No. 661,492. Patented Nov. 13, 1900.

F. A. BURNHAM.

MILLING MACHINE.

(Application filed May 8, 1900.)

(No Model.) 2 Sheets—Sheet 1.

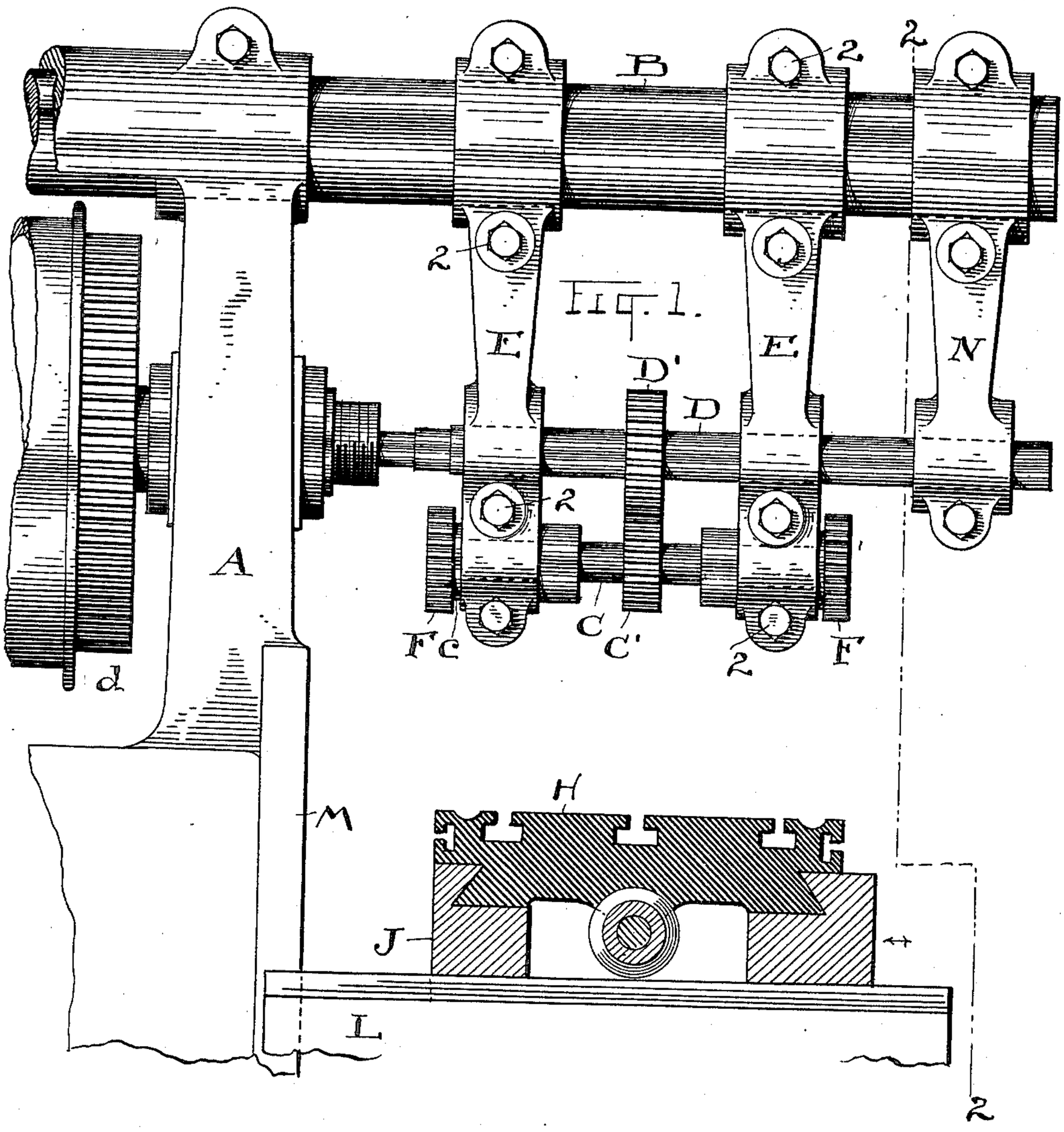

Fig. 1.

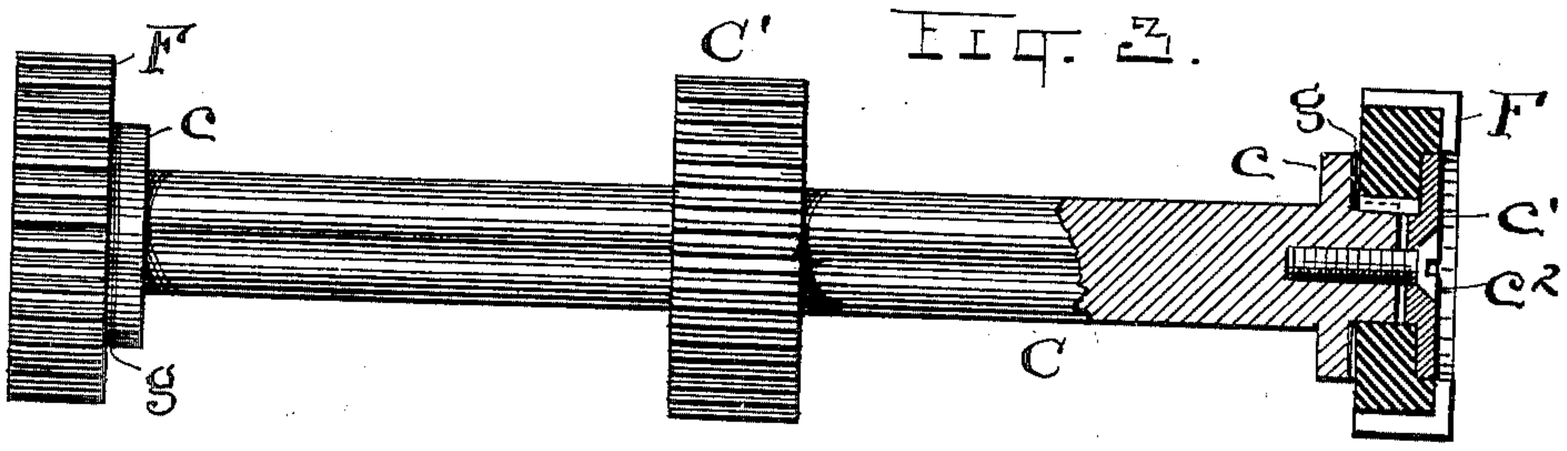

Fig. 2.

Attest.

T. B. Moore

H. E. Midra.

Inventor.

Frank A. Burnham

By W. V. Fisher Atty

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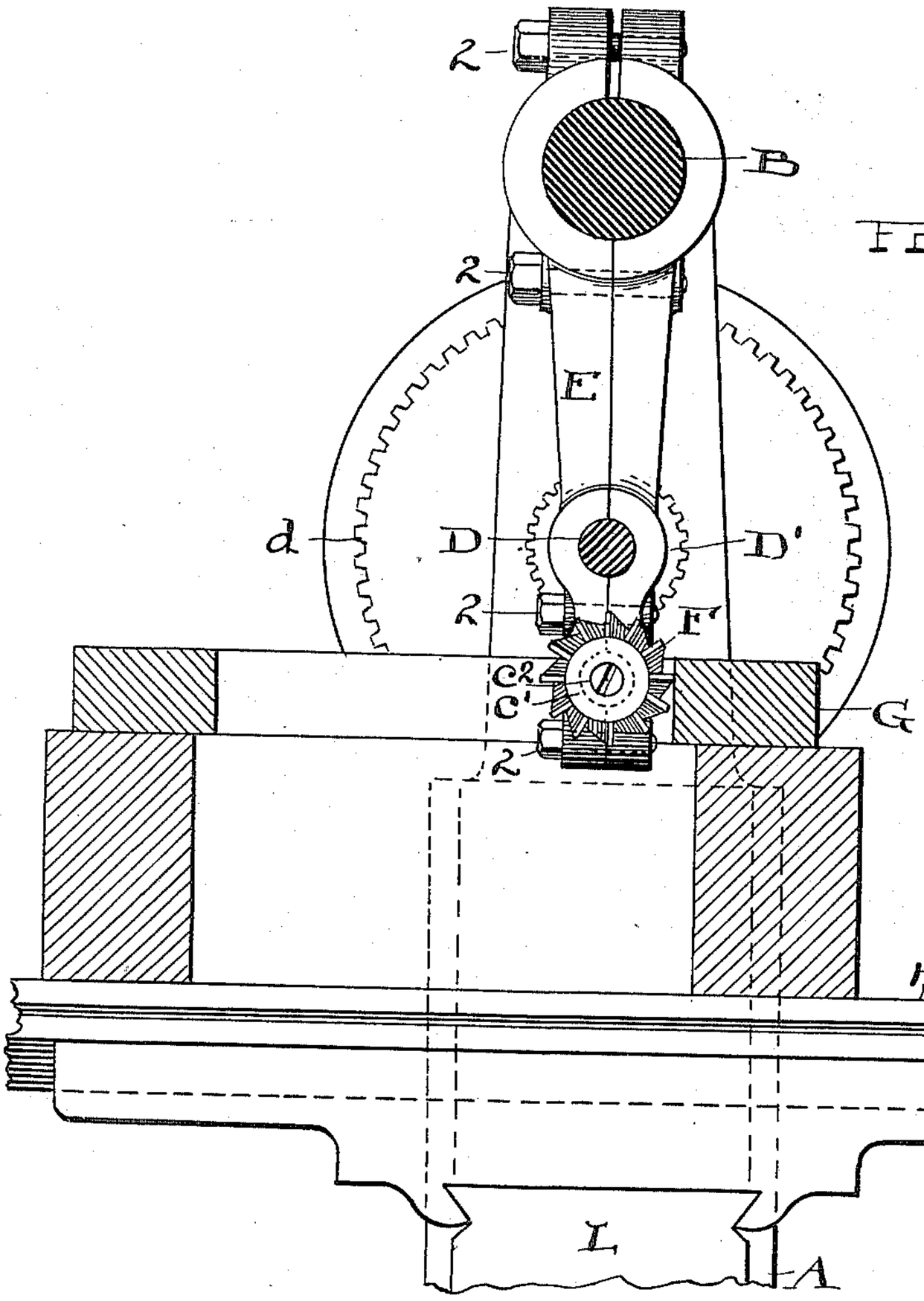
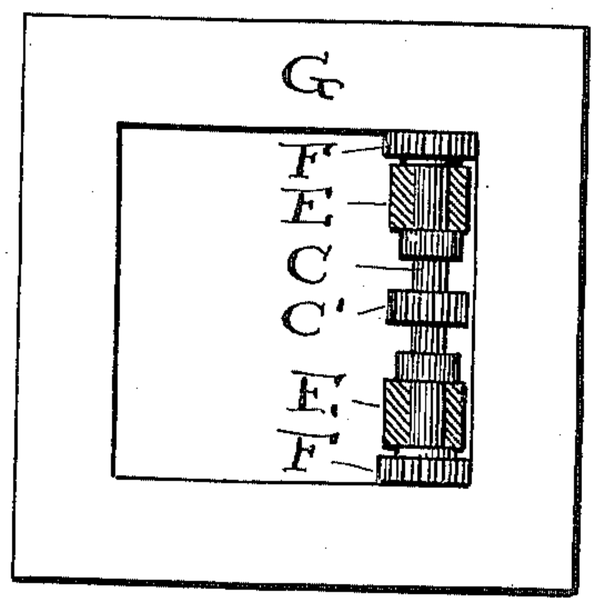


Fig. 2.

Fig. 4.



ATTEST

R. B. Moser

H. E. Mudra.

INVENTOR

FRANK A. BURNHAM

BY W. V. Fisher ATTY

UNITED STATES PATENT OFFICE.

FRANK A. BURNHAM, OF CLEVELAND, OHIO, ASSIGNOR TO THE CHANDLER & PRICE COMPANY, OF SAME PLACE.

MILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 661,492, dated November 13, 1900.

Application filed May 8, 1900. Serial No. 15,966. (No model.)

To all whom it may concern:

Be it known that I, FRANK A. BURNHAM, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Milling-Machines; and I do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in milling-machines; and the invention consists in the construction of certain novel and original attachments and in combinations of parts, all substantially as shown and described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is an elevation of that portion of a complete and well-known style of machine in which my invention is more particularly located and embodying my improvements. Fig. 2, Sheet 2, is a sectional elevation of the portion of the machine shown in Fig. 1 and on line 2 2 of said Fig. 1. Fig. 3, Sheet 1, is a plain elevation, enlarged, of a milling-shaft and its attached parts, one end and the tool thereon being sectioned to show the way of attaching the tool. Fig. 4, Sheet 2, is a plan view of a square piece of work and of a shaft and set of milling-tools therein as they appear when at work.

A in the drawings represents a portion of a common form of milling-machine known more especially as the "universal" milling-machine, and B is an arm thereon which is adjustable to extend a greater or less distance out from the frame of the machine over the work, according to the size of the work to be done and other conditions, as will appear farther along.

C is the cutter or milling-tool shaft, and it will be especially noticed that only a single milling-shaft is used, and D the drive or power shaft therefor, having any suitable power connections—in this instance a gear-wheel *d*. These two shafts are parallel to each other and to the arm B above and are suspended one over the other from said arm by longitudinally split, divided, or sectional hangers or brackets E. Said hangers or the sections thereof are connected by a series of bolts 2, here and there, and are clamped at their top to the arm B, while they also form bearings for said hangers. They may be separately adjusted on arm B, and the said arm itself is held adjustable in clamped supports on the main frame. For all ordinary work there is abundant room within the lengths of arm B and shaft D, as herein shown; but the milling-shaft is designed to be replaced or substituted by another with each change in the size of work. Hence said shaft has the tools or cutters F secured thereon practically as fixed members, except as they may be removed for sharpening or the like, and as the work of said tool is largely endwise as to the shaft they have a milling or cutting outer face, as well as a cutting-periphery and abut against a flange *c* on their shaft, which gives them the required strength and fixedness of backing. Then to attach them to the shaft I use a disk or plate *c'* outside, which sits in a recess in the face of the tool and is fastened by a screw c^2 penetrating the end of shaft C. Both cutters or tools are secured in the same way and the disks *c'* are retired within the cutting outer surface.

The shaft C also carries a permanent gear-wheel C', and the complete equipment of this shaft as an interchangeable member is the said gear and the milling-cutters E, and there is no exchange made for a larger or a smaller piece of work without bodily replacing shaft C with its attached parts.

For several reasons I regard this as a very important feature of the invention practically, and hence the hangers E are split or formed in sections and separately bolted together and clamped on arm B to facilitate the removal of said shaft. When the shaft C is to be removed, the hangers are simply unscrewed and it is free. The shaft D carries a gear D', which meshes with gear C' and imparts power to the milling-shaft. This or its equivalent connection may be used.

One application of the milling-tools thus arranged and operated is shown in Fig. 4, where a square frame G is illustrated having the said tools in actual working position on its inside. The frame G need not necessarily be square and may have either two or four sides or edges to be milled, according to what the work is, and the sides milled may be longer

or shorter than the other sides or ends, as the case may be. To start the cutting, there is presumed to be a substantial agreement between the width of the work and the length of shaft C and its tools, so that the tools will take only the usual amount of land and no more. Of course there are prevailing and well-known sizes generally of the work to which the cutter mechanism is built and adjusted, and a fine adjustment on the spot is effected by the use of paper or other sheets *g*, introduced between flanges *c* and cutters F, Fig. 3. If some of these are placed in originally, they may be decreased, if necessary, or increased, as may be required.

Any suitable support may be used for the work G to be milled. In this instance I show a platen or table H as its immediate support and which should be equipped with suitable means to hold the work, consisting in this case of a square metal frame, Fig. 4. The upper table H is adapted to be moved on the support J next beneath, Fig. 1, in which it is confined by dovetail bearings or channels, and said support or frame J is itself movable at right angles to table H on the vertically-movable bed or table L, which latter table travels up and down in vertical guideways M. Any suitable construction of these parts and of means to provide each and all with the requisite feed or lift may be adopted. Hence I do not deem it necessary to show more than is here shown, and especially since these tables are not really my invention and only appear here to show working relations of the parts.

At the outer end of arm B, I show an additional support or carrier N for the outer end of shaft D. This may be advantageously used especially with the longer shafts. It is of course understood that only square openings in any size of the work G are designed to be milled by this machine and not such as are round or circular. It will be noticed that though the suspenders or hangers E and shaft C be taken down the shaft D will still be held in place by its end supports.

Among the material advantages to be noted for a single shaft with the cutters on its ends is the fact that the two cutters thus work against each other and prevent racking and straining of their supports as would unavoidably occur if they had separate supports. This enables absolutely true and uniform work to be done, and in my experience is the only practical way of getting these results all the time.

Milling two sides of the work at the same time with cutters arranged and operated as described decreases the time and labor of working to one-half when compared with a single milling-cutter. Then again where duplicate pieces of work are turned out in quantities a uniformity of size of the finished product is obtained in less time and with the most accurate results.

What I claim is—

1. In a milling-machine, the main frame and an adjustable arm extending therefrom and free at its outer end, a set of hangers removably fixed on said arm, the drive-shaft beneath said arm separately supported and a drive-gear thereon, and the milling-shaft supported in said hangers and having a gear meshing with said drive-gear, substantially as described.

2. The main frame and an adjustable arm projecting therefrom, a set of sectional hangers clamped by bolts on said arm, a drive-shaft and a single milling-shaft supported in said hangers and operatively connected together, and milling-cutters on the ends of said milling-shaft, substantially as described.

3. The main frame and a free arm supported thereon, a milling-shaft and a drive-shaft therefor and sectional hangers supporting said shafts one above the other from said arm and a separate support for the outer end of the drive-shaft engaged on said arm, whereby the milling-shaft may be taken down and the drive-shaft will be held in place, substantially as described.

Witness my hand to the foregoing specification this 24th day of April, 1900.

FRANK A. BURNHAM.

Witnesses:

H. E. MUDRA,

R. B. MOSER.