NEW WORM AND WORM WHEEL AND GEAR CUTTER.

We give an engraving of an improved machine for cutting that class of worm wheels and endless screws in which the points of the teeth and the bottom of the spaces are formed on a concave outline adapted to the convexity of the screw, in order to present as much bearing surface as possible to its action. The teeth of the wheel in an endless screw are not, as in ordinary gearing, set perpendicularly to the plane of its face, but at an angle and with surfaces corresponding to the inclination and helical form of the thread of the screw. The outlines of the teeth are helical surfaces described about the cylinder, forming the screw with the proper pitch.

The old method of cutting the teeth in the wheel has been to first rough them out with a straight cutter in an ordinary gear cutting engine, and then to give the teeth the proper curved outlines by means of a hob made particularly for the purpose, and revolved in the nicks or spaces made by the gear cutter. It has heen ascertained, however, that it is impossible to cut an accurate worm wheel by this process, for the reason that the hob changes the sides of the teeth from a straight line to a helical form, and as the hob has so much metal to remove and also to revolve the wheel, that the motion given to the wheel is far from being accurate. The machine illustrated is intended to cut the teeth in the surface of the wheel as well as to cut the worm or screw perfectly, without regard to size or pitch.

The Hindley screw has much more bearing surface, at least four times as much, as the ordinary worm gearing, a large bearing surface that adds considerably to the durability of the screw and greatly reduces friction. This is a very important advantage, as the common worm has been known to cut away and become completely destroyed in a few hours. The cutting and wearing away of the worm greatly damages the teeth in the worm wheel. The threads in the Hindley screw can be made as long as required, not being confined to any particular length or shape, for the reason that they all point to one common center. For a dividing-wheel, where exact divisions are wanted, the teeth and screw can be made very short, even should a coarse pitch be required. A much steadier motion is obtained where a large number of teeth have a bearing at one and the same time, which makes it valuable for many kinds of machinery, such as elevators, hoisting machinery, cranes, derricks, jackscrews, and all machinery where great steadiness of speed is required.

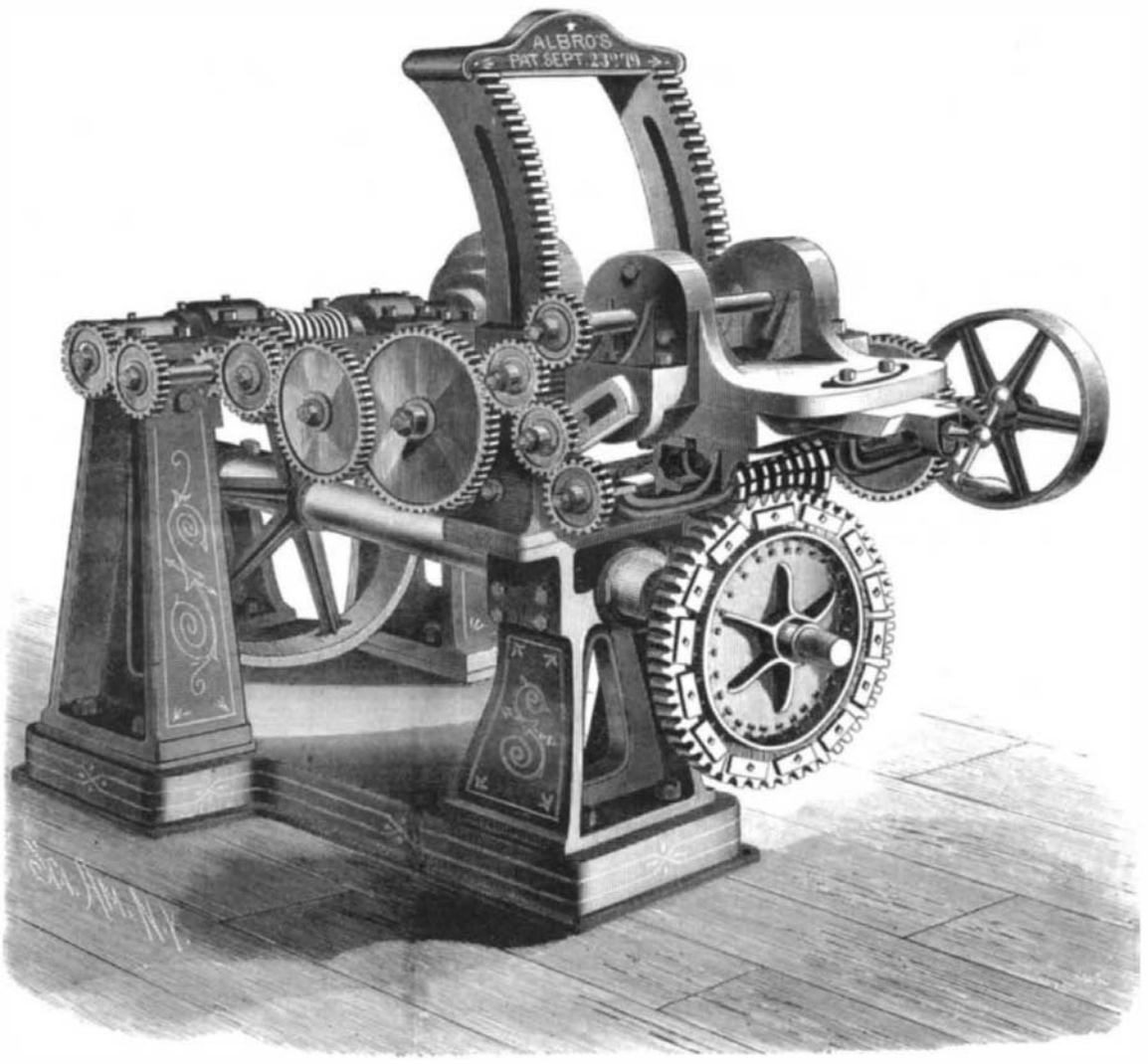
This form of worm gearing is very strong and capable of resisting any strain that may be brought to bear upon it.

The machine has two columns or standards, one on each side at the rear of the bedplate. On the top of these columns are journal boxes which carry the master worm or screw shaft. This worm or screw drives the master worm wheel, which is directly underneath the worm, and is fitted to the main spindle which runs the entire length of the bedplate, and is held in place by two shorter standards at the front and rear of the machine. The main spindle has a taper hole in the forward end for receiving the steel spindles carrying the gears to be cut.

On the inner side of the two long columns, and central with the journals, there are two trunnions on which the swing frame moves. This swing frame is made strong and rigid, and supports at its free end a compound slide rest by a flexible joint. The slide rest can be swung or revolved completely. This motion is necessary in order to cut bevel and spur gearing. Underneath the slide rest is journaled the cutter shaft, which extends across the slide rest and projects far enough to receive the proper gearing to revolve the master worm shaft. This slide rest has a movement of sixteen inches, and is swiveled in such a manner that spiral and skew gearing may be cut.

Accurate worm wheels are cut automatically in this machine in the following manner: The blanks to be cut are fastened on the steel spindle at the front of the machine, a Hindley worm cutter or hob is fastened on the cutter shaft, and the cutter shaft is connected with the master worm shaft by a train of gearing supported by the swing frame, and in such a manner that they will always remain in gear for the reason that the swing frame turns on the axis of the master worm shaft. Motion is given to the cutter shaft by a spur wheel, pinion, and pulley, and the train of gearing imparts motion to the master worm shaft, which causes the master wheel and main spindle with the blank fastened on the end to revolve. Both blank and hob or Hindley worm cutter being revolved uniformly, the teeth are cut on the blank with uniformity and accuracy. While the machine is in motion the free end of the swing frame continually falls, and the machine cuts the teeth in the blank to a depth regulated by a stop motion underneath the swing frame.

This machine is especially arranged to cut the Hindley screw. The Hindley blank is fastened on the cutter shaft, and a stiff flange or plate carrying hardened steel tools, the ends of which are made the proper shape and the proper distance from each other, is fitted to the main spindle. Arranged in this way the order of things is reversed, and instead of the hob cutting the wheel, as before shown, the teeth on the sides of the flange are cutting the worm. The pitch of the hob or cutter is made to correspond with the number of teeth to be cut in the blank, and the machine must be geared in such a manner that the cutter makes a revolution to each tooth to be cut. An ordinary cutter is used and fitted to the cutter shaft for cutting spurs, bevels, miters, spirals, etc. The shaft shown at flexible joint controls the automatic feed motion in cutting spu gears, etc. Near the front of the machine there are two toothed sectors, and the swing frame is mortised to allow its movement up and down. At the front of these sectors, and on the top of the swing frame, there is a shaft carrying two pinions which engage with the teeth on the face of the sectors.



THE ALBRO PATENT HINDLEY SCREW AND GEAR CUTTER.

This shaft is driven by a system of worms and wheels, and effects the downward feeding. A crank is fastened to the end of this shaft to raise or lower the swing frame to any required position.

Further information in regard to this useful invention may be obtained by addressing Messrs. Clem & Morse, 413 Cherry street, Philadelphia, Pa.

The Strength of Wooden Columns.

Some important tests of the strength of wooden columns, such as are in common use in the construction of cotton and woolen mills, have lately been made at the instance of Mr. Atkinson, President of the Boston Manufacturers' Mutual Fire Insurance Company. The tests were made with the testing machine at the Watertown Arsenal. The formulas in use for computing the strength of wooden columns are based on tests applied to columns of about two inches on a side and four or five feet long. The new tests were made with columns of pine and oak of the size and length used in actual construction. All but two were round, hollow columns, of from eight to eleven inches diameter, the two being about nine inches square. The greatest amount of pressure exerted in any case was about 265,000 pounds. The tests have disclosed frequent instances of defective boring in the columns. The object in boring is to open an air passage through the heart of the stick for the prevention of dry rot after it is in position in the building. It is essential, of course, that the bore should extend from end to end, but this has not always been effected. The sticks were bored first from one end and then from the other and the borings have sometimes failed to meet in the middle of the stick. The tests also show that to taper the sticks is a mistake, inasmuch as it weakens the column more than has heretofore been estimated. Reasons for exercising more caution in other respects in the construction and adjustment of wooden columns in building bave also been disclosed.

Underground Telegraph Wires in Germany.

The *Deutscher Reichs Anzeiger* (September 28) gives the following details of the subterranean telegraph lines at present in working in Germany. The total length of cable is 3,642 miles, the greater portion of which contains seven wires, though on some of the minor lines a four-wire cable is used. 10,170 tons of iron, three-quarters of a ton of copper wire, and 1,836 tons of gutta percha casing were employed on the system. 70 rivers were traversed, requiring between seven and eight miles of subaqueous cable. The first line constructed was begun on March 14, 1876, and the latest (that from Cologne to Aix-la-Chapelle), which is included in the report, was completed on June 26 of the present year.

ENGINEERING INVENTIONS.

Mr. Michael B. O'Neill, of Halifax, N. S., has patented an improved ash pan for locomotives. In this improvement the bottom of the ash box is formed of a series of end-pivoted pans, preferably of semicircular form in their transverse section, and with overlapping flanges on their upper edges. These pans are connected at one of their ends with a bar which has an attached crank movement that is operated by a rod from the cab, for the purpose of turning and dumping the pans and of returning them again to their receiving position. A perforated pipe connected with the water tank, and provided with a cock, passes over the pans for wetting down the ashes before emptying them. By this construction the ashes can be emptied at any time or place. Being wetted, they will not set fire to bridges or sleepers, and being frequently emptied will serve as ballast and prevent growth of grass. The readiness with which the ashes may be cleaned out while the locomotive is in motion is of great advantage. An increased draught results from the ash box being emptied frequently, thus saving labor and fuel.

An improved feed-water heater for steam boilers has been patented, the principal features of which are any number of drums arranged below and at the rear end of the boiler, and which are connected by pipes with the lower water space of the boiler, also, by a series of upwardly inclining pipes, with uprights, situated at the front end of the boiler, and connecting by pipes with the steam space of the latter. These drums serve both as feed water receivers and as mud receptacles, and are provided with water-supply pipes and blow-off connections. They and most of their pipes are exposed to the action of the fire, and consequently both heat the feed water and assist in generating steam, likewise promote circulation within the boiler. The patentee is Mr. George W. Sloane, of Brooklyn (Greenpoint P. O.), N. Y.

Mr. William C. Waring, of Yonkers, N. Y., has patented an improvement in fulling mills. In this improvement the hinged lining plate in the forward portion of the fulling box is vibrated automatically by a crank motion derived from the cam roller shaft which actuates the beater, for the purpose of insuring the dislodgment of the material from the place into which it has been driven by the beater, and for regularly turning the material so that it will be struck by the beater in a new place. Manual labor, too, for vibrating said lining is dispensed with.

The Electric Light vs. Gas in Theaters.

It is said that a marked improvement has been noticed in the acoustic properties of the Grand Opera House, Paris, since the introduction of the electric light. A layer of heated gases acts as a screen for sound, hence the volumes of hot fumes arising from the old gas foot-lights obstructed and marred, to some extent, the voices of the singers. With the electric light, inclosed in air-tight bulbs, no fumes can be emitted, and very little heat is given off. Hence it benefits the ear as well as the eye.