THE "HERCULES" BONE MILL.

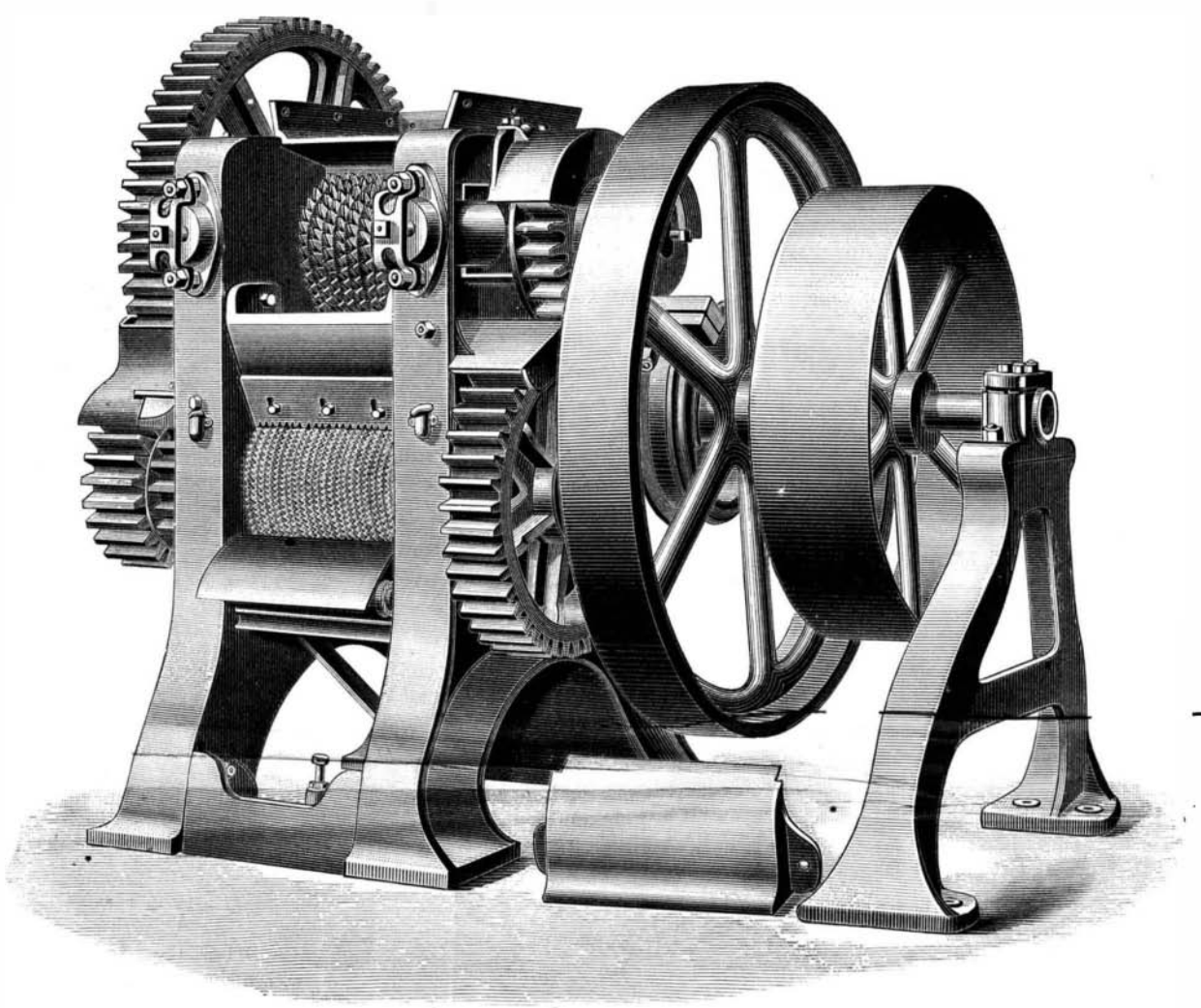
Messrs. Nicholson, of Trent Iron Works, Newark-on-Trent, designed and are manufacturing the "Hercules" mill, of which we give a perspective view from *Iron*. There are two classes of these mills made, viz., one in which only one pair of rollers is used, and another in which two pairs are employed.

The mills fitted with one pair of rollers will reduce raw bones to three-quarter inch, five-eighths inch, and one-half inch pieces, and making comparatively very little dust.

The more complete mills, with two pairs of rollers and concaves, will grind to any degree of fineness from one-half inch pieces down to bone dust, or by shutting off the lower pairs of rollers by the use of a single slide, can be made to produce a similar sample to the mills with a single pair of rollers. The rollers are composed of case hardened disks of tough annealed crucible cast steel, bolted together; the additional precaution has been taken of securely interlocking them—a most important provision. Should, therefore, one of the disks on either side of it, and are not liable to fall out and be passed between the rollers, with the certainty of causing serious damage to them or the gearing. They are further protected from breakage caused by sudden strain, or by the introduction of hard foreign substances, by automatic safety appliances, consisting of compressible boxed springs, which offer uniform resistance up to their ultimate compression. The concaves are similarly protected by a weighted lever, by means of which the pressure can be regulated and a coarser or finer sample of bone dust produced; or the concaves can be thrown altogether out of use.

"An additional safeguard is provided in the shape of a friction clutch on the main driving shaft. This is found of great service. Occasionally hard substances of large size are accidentally passed into the rollers, which it is impossible for them to avoid even when the safety springs are compressed to their full extent. The resistance then of the obstacle overcomes the resistance of the clutch, and the rollers remain idle and consequently uninjured, enabling the attendant to remove the source of danger at his leisure. All the rollers run at different velocities, so that a tearing as well as a crushing action is obtained, and they are rendered to a great extent self-cleaning. The lower pair of rollers deliver into and work against corresponding toothed adjustable concaves, which embrace the lower half of the periphery of one or both rollers, and by their action the bones are further reduced to a fair sample of bone dust at a single operation. These adjustable concaves also keep the fine rollers free from fatty or glutinous matter exuded from the crushed bones.

"For the upper rollers a series of efficient separate cleaners are provided. We had an opportunity of examining these mills at the late Royal Show at York, and can affirm that their construction throughout is of the most substantial character, and calculated to withstand without risk of breakage the sudden and severe strains so frequently fatal to ordinary bone mills, while the testimony of users places their efficiency at about double that of mills requiring the same driving power, but not possessing the same detail improvements. The spindles are of steel, as also is the main driving pinion. The side frames are each cast in one piece, and are securely braced together. On the driving shaft is fitted a pulley, up to 36 inches diameter, and a separate and heavy fly wheel. The bearings are of the best gun metal, with careful arrangements for lubrication. A strong floor bracket with pedestal is provided to carry the outer end of the driving shaft, as seen in our engraving."

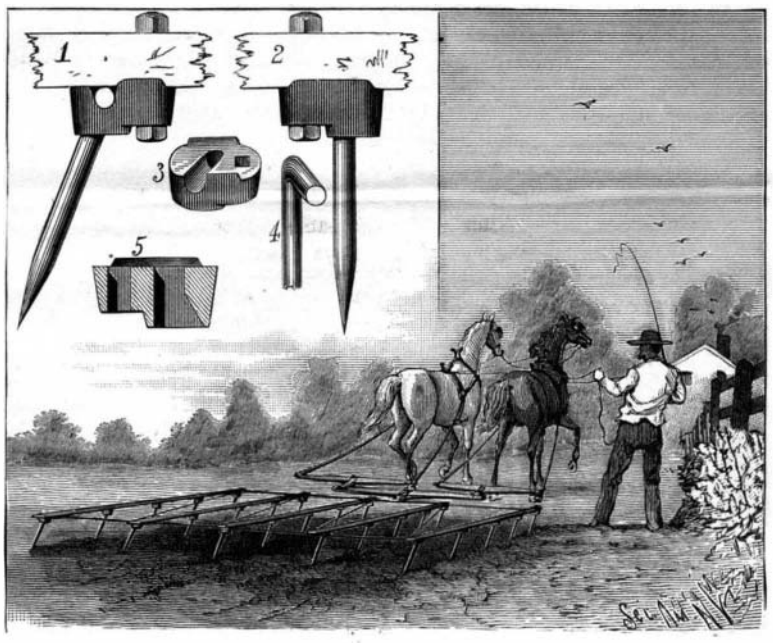


THE "HERCULES" BONE MILL.

GAS engines from ¼ horse power to 80 horse power are now made. Medium sized gas engines, say 16 horse power, will run on a consumption of fuel equal to 1½ pounds of coal per horse power per hour, which is about one-half the fuel required for the most economical steam engines of the largest size.

SOCKET FOR HARROW TEETH.

The harrow tooth is constructed with a right angled arm at its upper end, as shown in Fig. 4. The metal socket that carries the tooth is arranged on the under side of the bar, and has at one end a bolt hole, and is made with opposite side flanges on its upper surface to clip the bar on either side, and thereby assist in holding the socket to its place. Formed within the upper surface of the socket is a channel, which extends from the side of the socket to an aperture passing down through the socket, as indicated in Figs. 3 and 5, the latter figure being a vertical section through Fig. 2. The channel occupies an oblique position to the sides of the socket and length of the bar, and is of such size as to freely receive the arm of the tooth.



CARSTENSEN'S SOCKET FOR HARROW TEETH.

The aperture through which the shank of the tooth passes is of gradually increasing oblong shape, having one vertical side and one sloping side shown in Fig. 5. This construction enables the tooth to adjust itself either to a perpendicular or backwardly inclined position relatively to the beam. In Fig. 1 the draught is toward the right, and the shank of the tooth rests against the inclined side of the aperture; in Fig. 2 the draught is the same way, but as the position of the socket has been reversed the tooth bears against the vertical side. The teeth are fitted in sockets which can be readily applied to either iron or wooden frames.

This invention has been patented by Messrs. P. C. and I. A. Carstensen, of Walnut, Iowa.

A CORRESPONDENT of the *Engineer*, London, commends the water-tight coal bunkers of the new United States steamship Chicago, and thinks that if the Austral had been so provided she would not have gone down so readily.

A New Aperiodic Galvanometer.

If we add a third magnetic needle to an astatic galvanometer, so that it is below the frame and parallel to the two others, and so that its poles may be opposite to those of the needle above it, we obtain a galvanometer the sensibility of which is nearly trebled, and which preserves a directive force. We may also reverse the arrangement, making the frame movable, into which the current arrives by the suspension wires, and leaving the needles fixed.

The above considerations have led the author to devise an *aperiodic* galvanometer, which has been exhibited at the Vienna Electrical Exhibition. A more perfect model has since been constructed by the firm of Breguet.

In this instrument the six poles are retained, but the poles are formed by three horse shoe magnets with legs very near together. These three fixed magnets are placed horizontally one below another, at a distance of 0·005 meter. The frame incloses the two poles of the middle magnet, with play sufficient to permit it to oscillate freely, and obtain a deviation of 20° on each side. The light wire of this small frame is perpendicular to the axis of the magnets, and the current arrives by means of the suspension wire, as in the siphon recorder of Sir W. Thomson and other analogous frames.

If we place this galvanometer in communication with the two ends of a telephone from which the vibrating plate has been removed, then, in order to make the frame deviate, it is sufficient to let fall upon the pole of the magnet of the telephone a small fragment of iron filing, weighing a few milligrammes. This example will show its sensitiveness.

It is completely aperiodic, *i. e.*, if the two extremities of the galvanometer are connected by a wire of little resistance, the frame, having deviated from its position, stops at zero without passing it.

If we examine the position of the lines of force with reference to the four sides of the frame, we see that electromagnetic induction is produced on the four sides of the frame, and in the same direction.—*M. G. Le Goarant de Tromelin, in Comptes Rendus.*

The Present Nail Product.

The *Bulletin* of the Iron and Steel Association prints a list of the nail works, and states that seventy-four now completed have 5,008 machines, and will add 391 more before the close of the year, while there are five new works being built which will have at least 200 more nail machines in operation by January 1. By that time there will be 6,599 nail machines ready to work, with a capacity of 12,376,000 kegs of cut nails and spikes yearly. The mills and machines now completed have a capacity of about 1,000,000 kegs less; about 3,264,000 in Pennsylvania, 2,200,000 in Ohio, 1,668,000 in West Virginia, 875,000 in Massachusetts, and 690,000 in New Jersey.

Apropos of the same subject, the Philadelphia *Press* remarks: "The building boom has been for at least nine months past the chief support of the iron market; but there are many minor signs that it is near its end. The pause in the rise of rents on Manhattan Island last May was the first indication that building in New York city was overdone, and it has been followed by others which point to a serious check in real estate values there in the next six months. Nails, which since their tremendous jump in 1879–80 have been in steady demand, now show overproduction. The capacity of the nail works in the country, finished or unfinished, is 12,376,000 kegs, or twice the output in 1882, and this increase is launched on a failing market. In addition, various forms of iron used in building show a decided decrease in demand. Unless there is a sudden increase in railroad building, the falling off in house building must have a serious effect on the labor market before spring."

T. G. MERRILL, a mining engineer, says that this year's product of the Montana gold mines will reach $15,000,000.