the rope 8, is shown in cross section. At the point 25, I fasten the rod 17, the other end of which is secured to the mast at some suitable height (23) of the mast. This rod 17, prevents the end 25, of the girder 4, 4, 4, 4, from lowering. I make this girder strong enough to carry in a transverse direction, the vertical component of the stress in the rod 9, at one of the girder's ends, and the vertical component of the stress in the rod 17, at its other end, and hence the bull wheel is braced rigidly in the plane of the forces acting normal to the plane of the diameters of the bull wheel, and warping of the rim of the bull wheel is prevented, which is the first object of my invention. Also, the rod 17, prevents the bull wheel from tipping due to an upward pulling force in the rod 9, and this is the second object of my invention.

By the term "bottom of the mast" is meant the hollow iron block into which the mast timber is set and of which iron the pivot 12, is a lower projecting part. The shoulders of the square part of this iron where the upper part of the pivot 12, ends, form the convenient abutment where it is customary to place the center 2. Plate 2 is bolted to the girders 5, and 6, in a similar manner as to girder 4, 4, 4, 4. Plate 2, although fastened to the bottom of the mast in the manner shown, is not stiff enough to keep the wheel from tipping in respect to the center line of the mast.

A similar arrangement of rods at the opposite side from the one specifically described above, produces the same effect of stability in the bull wheel when the rope 8, pulls the wheel in the counter-clockwise direction. The rod 16, is then the one holding the bull wheel so that it cannot tip from the action of the vertical component of the stress in the rod 10. Further girders 5 and 6, and rods 18, 19, 20 and 21, keep the bull wheel horizontal against any tendency to tip along the respective axes of these girders, such tipping tendencies being produced by the eccentric manner in which the various connections of the bull wheel parts must be constructed in respect to the forces acting in the various members and ropes. Heretofore, these tipping forces have been held by rigid braces running from numerous points along the rim of the bull wheel, to a point on the mast, and, without these braces, the wheel possesses practically no rigidity in a

direction normal to the plane of the diameters, and especially not sufficient stiffness to resist the vertical components of the stresses existing as described in the rods 16 and 17. In my arrangement of the braces and girders 4, 5 and 6, no attachment of the braces to the mast is necessary either in a direction from left to right or from front to back, to make the wheel a rigid unit.

It is evident that a rigid wheel as described above, having no stiff braces running from its rim to a point some distance up the mast, can be attached to a mast of any size without altering any of its parts. The wheel is held in place when the center plate 2 is kept by suitable bolts or similar fastening, from sliding horizontally on the bottom of the mast, and when the rods 16 and 17 are bolted to the mast as shown at 23. Hence my improvement over the former methods where new braces had to be fitted to each new size of mast, accomplishes the third object of my invention, and produces a bull wheel that fits various sizes of masts without alterations of the bull wheel parts or braces.

When there is a pull in the rod 16 (or 17), a downward pull results on the mast at the point 23 and also a transverse pull which must be taken care of by a sufficient bending strength in the mast. It is impractical to make compression members of more than a limited length. Hence, in the old methods of using braces of compression members from the rim of the wheel to the mast, the connection of these stiff braces on the mast cannot be made but a short distance up from the base of the mast *i. e.* above the bull wheel), consequently the angle which the braces make with the mast is large, usually about 45 degrees. This causes a large side thrust on the mast. By making the braces 16 and 17 (as well as 18, 19, 20, 21 and any others that may be desired) tension members, they can be made of any desired length. The longer they are, the smaller will be the side pull on the mast tending to bend the latter, and if these tension members are fastened, at their upper ends, at the top of the mast where it is held by the guys or stiff legs as the case may be, the mast will have no side thrust from the bull wheel rods that cause bending stresses otherwise in its material; and thus I attain the fourth object of my invention which is to reduce or eliminate (depending upon the extent to which the principle of my invention is applied) bending in the mast by attaching the braces at a suitable location as described.

I claim:

1. In a derrick bull wheel, a system of rigid vertical girders, extending from approximately diametrically opposite sides of the bull wheel, with one end of each girder at a point in the rim of the bull wheel where there is a vertical force tending to raise or lower said rim.

2. In a derrick bull wheel, a system of braces running in pairs from points near the center of the wheel, to points on the rim of the wheel approximately diametrically opposite, said braces forming a system of girders rigidly bracing the rim of the wheel in horizontal and vertical directions, said self contained rigidity of the wheel being due to the rigidity of the girders without the aid of connections to the mast or other stiff members, substantially as described.

3. In a derrick bull wheel, the combination of a rim 3, a girder 4, 4, 4, 4, said girder approximately at right angles to the center line of the boom and with its ends at approximately diametrically opposite sides of the bull wheel, means for fastening the ends of said girder to the rim, and means for fastening said girder to the mast against horizontal displacement in respect to the center line of the mast.

4. In a derrick bull wheel, the combination of a rim 3, a girder 4, 4, 4, 4, said girder approximately at right angles to the center line of the boom and with its ends at approximately diametrically opposite sides of the bull wheel, means for fastening said girder to the rim, means for fastening said girder to the mast against horizontal displacement, but said fastening to the mast not preventing the rim at the ends of the girder 4, 4, 4, 4, from raising and lowering.

5. In a derrick bull wheel, the combination of a rim 3, a girder 4, 4, 4, 4, said girder approximately at right angles to the center line of the boom and with its ends at approximately diametrically opposite sides of the bull wheel, other girders, 5, 6, means for fastening the ends of said girders to the rim, means for fastening the girders to each other, and means for fastening the bull wheel on the mast against horizontal displacement in respect to the center line of the mast but said fastening to the mast not preventing the bull wheel from tipping so as to raise or lower at the rim.

6. In a derrick bull wheel, two or more tension braces, 16, 17, 18, 19, 20, 21, extending from the rim of the wheel to one or more points on the mast, substantially as described and for the purpose set forth.

7. The combination of a derrick bull wheel possessing rigidity through a self contained system of spokes and girders, with two or more tension members, 16, 17, 18, 19, 20, 21, arranged as described and for the purpose set forth.

8. In a derrick bull wheel, the combination of one or more vertical girders, each extending from a point on one side of the bull wheel to a second point approximately diametrically opposite the first point, with

tension members connecting the ends of said girders, to one or more points on the mast, substantially as described.

9. In a derrick bull wheel, the combination of a rim 3, a girder 4, 4, 4, 4, said girder approximately at right angles to the center line of the boom and with its ends at approximately diametrically opposite sides of the bull wheel, means for fastening said girder to the rim, means for fastening the girder to the mast against horizontal displacement in respect to the center line of the mast but said fastening to the mast not preventing the bull wheel from tipping so as to raise or lower at the rim, and tension members with one end of one tension member fastened at one end of the girder, one end of another tension member fastened at the other end of the girder, and the other ends of the tension members fastened on the mast at a distance from the bull wheel to keep the wheel from tipping in respect to the center line of the mast.

10. In a derrick bull wheel, the combination of a rim 3, a girder 4, 4, 4, 4, said girder approximately at right angles to the center line of the boom and with its ends at approximately diametrically opposite sides of the bull wheel, means for fastening said girder to the rim, means for fastening the girder to the mast against horizontal displacement in respect to the center line of the mast but said fastening to the mast not preventing the bull wheel from tipping so as to raise or lower at the rim, tension members with one end of one tension member fastened at one end of the girder, one end of another tension member fastened at the other end of the girder, and the other ends of the tension members fastened on the mast at a distance from the bull wheel to keep the wheel from tipping in respect to the center line of the mast, and tension members extending from each end of the girder 4, 4, 4, 4, to a point on the boom some distance from the bull wheel.

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