

The writer, some time since, made a comparison of the light of the sun with that given from the molten steel in the Bessemer converter. This was chosen as an example of the greatest temperature attained on the large scale in the arts, and it is one which is known to equal that at which platinum melts. Looking down the mouth of the converter we see at one stage of the process a stream of molten iron poured into the vessel in which the melted steel is already glowing in the background. Every one knows how bright white hot (and still more melting) iron appears, but in this case the steel is so much brighter, that the fluid iron in front seems like thick chocolate poured into a white cup. The steel, just before it is itself poured, seems of sun-like brilliancy, until we come to compare it with the sun itself, which was done by means of a photometer, so arranged that the steel light shone in at one side and the sunlight on the other. When the angle subtended by each source of light was equal, the image of the molten steel was put out by the presence even of much enfeebled sunshine, and ceased to be visible as the dull flame of an alcohol lamp would be if it were set beside an electric light. The area of glowing metal exposed was considerably over one square foot, and measures made with every precaution showed that any single square foot of the solar surface must be giving out much more, at any rate, than one thousand times the light that the melted steel did.

We are not, it is true, entitled to conclude from this that the heat is in exactly the same proportion, but we are justified by inference from this, and by other experiments not here given, in saying not only that the temperature on the sun's surface is far higher than that reached in our furnaces, but that the heat is in fact so enormously greater than any furnace heat here that they can scarcely be made the subjects of comparison. Other considerations, on which we cannot now enter, give the best grounds for belief that this heat is likely to be kept up sensibly at its present rate of emission for a period which, with reference to the brief history of the human race, may be called almost infinite. These are important conclusions, whose practical bearing will be more fully developed in a concluding chapter.

AMATEUR MECHANICS.

GEAR CUTTING APPARATUS.

The index plate, A,* is attached to the larger of the pulleys on the mandrel of the lathe by means of three or four screws, and the stop, C, provided with a point well fitted to the holes in the plate, is held in position on the bed plate, B, by a screw passing through a slot in the foot into the bed piece. The stop, C, is capable of springing sufficiently to admit of

withdrawing the pin from the hole in the plate, and it is strong enough to hold the plate without vibration. Two standards, G, mounted on the plate, B, support pulleys over which the driving belt runs. The gear cutter head consists of a casting, D, fitted to the tool post of the slide rest, and the mandrel, E, provided with a pulley and mounted on carefully fitted centers in the casting. The casting, D, has upon opposite sides, near the upper end, ears (as shown in Fig. 3) for receiving the pulleys, *a b*, which guide the driving belt, so that the cutter may be moved across the face of the wheel, being cut without changing the tension of the belt. The extreme end of the loop formed by the belt is supported by the pulley, H, mounted on a standard rising

presents the side, the lower view the edge of the cutter. It has but a single tooth and is adapted to brass and similar alloys only. It may be sharpened by grinding. When iron or steel is to be cut the cutter should have several cutting edges, and the mandrel, E, should have a larger pulley, as more power will be required and the speed must be slower. By setting the slide rest at an angle bevel gears may be cut.

In a subsequent article the subject of sizing and cutting small gears will be treated. M.

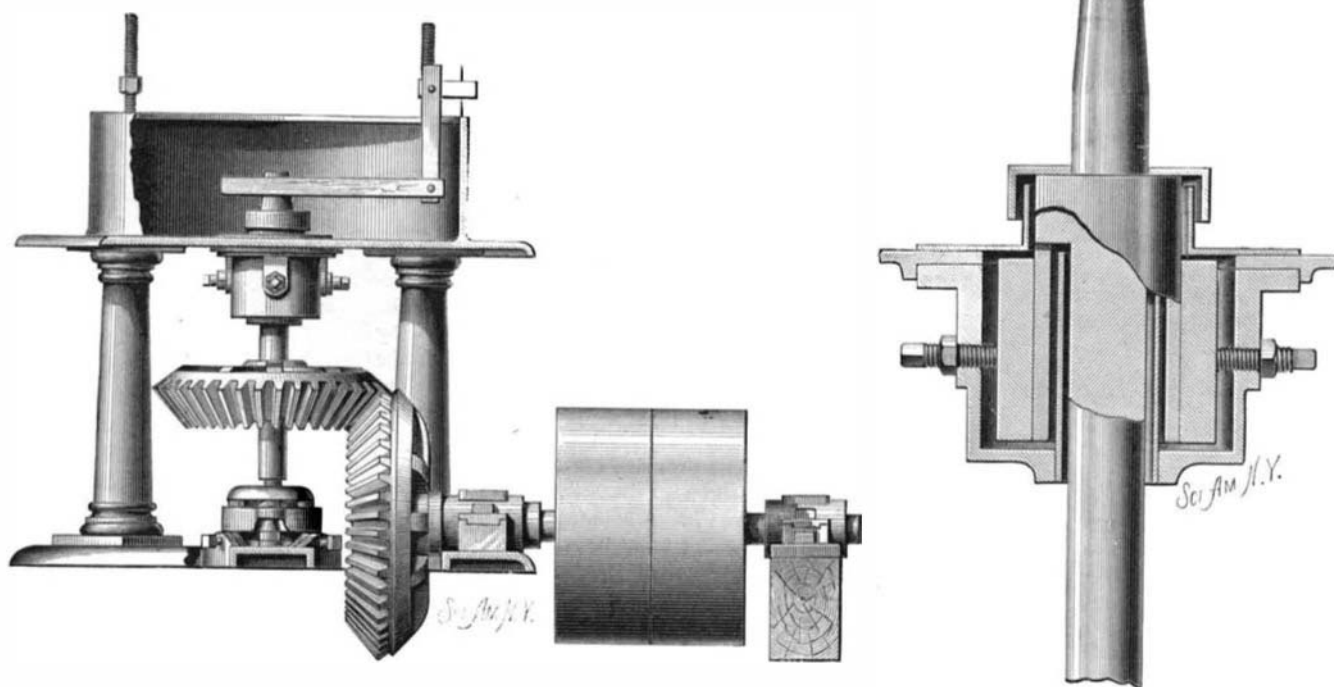
AN IMPROVED MILL.

We give herewith engravings representing some recent improvements on the Munson mill, which was described in these columns some time since. The late improvements relate to the trammings of the spindle, to a novel device for lubrication, and to other points of merit.

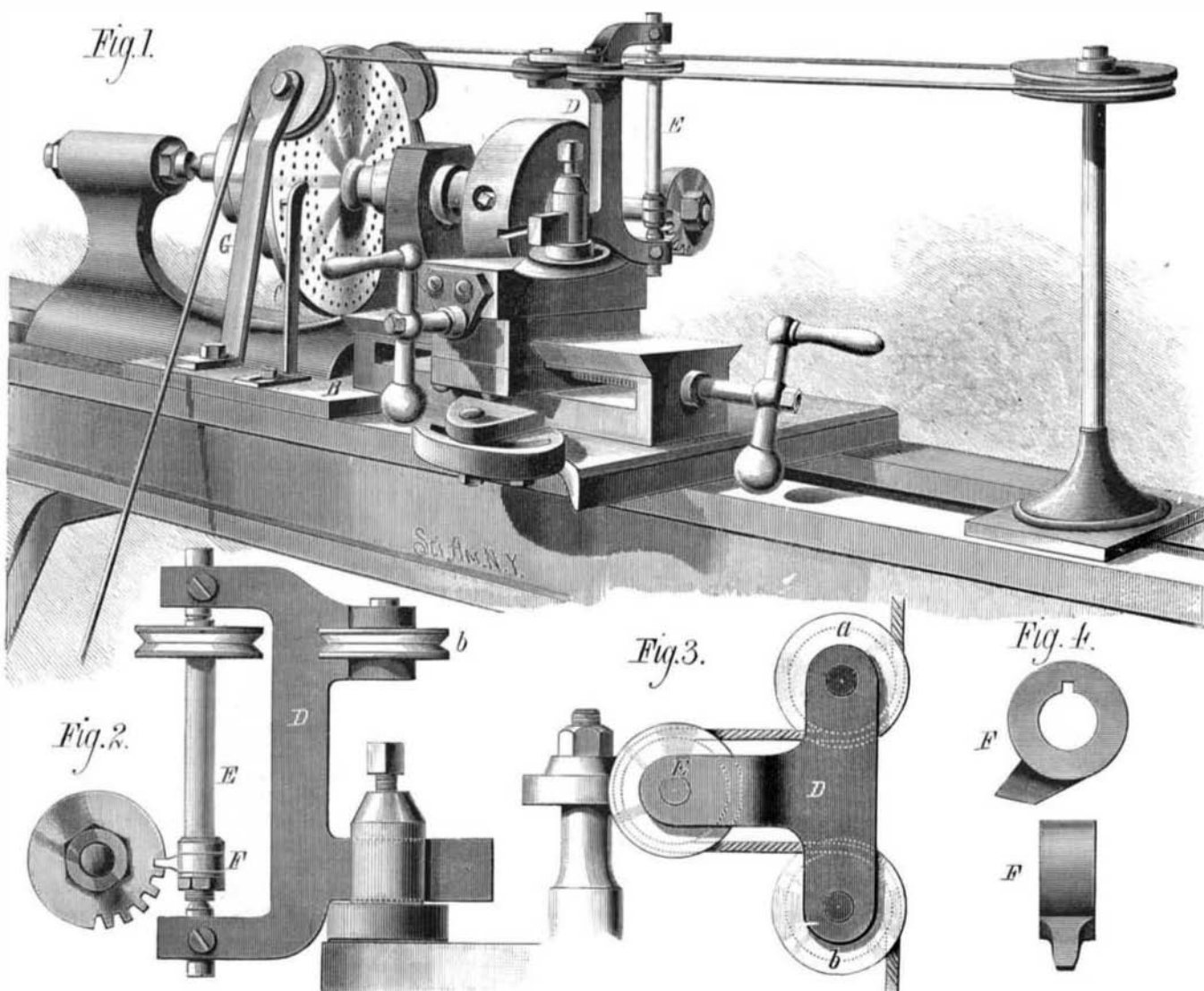
The manufacturers of this mill say that the so-called portable mills now being sold in the market answer very well on coarse grains and coarse grinding, but for fine work they do not meet the demands of the trade; they are constructed without regard to the trammings of the spindles or the importance of keeping them in their true working positions. The metal boxes, which are held up against the collar or the neck of spindles, are con-

tinually wearing out, and unless some provision is made whereby the spindles may be perfectly and accurately adjusted, the work performed is of an inferior quality, and the loss of power by friction greatly increased. The Munson mill is made on mechanical principles, and special pains have been taken in their construction to obviate these defects. The curb of the mill, being cast in one piece, has its inside rim turned perfectly true, and by means of a tram stick or index, as shown in our illustration, any deviation or any perceptible change in the position of the spindle, no matter how slight, can be easily detected and easily adjusted.

The spindles are made of solid wrought iron or hammered iron and are provided with inserted solid steel points ground in on a taper fit with emery and oil, making an absolutely perfect bearing, which may be easily removed when injured. The neck or collar is forged solid on the spindle and reamed out to fit within the bush; inside the bush Babbitt metal boxes are placed, which are held up against the collar by setscrews. The bush is provided with a central vertical tube around which the collar works, the tube passing up between the collar and the bottom of the spindle, the collar in the bush forming the bearing surface of the spindle. The bush is covered by a cap having a circular central opening through which the spindle passes. The bush once filled with oil will keep the bearing of the spindle perfectly



MUNSON BROTHERS' MILL.



APPARATUS FOR GEAR CUTTING.

* See "Index Plates for Gear Cutting," page 20, current volume of SCIENTIFIC AMERICAN.