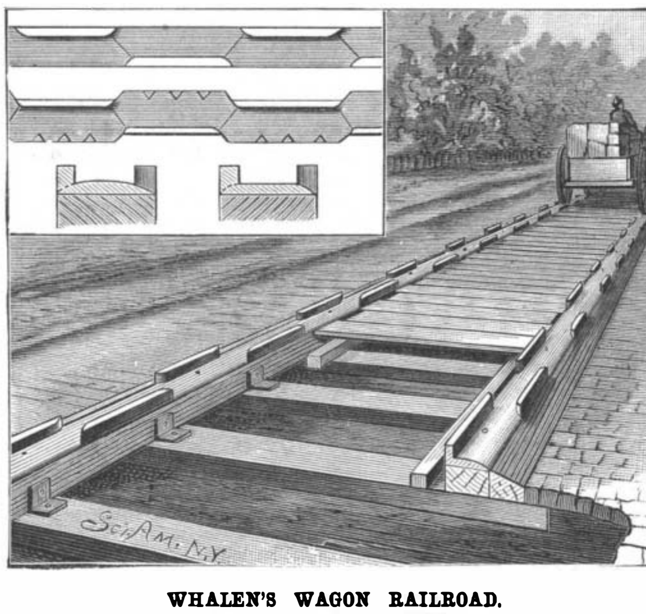
A RAILROAD FOR COMMON CARRIAGES OR WAGONS.

An improved road, to take the place principally of the ordinary plank road over much traveled thoroughfares where heavy hauling is done, has been patented by Mr. Timothy Whalen, and is represented in the accompanying illustration, the small figures showing plans and sections of the wheel tracks. The rails are preferably formed of iron or steel, placed at the proper distance apart to form tracks for the wheels of wagons or other vehicles, and fastened to string timbers at the surface of the ground, these timbers resting upon cross ties. The rails are formed with a bottom plate, the surface of which constitutes the tread for the wheels, there being raised flanges at the edges of the plate to prevent the wheels rolling off the tracks. These flanges are preferably divided into isolated parts or sections, the openings serving to allow the discharge of dirt, water, etc., a flange at one side being made opposite a space at the other side. A longitudinal timber is secured upon the ties immediately outside the rails, having its upper surface in whole or in part beveled and made even with the floor of the rail, to assist the wheels of vehicles in rolling smoothly on or off the track. The decided advantages of such a wagon railroad, in the facility it affords for transporting greatly increased loads with but little strain and wear and tear on horses and wagons, will be at once obvious.

For further particulars in relation to the invention address Mr. John L. Whalen, 1 and 5 Whalen Court, Rochester, N. Y.



WHALEN'S WAGON RAILROAD.

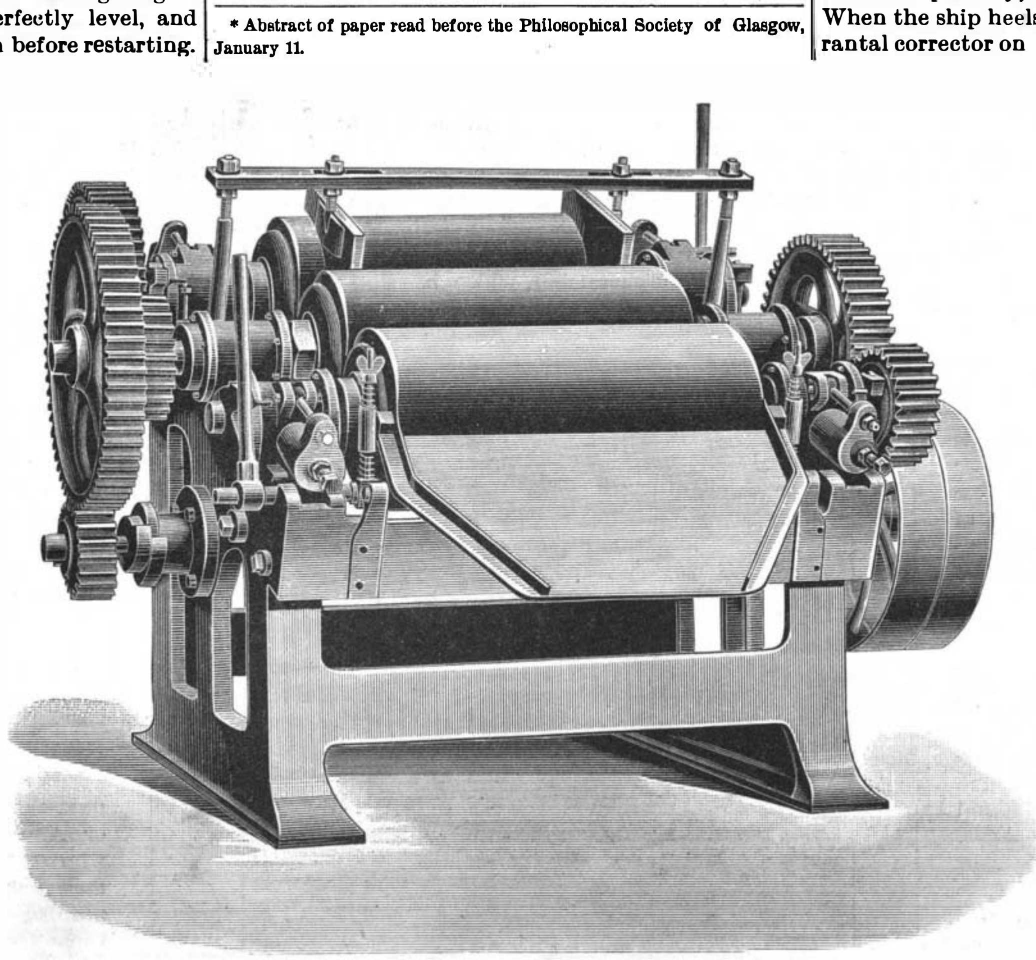
IMPROVED PAINT MILL.

The paint mill which we illustrate below was exhibited, says *Engineering*, at the late Manchester exhibition by the patentees, Messrs. Hind & Lund, of Preston, who, for a considerable time past, have paid special attention to the perfecting of this class of machinery.

These mills are used for grinding a great variety of substances, some of which would be seriously damaged by admixture with foreign matters; for instance, with such substances as paint, white lead, zinc white, soap inks, chocolate, cocoanut, starch, etc. It is highly desirable that they should be kept free from dirty lubricating oil, which in the old type of machine was very liable to escape from the bearings to the rolls. In the improved machines now manufactured by Messrs. Hind & Lund all the bearings are self-lubricated, and so arranged that it is almost impossible for oil to get on to the rolls.

The mill is provided with three rolls, the bearings of the center roll being a fixture, while the outer ones are provided with swing bearings. This method of swinging the bearings is found to be far superior to the old method of placing them in slides. The bearings are fixed upon an eccentric which is locked in position after the rolls have been set. The operation of setting is accomplished by means of a leveling plate.

To insure uniformly fine grinding, the mill should be examined from time to time and tested by the leveling plate in order to ascertain whether the rolls are in perfect contact. They can be readily adjusted if required by unlocking the eccentric and giving it a slight turn until the plate is perfectly level, and again locking it in its new position before restarting. The bearings are set up by means of screws; they are also provided with springs to allow the rolls to separate when any hard substance gets into the mill, and thus minimize the damage done to the rolls. By means of a handle on the side of the machine, the attendant can immediately relieve the rolls from all pressure when it is desired either to run them empty or to prevent them from clogging when standing idle for a time. By this device they can be immediately brought back to their original place without requiring any fine adjustments. The rolls are 30 inches long by 14 inches in diameter, of the best granite, and mounted on their spindles by collars and nuts at each end. They are turned and polished by special machinery made by the firm, by which means they are enabled to finish them in first-class style.



IMPROVED PAINT MILL.

CHLORAL camphor, with a drop of hydrochloric acid and a few drops of peppermint oil, gives a red color, which becomes violet blue on heating. On diluting, it passes through green to a blood-red fluorescence.

The Heeling Error of the Compass in Iron Ships.*

BY MR. WILLIAM BOTTOMLEY, C.E.

In this paper I do not propose to enter into the general question of the magnetism of an iron ship and the errors of the compass which it produces, but will confine myself to the consideration of the disturbance which is experienced when the vessel heels over. I will assume that, with the ship on an even keel, the effect of the magnetism of the ship's iron on the compass has been compensated by Airy's well known plan of placing magnets fore and aft and thwartship, to correct the semicircular error, and masses of soft iron on each side of the compass, for correcting the quadrantal error, and that the compass is correct on all courses when the ship is on an even keel. When the ship heels over, the altered position of the iron of the ship produces a change in its effect on the compass, and gives rise to the heeling error. The general effect of the heeling of the ship is to produce an error which is greatest when the ship's head is north or south, and which gradually diminishes as the ship turns round toward the east or west. With the ship's head east or west, there is no sensible heeling error. In general, when the ship is in the northern hemisphere, the north point of the compass card is drawn to the high side of the ship. In the southern hemisphere it is drawn to the low side of the ship.

The disturbance due to heeling arises from two separate causes: (1) The component of the ship's permanent magnetism which is perpendicular to the deck; (2) the magnetism induced in the soft iron of the ship by the vertical component of the earth's magnetism. The special object of this paper is to deal with the error which is produced by the second of these causes, that is to say, by the magnetism induced in the soft iron of the ship by the vertical component of the earth's magnetic force, and to show that the masses of soft iron which are placed on each side of the compass, to correct the quadrantal error when the ship is upright, exercise a most important part in correcting the heeling error when the ship heels over, if they are fixed to the binnacle and move with the ship. I have spoken of the magnetism induced in soft iron, and perhaps it would be desirable for me to explain very briefly the terms hard iron and soft iron, and the effects produced by magnetic force on these different kinds of iron. Soft iron is iron which becomes magnetized almost or quite instantly when brought under the influence of a magnetizing force, and which loses its magnetism as soon as that influence is removed. Hard iron, on the other hand, is iron which does not acquire magnetism so easily, but when once it is magnetized the iron retains its magnetism even when the magnetizing force is removed. I have here a bar of soft iron with which I will illustrate the effect of magnetism on soft iron. When I hold it in a vertical direction, or in the direction of the dip, it is brought under the influence of the earth's magnetic force, and it at once becomes magnetized. The upper part attracts the north-seeking end of this suspended needle, and the lower part the south-seeking end of the suspended magnet. Now, if the bar be reversed, end for end, its magnetism will at once become reversed. The lower end of the bar, which was uppermost before and attracted the north-seeking end, now repels it and attracts the south-seeking end. When the bar is held horizontally, with its length in an east and west direction, it loses its magnetic effects if it is perfectly soft. On the other hand, a piece of unmagnetized hard steel will not become magnetized unless acted on by a powerful magnetic force; but when it has been magnetized by a sufficiently great force, it retains its magnetism permanently.

The iron used in ship building is neither perfectly hard nor perfectly soft, and in consequence we find the effect both of hard iron and of soft iron on board an iron ship. By the hammering in riveting the iron of the ship becomes partially magnetized, so that the ship acts as a permanent magnet; but at the same time the iron of the ship also exhibits the properties of the soft iron, and becomes magnetized by induction from the earth's magnetism. In the northern hemisphere the whole of the upper part of the ship acquires magnetic polarity similar to that of the earth's north pole, while the lower part acquires polarity similar to the earth's south pole. Now, when the ship heels over, this induced magnetism shifts in position in the ship. The upper side of the deck becomes more powerfully magnetic than the lower side and attracts the north point of the compass toward it, and produces a heeling error, drawing the north point of the compass to the high side of the ship. In the southern hemisphere the opposite effect will be found. The upper part of the ship will acquire magnetic polarity similar to the earth's south pole, and when the ship heels over, the upper part of the deck will repel the north point of the compass and cause a heeling error, drawing the north point of the compass to the low side of the ship.

I wish now to show you that the soft iron correctors, which are used for correcting the quadrantal error when they are fixed to the binnacle and move with the ship, exercise a most important part in correcting the heeling error when the vessel heels over. They are made of soft iron, and become megnetized by induction from the earth's force. The upper part acquires northern polarity, and the lower southern polarity. When the ship heels over, the lower part of the quadrantal corrector on the upper side of the ship rises up toward the level of the compass needles, and having southern polarity, it repels the north point of the compass from the high side of the ship, and thus acts as a most important corrector for the heeling error. With regard to the amount of this correction, I may say that globes of soft iron, 8½ inches in diameter, when placed about 8 inches from the center of the compass, correct about 7 degrees of quadrantal error. This is a very usual amount on board a merchant ship.

These globes will correct about 1 degree of heeling error for each degree of heel of the ship; that is, if the ship heel over 10 degrees, the globes will correct 10 degrees of heeling error. Notwithstanding this large correction of the heeling error which is effected by the quadrantal correctors, it is found in practice that it is not sufficient to correct the whole of the heeling error, and it is necessary to apply a magnet perpendicular to the deck, underneath the center of the compass, to augment the correction of the heeling error which is effected by the quadrantal correctors.

* Abstract of paper read before the Philosophical Society of Glasgow, January 11.