THE BESSEMER OSCILLATING SALOON.

As we shall probably soon hear that the oscillating saloon steamer Bessemer is running between England and France, conveying passengers over the uncomfortable and uncertain Straits of Dover, we present to our readers an engraving of the gyroscopic arrangement (by which the saloon is kept in a horizontal position, even under the greatest possible angles of variation of the ship), selected from *Engineering*.

The ordinary form of gyroscope (for an illustration of which see page 91, volume XXXI). is a heavy disk or wheel, made to revolve rapidly in any given plane, tending always to remain revolving in that plane; and it can only have the direction of its action of rotation changed by the application of considerable force, the amount of this force depending upon the weight of the revolving body and its speed of rotation. The manner in which Mr. Bessemer has availed himself of this gyroscopic action will be understood by reference to our engraving, which represents the controlling apparatus as constructed for the steamer. The gyroscope in this case consists of a steel disk wheel, A, 2 feet in diameter, and with a rim 4 inches square, this wheel being made of steel forged so as to make the mass as nearly homogeneous as possible, and carefully turned so as to insure its running perfectly true. As it may possibly be necessary under some circumstances to run the disk at as high a speed as 5,000 revolutions per minute, it is evident that great care is necessary to ensure perfect balancing. The boss of the disk is bored out conically to fit the conical upper end of the spindle, B, the spindle and disk being ground together to secure a perfect fit. A nut and washer at the top secure the disk in place, no keys or pins being used.

The spindle, B, which is also of steel, is steadied by two bearings, C and D, through which it passes, these bearings being capable of adjustment in one direction (that in which a disturbing force will be brought upon the spindle) by set screws as shown. The bearings are fitted to boxes formed by castings fixed to the top and bottom of the gun metal casing or frame, E, this casing being strengthened by internal ribs, and being slung on a pair of trunnions with which it is provided. The center line of these trunnions corresponds with the center line of the vessel, and the casing, E, can thus swing athwartships, but not in a fore and aft direction. The trunnion bearings are supported by wrought iron standards springing from the floor beams of the saloon; and thus, if the axis, B, be kept perpendicular by the gyroscopic action of the disk, A, the casing, E, must rock on its trunnions if the floor of the saloon departs from a horizontal position. The manner in which this movement of the casing, E, is made to control the action of the cabin we shall explain presently; meanwhile we must explain how the gyroscope is driven.

It is evident that in such an arrangement, where the slightest interference with the gyroscopic action is to be avoided, the use of belts or other similar driving gear would be inadmissible, and Mr. Bessemer therefore decided to give motion to the gyroscope by means of a kind of reaction turbine, or Barker's mill, formed on the spindle of the gyroscope itself. For this purpose, the spindle, B, has, as will be seen, a pair of arms formed on it, these arms being bored out, and the hole through them communicating with another hole, J, bored up through the spindle from its lower end. Water under pressure enters through one of the trunnions of the casing, E, and passes down through a suitable pipe to a small casing, N, below the bottom of the spindle. Thence it passes up through the hole, J, in the spindle and through the radial arms, finally escaping through the lateral opening in the caps, I, with which the ends of the arms are provided. A small hole, forming a prolongation of J, conducts a supply of water to the upper bearing, C, and any water escaping at the upper end of that bearing is deflected downwards by the dished plate, Q, and thrown back into the casing, E. A flexible waste pipe, not shown in the illustration, conducts away the water from the casing, E, back again to the tank from which the pumps draw, this tank being fitted with screens so as to keep the water perfectly clear, and remove any particles which, if allowed to circulate through the apparatus, might cause a stoppage of the openings in the arms, I.

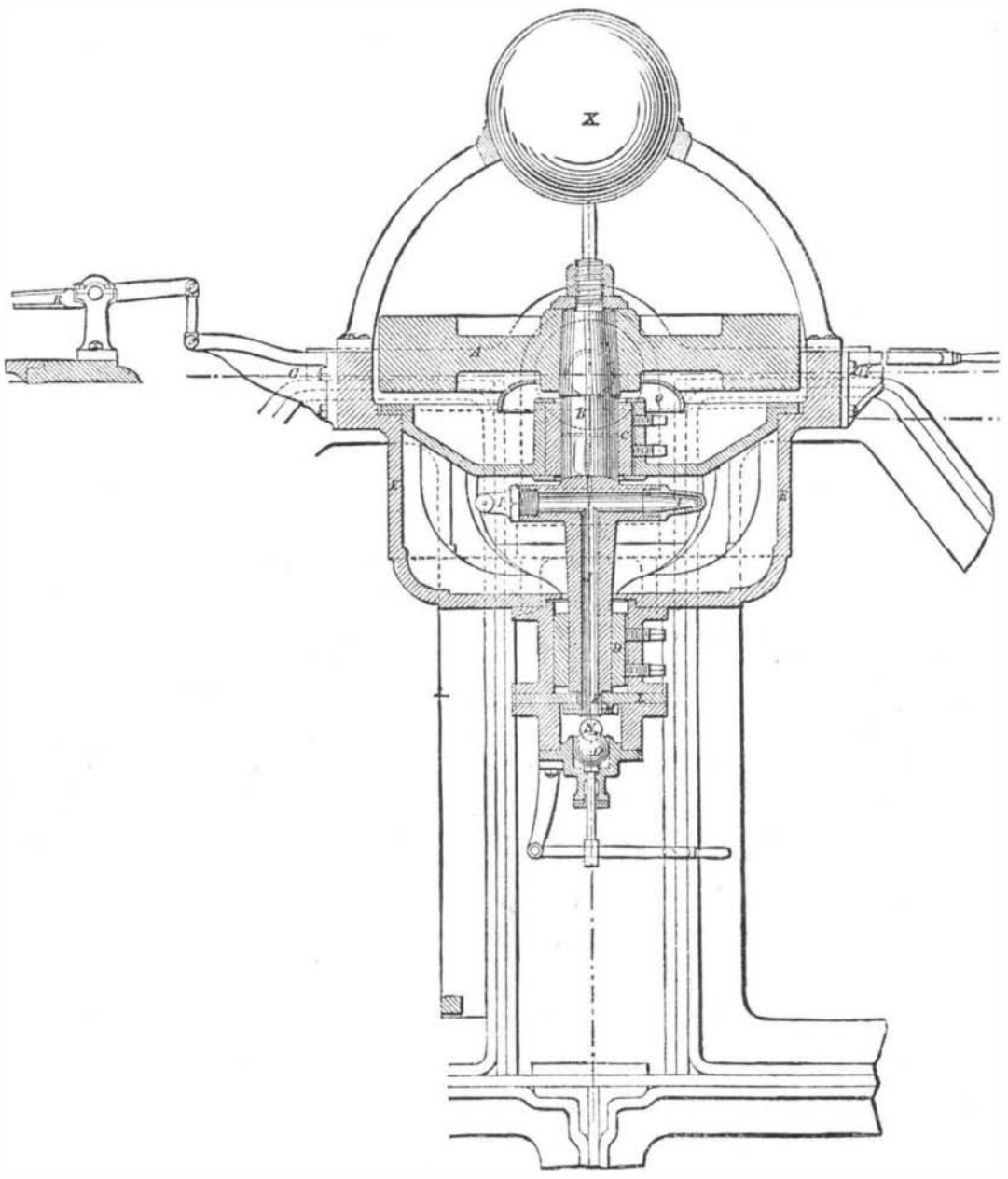
An exceedingly neat point in the design is the provision made for avoiding any frictional resistances due to the weight of the gyroscope. It will be seen that the lower end of the spindle, B, is considerably reduced in diameter, there being formed, at K, a square and carefully finished shoulder. Below this shoulder the reduced portion of the spindle passes through a phosphor bronze plate, L, the spindle being a free fit in this plate. Below the plate, L, are two metal disks, M, which also fit the spindle freely, and which are kept pressed lightly against the plate, by springs not shown in the engraving. These springs are only required to keep the disks, M, in place when the water is shut off from the apparatus; when in regular work, the pressure of the water tends to force them upwards. As a result of the free fit of the lower end of the spindle in the plate, L, there is always a slight leakage at that point when the apparatus is in use; and this leakage, besides lubricating the lower bearing, D, serves an important purpose, as we shall now explain. The upward pressure of the water on the area corresponding to the section of the lower end of the spindle suffices to balance the greater part of the gyroscope; but inasmuch as variations in the pressure of the water might otherwise create difficulties, the diameter of the lower part of the spindle is made such that, at the ordinary working pressure of the water, about fifty pounds of the weight of the revolving disk, spindle, etc., remains unbalanced. If no means were taken to prevent it, this weight would rest upon the square shoulder, at K, and a rapid abrasion of the plate, L, would result. But the leakage to which we have already referred prevents this. Thus the water leaking through the hole in the plate, L, around the lower end of the spindle comes against the shoulder formed on the spindle, at K, and it is thus brought to bear against an enlarged area, and is enabled to raise the spindle and its attachments. As soon as it has thus lifted the spindle, the leakage water can escape between the plate, L, and the square shoulder, at K; but it is evident that the amount by which the spindle is lifted is strictly limited by the amount of the leakage, and can never become excessive. It is also practically independent of moderate variations in the water pressure, an alteration in pressure merely producing a slight alteration in the thickness of the film of water flowing away between the plate, L, and the square shoulder, at K. Thus in all cases, when in action it is insured that the weight of the gyroscope is carried upon what may be called a water bearing, and one that it is consequently practically frictionless.

If while the apparatus was in action, the supply of water was shut off by means of a valve fitted to the supply pipe, the pressure of the water in the box, N, would at once cease, and the weight of the gyroscope, ceasing to be water-borne, would at once cause abrasion to commence between the square collar at K, and the plate, L. This result, however, Mr. Bessemer has ingeniously guarded against as follows: In a recess at the bottom of the box, N, is a gun metal ball, O, while at the lower end the hole, J, in the spindle, B, is countersunk so as to form a kind of valve seat. Under ordinary circumstances, the ball, O, rests in its recess at the bottom of the box, N; but when it is desired to stop the gyroscope, it is raised by means of the plunger and hand lever shown, until it is close to the lower end of the spindle. Immediately this is done, the pressure of the water carries it against the seat at the lower end of the spindle, and it then revolves with the latter, until, from the water being cut off from the arms, I, the gyroscope comes to rest. During this time, when the gyroscope is running down, as it may be called, the apparatus is still water-borne, as the pressure continues to be maintained on the box, N. When the gyroscope has come to rest, the water is shut off by a valve in the supply pipe; the leakage then reduces the pressure of the box, N, and the ball, O, falls into its normal position at the bottom of the box.

We have now to speak of the manner in which the gyroscope is made to actuate the valves by means of which the movements of the saloon are controlled. The saloon is hung on a longitudinal axis, and on either side of it are placed the hydraulic cylinders by which its movements in relation to the hull of the vessel are controlled. These cylinders are double acting, so that a pull upwards on one side of the saloon is always accompanied by a downward pull on the other, and *vice versa*, and the water has therefore to be admitted to, say, the top of the port and bottom of the starboard cylinder (or the reverse) simultaneously. The whole distribution of the water is effected by a cylindrical slide valve.

The connection between the valve and gyroscope will be readily understood. On the side next the valve the casing of the gyroscope carries an arm which is connected by a link with one end of a lever, the other end of the lever being connected to the valve spindle. Let us suppose that in our engraving we are looking towards the head of the vessel, and that the latter gives a roll over to port. The effect of this would be that, the gyroscope spindle remaining vertical, its lower end would be brought nearer to the valve casing, the arm raised in relation to that casing, the valve lowered, and water under pressure admitted to those ends of the hydraulic cylinders with which the pipe communicates; this admission of water to the hydraulic cylinders raising the port side of the cabin in relation to the hull of the vessel, and thus counteracting the list of the latter to port. On a roll taking place to starboard, the opposite action would, of course, take place.

It will be seen from this description that a slight movement of the saloon must take place before the gyroscope can actuate the controlling valve; but by adjusting the length of the lever in proportion to the length of the arm of the lever to which it is coupled, this movement, it is expected, will be brought within such small limits as to have no practical effect on the comfort of the passengers. This, however, is one of the points which of course can only be conclusively decided by actual trial.



THE CONTROLLING GEAR OF THE BESSEMER SALOON.

Concrete Gravel Walks.

In Dick's *Encyclopedia of Practical Receipts* are the following directions for making concrete surfaces:

Dig away the earth to the depth of about 5 inches, then lay a bottom of pebbles, ramming them well down with a paving rammer. Sweep them off as clean as possible with a broom, and cover the surface thinly with hot coal tar. Now put on a coat of smaller gravel (the first bed of pebbles should be as large as goose eggs), previously dipped in hot coal tar, drained, and rolled in coal ashes, with an intermixture of fine gravel, and roll it down as thoroughly as possible. Let the roller run slowly, and let a boy follow it with a hoe to scrape off all adhering gravel. Next put on a coat of fine gravel or sand and coal tar, with some coal ashes, to complete the surface, and roll again as thoroughly as possible; the more rolling, the better. It will take some weeks to harden, but makes a splendid hard surface which sheds water like a roof. Do not use too much tar. It is only necessary to use enough to make the ingredients cohere under pressure, and a little is better than too much.

Nickel-Plated Screws.

In car building, nickel-plated screws are rapidly coming into general use. This grows out of the fact that, though their original cost may be a trifle more than silver-plated screws, yet, as nickel does not oxidize by exposure to air, the excess of cost is more than made up in the durability of the plating. Hence, in nearly all of the large car manufactories, nickel-plated screws are superseding silver-plated for use in joinery work. There is a steady increase in the use of nickel-plated screws in house joinery, which argues well for their final adoption for all such work in which silver-plated screws are now employed.

A Telegraphic Congress is to be held in St. Petersburg during the present year. The Russian telegraph department has set aside some $20,000 to pay the expenses.