(No Model.) 2 Sheets—Sheet 1.

F. H. RICHARDS.

GEAR CUTTING MACHINE.

No. 305,229. Patented Sept. 16, 1884.

Fig. 1

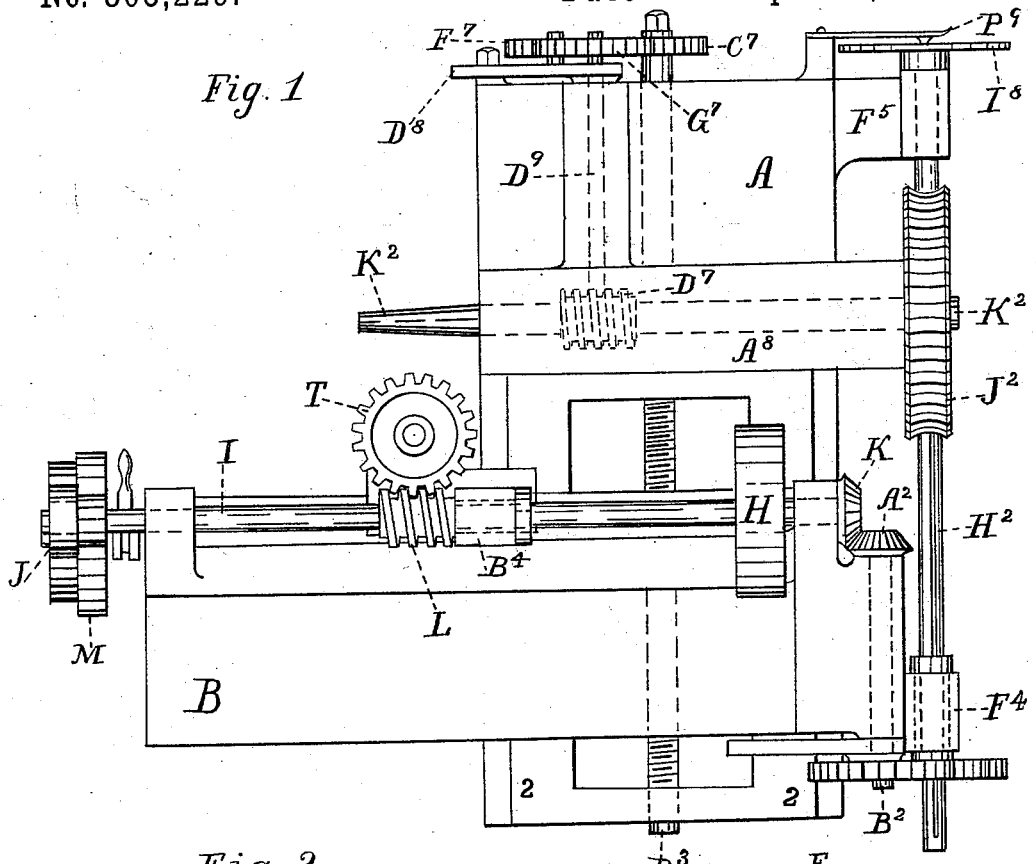
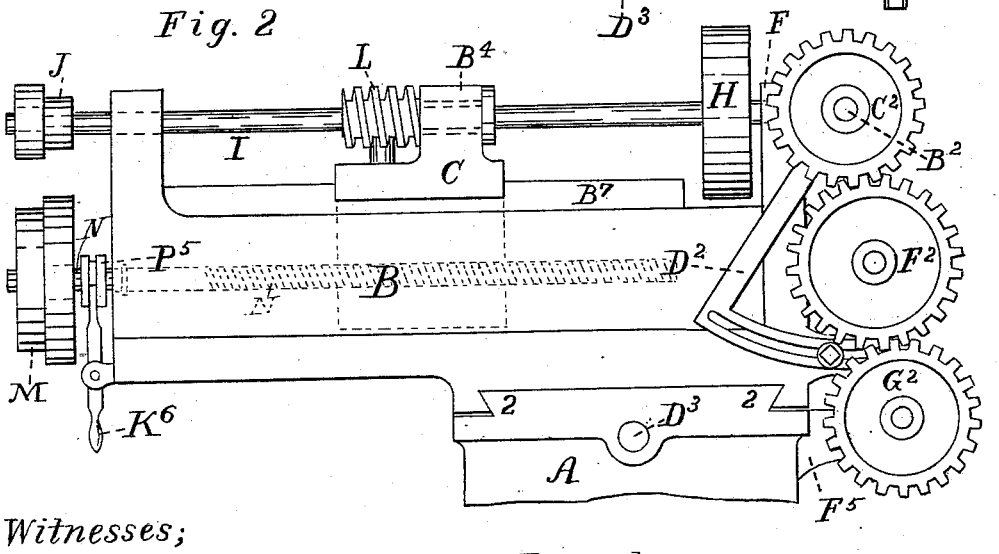


Fig. 2



Witnesses;

H. W. Faulkner

Chas. O. Palmer.

Inventor;

Francis H. Richards.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3

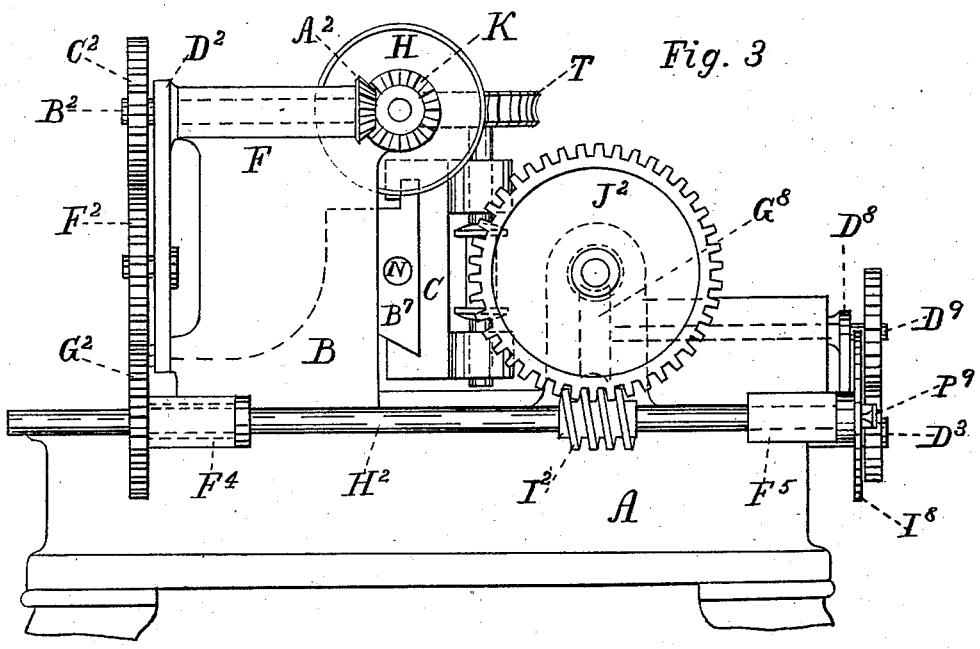
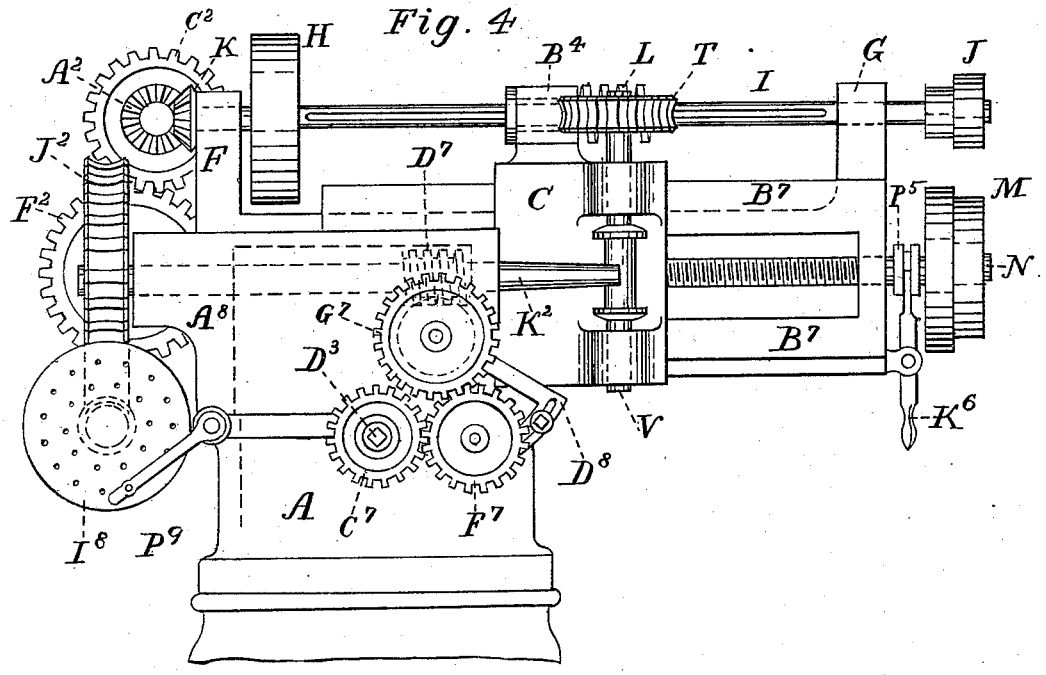


Fig. 4



Witnesses;

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Inventor;

Francis H. Richards.

UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF SPRINGFIELD, MASSACHUSETTS, ASSIGNOR TO THE PRATT & WHITNEY COMPANY, OF HARTFORD, CONNECTICUT.

GEAR-CUTTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 305,229, dated September 16, 1884.

Application filed December 31, 1883. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Gear-Cutting Machines, of which the following is a specification, reference being had to the accompanying drawings, in which similar reference-characters refer to similar parts throughout the several views.

My invention relates to the manufacture of spur-wheels and of worm-wheels, and has for its object to provide for the making from suitable blanks of either of said kinds of wheels by means of a machine having but a single master-wheel. My invention is, in that respect, an improvement, of more simple construction, upon a machine for a similar purpose invented by Francis A. Pratt, of Hartford, Connecticut, whose application for Letters Patent therefor was filed November 5, 1883, and has the Serial No. 110,955, to which reference may be had.

Like unto the invention of said Francis A. Pratt, my invention consists of several mechanisms organized into a machine, and in the particular combinations contained therein. Some of said mechanisms and combinations in the machine shown and described herein as embodying my invention are or may be similar or identical to certain of those in the machine embodying his invention. Therefore, to facilitate reference to them, I have in this application generally indicated those parts of my machine that are also contained in his machine by the same reference-characters that he has employed to indicate said parts in his application.

In the drawings, Figure 1 is a plan view of a machine embodying my invention. Fig. 2 is an elevation of the rear end thereof, drawn in projection with Fig. 1. Fig. 3 is an elevation of the rear side, and Fig. 4 is an elevation of the front end, of the machine.

The bed A of the machine—in this instance located horizontally, but not necessarily so—has an elevated portion, as A^8, in which any suitable blank-carrying arbor is fitted to revolve, and ways, as 2 2, Fig. 2, whereon the frame B is adapted to travel. That frame has ways B^7, on which a carriage, C, of the cutter-carrying mechanism is fitted to travel, bearings G F for the driving-shaft I, bearings for traverse-screw N, and a bearing for shaft B^2. The carriage C carries a cutter-arbor, V, which has a gear-wheel, T, driven by a pinion, L, that is revolved in bearing B^4 by splined shaft I. A nut (not shown) fixed on the back side of carriage C is formed to receive screw N, which is driven by any convenient means—as, for instance, pulleys J M—a clutch, P^5, operated by lever K^6, serving to start and stop the said screw.

The driving-shaft I is driven by a pulley, H, and carries a pinion, K, meshing with a gear, A^2, on shaft B^2, which shaft B^2 carries also the first one, C^2, of a train of change-wheels, C^2, F^2, and G^2, of which the second or intermediate one, F^2, is carried by and upon an adjustably-fixed yoke, as D^2. The third one of said change-wheels is carried by a bearing, F^4, of frame B, and is adapted to drive a splined shaft, H^2, parallel to ways 2 2. Fixed upon this shaft, and meshing with master-wheel J^2, is the pinion I^2, whereby said shaft rotates the blank-arbor K^2. The shaft H^2 also carries an index, as I^8, preferably removably fixed thereto, or other device for use in spacing spur-wheels. A spring-point, P^9, secured to bed A, operates to prevent said index from turning in the usual manner.

In the bed A are bearings for a traverse-screw, D^3, which works in a nut (not shown) fixed to the under side of frame B, for sliding that frame on ways 2 2. On blank-arbor K^2—in the present instance within the part A^8 of the bed A—is a pinion, D^7, which meshes with a gear-wheel, G^8, (see Fig. 3,) on shaft D^9, that shaft being adapted to drive traverse-screw D^3 by means of any convenient appliance—as, for instance, a train of gears, as G^7, F^7, and C^7, of which the intermediate one, F^7, is carried by a yoke, D^8. By this means the power required to move frame B in the operation of cutting worm-wheels may be taken from the arbor K^2, which, owing to its naturally slow rotary motion, is particularly adapted to communicate the required slow feeding motion to said frame.

The parts B^7, C, B^4, V, T, L, G, F, I, J, M, N, P^5, K^6, H, K, A^2, B^2, C^2, D^2, F^2, G^2, H^2, I^2,

J^2, K^2, D^5, and F^5 are or may be similar or identical to the corresponding ones described in the said application of said Francis A. Pratt. The other parts of my machine are not the same as in that application, but are substantially as herein shown and described.

I do not claim, but, on the contrary, I hereby disclaim, anything herein described and claimed that is described in the said application of said Pratt.

I do not limit my claims to the use of a worm-wheel for the master-wheel J^2; but I may use other forms of gearing than worm-gearing between shaft H^2 and arbor K^2, as shown, for instance, in Fig. 19 of the application of said Pratt aforesaid, wherein bevel-gearing is shown thus employed. Neither do I limit myself to a blank-spacing device having an index, as shown and described; but I may use any other device adapted to perform the same function—as, for instance, that shown and described for that purpose in the aforesaid application of said Pratt.

When a spur-wheel is to be cut in this machine, the blank therefor is first fixed to the blank-arbor k^2. A suitable cutter is fixed on arbor V. One of the train of gear-wheels between shafts B^2 and H^2 is removed, and the frame B is moved by means of screw D^3 to a proper position to allow the cutter to make a groove in the blank of a predetermined depth. The cutter is next started rotating by means of a band on pulley H, and the cutter is fed across the blank and then withdrawn in the usual manner. The blank is then rotated through a proper space to form a tooth, and the aforesaid operation repeated as required, the said index, or its equivalent, being used to determine said space.

When a worm-wheel is to be cut in this machine, the blank therefor and a suitable hob and the frame B are first suitably fixed in proper positions. The point P^9 is removed from holding the index, and suitably-proportioned gears C^2 and G^2 are selected to rotate shaft H^2. Those gears are usually taken from a series of them provided for that purpose, and are to be of such relative proportions (having due regard to the other gearing of the machine) that the hob will traverse the periphery of the blank the same as a worm corresponding to that hob in pitch and size would, if in place of that hob, traverse the periphery of the completed worm-wheel. The hob and blank are now started rotating, and by means of screw D^3 the frame B is fed toward the blank-arbor K^2 until the worm-wheel is completed. That operation of feeding the hob to the blank may be performed by hand in the usual way, or by means of the gearing described for that purpose.

I claim as my invention—

1. In a gear-cutting machine, a mechanism consisting of frame A, arbor K^2, having a master-wheel, J^2, shaft H^2, having a pinion meshing with said master-wheel, sliding frame B, having ways for carriage C and bearings for shaft I, carriage C, arbor V, having a gear-wheel thereon, shaft I, having a pinion meshing with said gear-wheel on arbor V, jointly with a detachable train of gearing, substantially as described, between shaft I and shaft H^2, for use in cutting worm-wheels, and with an indexing device on shaft H^2, substantially as described, for use in cutting spur-wheels, all combined and operating substantially as set forth.

2. In a gear-cutting machine, in combination, a suitable frame-work, as A, frame B, sliding on said frame A and carrying the cutter-carrying mechanism, arbor K^2, working in a fixed bearing on frame A transversely to the line of motion of frame B, shaft D^9 working in a fixed bearing on frame A parallel to said line of motion, gearing, substantially as described, between said arbor and said shaft, screw-shaft D^3, parallel to said shaft D^9 and the aforesaid line of motion, and working into a nut on frame B, and a train of changeable gearing between shaft D^9 and said screw-shaft, all combined and operating substantially as set forth.

3. The combination of these four elements: first, a frame-work, as A, having transversely thereon a fixed bearing for a blank-arbor, longitudinal ways 2, and bearing F^5; second, a blank-arbor working in said fixed bearing and provided with a master gear-wheel, a splined shaft, H^2, working in said bearing F^5 parallel to ways 2, and having a pinion gearing with said master gear-wheel; third, a frame, B, sliding on ways 2 and partially overhanging said frame A, having upon the side thereof toward the blank-arbor ways, parallel to said arbor, for a cutter-carrying mechanism, and having bearings for the shaft I of a cutter-operating mechanism, and fixed bearing F^4 in line with bearing F^5; fourth, gear G^2, carried in bearing F^4 and splined to shaft H^2, and a train of gearing, substantially as described, connecting gear G^2 with shaft I, all combined and operating substantially as described.

FRANCIS H. RICHARDS.

Witnesses:

FRANCIS A. PRATT,

GEO. A. REYNOLDS.