Sheet 1, 2 Sheets.

F. A. Pratt.

Cutting and Shaping Gear Cutters.

No. 112,379. Patented Mar. 7, 1871.

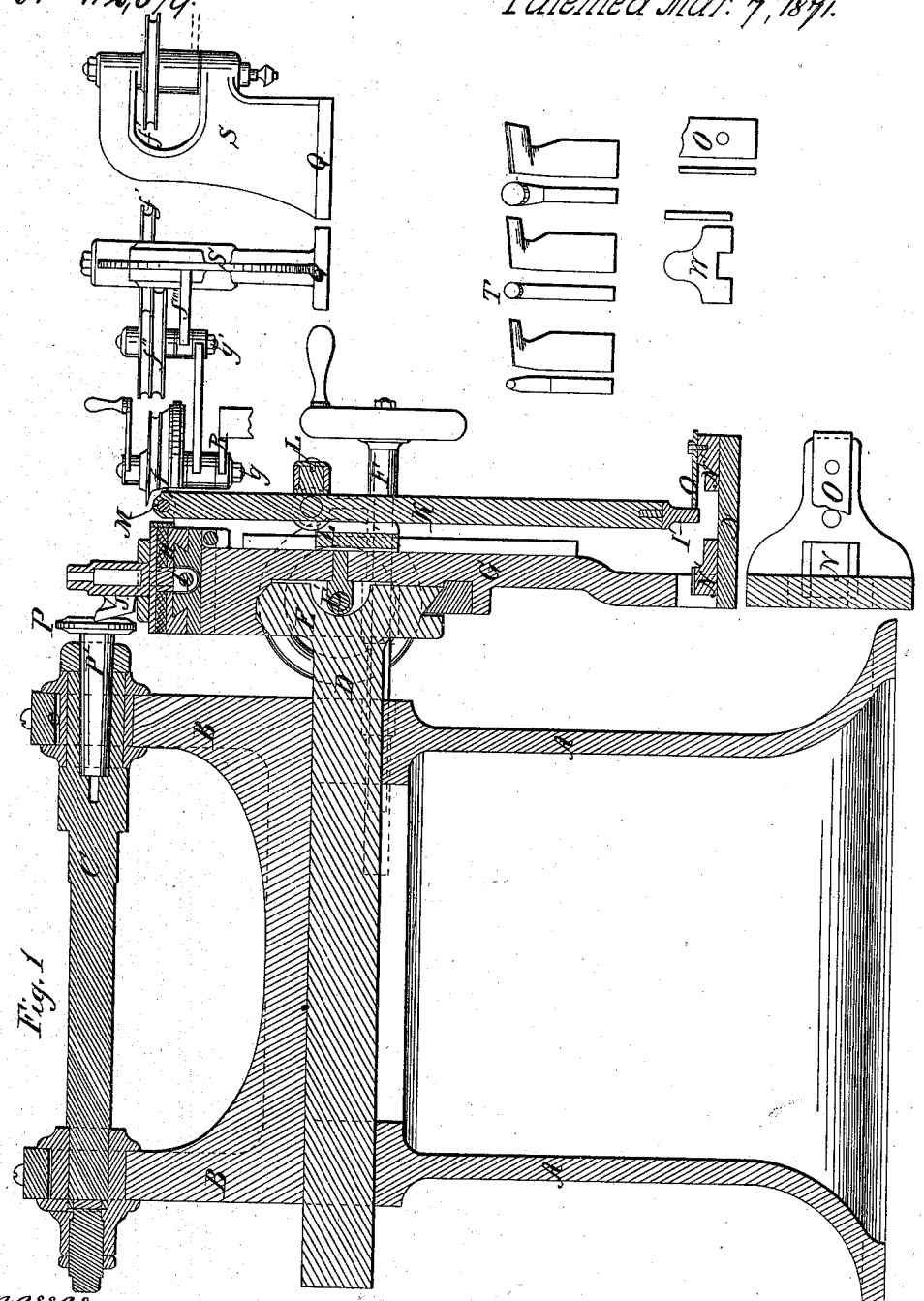

Fig. 1

Witnesses.

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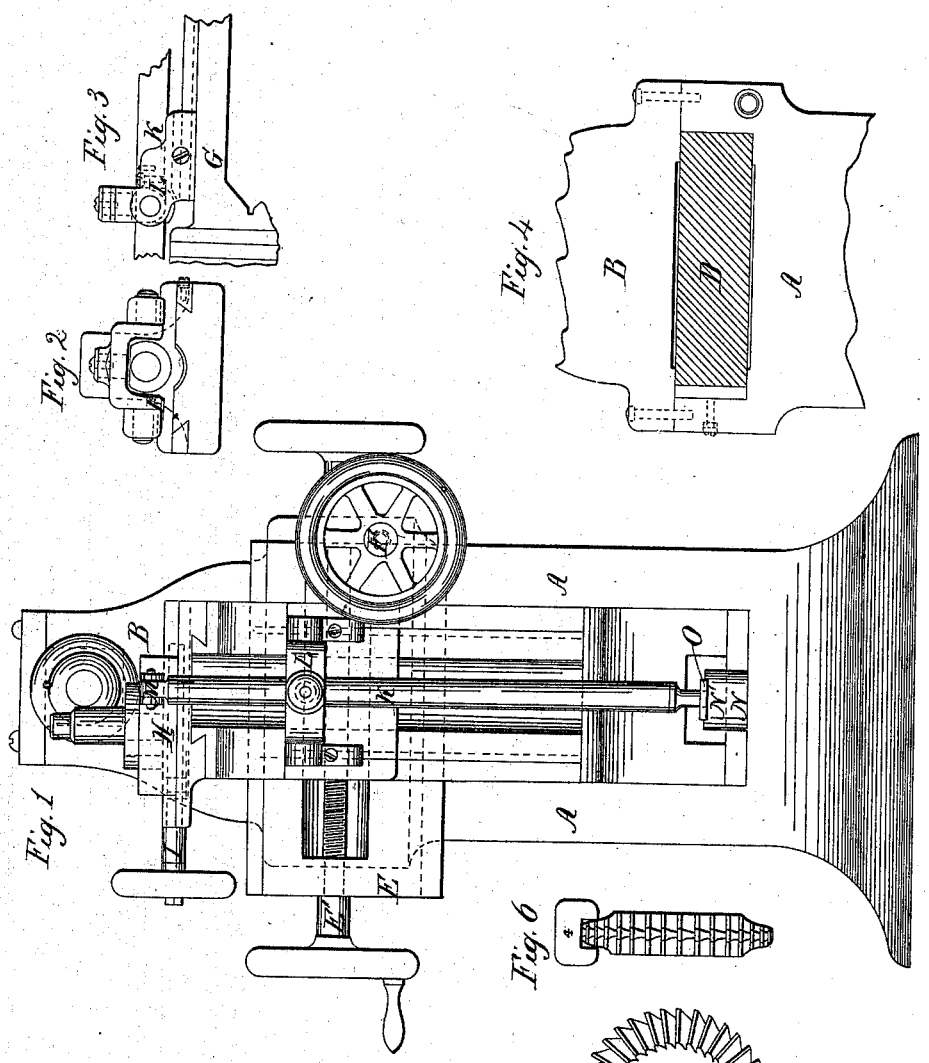

Witnesses
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Inventor.
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FRANCIS A. PRATT, OF HARTFORD, CONNECTICUT, ASSIGNOR TO "THE PRATT & WHITNEY COMPANY," OF SAME PLACE.

Letters Patent No. 112,379, dated March 7, 1871.

IMPROVEMENT IN MACHINES FOR SHAPING AND CUTTING GEAR-CUTTERS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, FRANCIS A. PRATT, of the city and county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Shaping and Cutting Gear-Cutters for Cutting Gear-Teeth; and to enable others skilled in the art to make and use the same I will proceed to describe, referring to the drawing, in which the same letters indicate like parts in each of the figures.

The nature of this invention consists in the arrangement of a machine, in connection with templets, tools, and gauges, whereby I am enabled to produce more perfect cutters for cutting the teeth of wheels or gears, and in much less time and at less expense than has hitherto been done. Heretofore it has been found to be a very difficult part of machine building to produce good working gearing, in consequence of the difficulty in producing properly-shaped cutters, it being necessary to make a templet and shaping-tool for each cutter, which is done with great difficulty, especially on the finer pitches.

In my apparatus I use only one set of formers, representing the number of teeth in the wheel that the cutters are designed to cut. I make the formers of large dimensions, thereby insuring greater accuracy, and reducing the sizes or pitch of the cutters by means of a movable fulcrum upon the actuating-lever, which is graduated upon its line of traverse to suit the different pitches. It will be readily seen that, instead of a large number of templets, some of them being very small and difficult to make, I can by my system produce a cutter for any number of teeth or of any required pitch with a great degree of accuracy.

I am also enabled to cut the teeth upon the cutter, with my apparatus, with dispatch.

This machine operates upon the same principle as the pantagraph, one end of the lever bearing against the edge of the former, guide, or templet *o*, and the other end being attached to the tool-rest, and moves said tool-rest in exactly the same track, and describes a curve like the former or templet on the other end of the lever.

In the different pitches or grades of cutters the same templet is used, (using the templet representing the number of teeth the cutter is desired to cut,) and making the different pitches by changing the fulcrum of the lever. Thus it will be seen that in moving the fulcrum up nearer to the tool-post the upper end of the lever is shortened, and that the same curve or shape will be traced; only it will be diminished in size.

It will be also seen that, in forming cutters of different pitches, different sizes of tools must be used corresponding with the different pitches, as, for instance, the formers represent No. 1 (diameter pitch) and the follower-pin is one inch; consequently the tool to be used for forming a cutter one to the inch must be one inch in diameter or one-half inch radius on the cutting-point; and for a cutter two to the inch a half-inch tool must be used; for four teeth to the inch a one-fourth inch tool at the cutting-point; the tool in all cases being proportioned to the pitch of the cutter to be made; and in practice it is found that the proper shapes are obtained of the different pitches, and that, whatever the pitch may be, the gearing will run accurately.

It has also been quite difficult to obtain readily the proper thickness of cutter at the pitch-line. I provide close gauges W, representing the different pitches of teeth. After one side of the cutter has been formed the other side is then turned until the gauge just fills at its points of contact at pitch-line and top of cutter, as shown in fig. 6.

In the accompanying drawing, sheets 1 and 2, is shown my machine for forming and cutting the cutter.

In sheet 1—

Figure 1 is a side sectional elevation.

Figure 2 is a side and end view of the apparatus for cutting the cutter, detached from the machine.

Sheet 2—

Figure 1 is an end elevation.

Figures 2 and 3 are detached portions of the machine.

Figure 4 is a partial section of the frame-work and head-stock of the machine, showing how the sliding bar is fitted to slide back and forth between the under side of the head-stock and the upper side of the frame-work, the working mechanism being secured to the front end of said sliding bar.

Figures 5 and 6 show a side and edge view of one of the cutters.

Figure 7 is a side view of the templet.

A is the frame-work of the machine.

B is the head-stock, having a spindle, C, fitted in boxes in the common way. This spindle is provided with a socket to receive and hold a mandrel, upon the outer end of which is secured the blank to be formed into a cutter.

D is a sliding stock or bar, fitted into a chambered recess between the under side of the head-stock and the upper side of the frame-work.

To the outer end of this stock D, and at right angle therewith, is secured a cross-head E—the upper edge and the lower edge of this cross-head parallel, and beveled on an angle with its face. This stock is operated back and forth by means of a screw-spindle, F.

G is a tool-stock frame-work, fitted and secured upon the cross-head E in the common way of fitting lathe-work, so as to fit closely and slide freely back and forth thereon. This tool-stock G is operated back and forth on the cross-head E by means of a screw-spindle, E'.

H is a tool-holder, having a two-way movement, the joint fittings of which are made in the usual way, one movement of which is to and from the face of the machine, and the other at right angle with the first movement or parallel with the face of the machine, one of which is operated back and forth by the screw I. These slides depend entirely upon the former or templets O for their movement.

J is the cutting-tool, arranged and secured in the common way to the upper side of the holder H.

K is an actuating-lever, the upper end of which is secured in a swivel-joint, M, on the tool-holder H. This actuating-lever is fitted closely and works freely upon its fulcrum, the universal joint L being its fulcrum. This universal joint is fitted so as to move up and down upon the face of the frame-stock G, and is secured in the desired position thereon by screws *a*.

Upon the face or edge of the stock G I form a scale for accurately placing the universal joint at any desired point, to produce, by the action of the lever K and pattern or templets O, the desired pitch or size of the cutter.

At the lower end of the stock G, and extending forward at a right angle therewith, is formed a bracket, N, on which is provided steps N′. Upon these steps the templets O are secured, the templet or pattern edge of which is arranged and secured in a true position relative to the actuating-lever K.

The cutter-blank P is secured to the outer end of the spindle P′.

The tool J is first secured in its stock and then adjusted to the cutting-point on the outer edge of the blank P by means of the screws F. Then, by the screw I, the tool is moved forward gradually, and the tool cuts and travels in the path governed by the action of the lever-spindle K against the templet or former O. When one side is finished then the blank is reversed on the spindle, and the same shape is produced on the reversed side.

After the proper thickness of the cutter is obtained by the use of the gauge W, then the apparatus shown in fig. 2, sheet 1, is arranged for cutting the teeth upon the cutters. First the tool-post is removed and the foot Q is secured thereon, and the bracket-foot R is secured to the head-stock at *e*, and is provided with a stud-pin, *g*, on which is arranged a friction driving-wheel, *f*.

I′ is the follower-pin, secured in the lower end of lever K, which pin bears against the edge of the templet O and follows the curved shape thereof, said pin being changed for the different pitches of the cutters.

The spindle of the gear or wheel *f* and the spindle of the stock S are connected by arms, which form an elbow or swivel-joint. The two center ends are united by a stud-pin, *g′*, and on this stud-pin is arranged gears or grooved pulleys, or driving-wheel *f‴*, and forms a connection by toothed rim or by bands and arms *f⁗*, so as to transmit motion from the wheel *f* on the stud-pin *g* to the cutter-spindle *h*. Its construction admits of motion in all directions.

S is a stock supported by and is a part of the foot Q, in which is arranged a spindle, *h*, and the driving-wheel *f′*. In the lower end of this spindle is secured a cutter for cutting teeth in the cutter-blank P. Thus, when the power is applied to the machine, the cutter is moved forward by turning the screw-spindle I, and the cutter is guided by the lever-spindle K in the same manner as when forming the shape of the cutter. The lever K is pressed against the edge of the former or templet O by a weight or by foot pressure, not necessary to show here.

The spindle P is firmly held in a fixed position by an index and dog, so that it may be turned, at intervals of forming each tooth, sufficiently to form a tooth on the cutter successively of equal dimensions, in the common way. By this arrangement the teeth of the cutter may be formed on each side and edge without removing the cutter from the spindle P′, simply by changing the templet or pattern O from one step, N, to the other.

T represents different-size tools for different pitches of cutters.

I believe I have thus shown the nature, construction, operation, and advantage of this invention, so as to enable others skilled in the art to make and use the same therefrom.

What I claim, and desire to secure by Letters Patent, is—

1. The combination of the templet O, lever K, adjustable fulcrum L, sliding carriage and tool-carrier H, with the slide G, substantially as described.

2. In combination with the subject-matter of the first claim, the slide D E and head-stock A B, substantially as described.

3. The combination of the templet O, lever K, adjustable fulcrum L, slide G, sliding carriage H, with the stand Q and milling-tool spindle *h*, substantially as described.

4. In combination with the slide G, sliding carriage H, stand Q, spindle-carriage shaft *h*, the double-jointed radius bars, the pulleys, support R, and head-stock A B, substantially as described.

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Witnesses:

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