# H. Fairbanks,

## Milling Knife Edges.

No. 98,363. Patented Dec. 28. 1869.

Fig. 3.

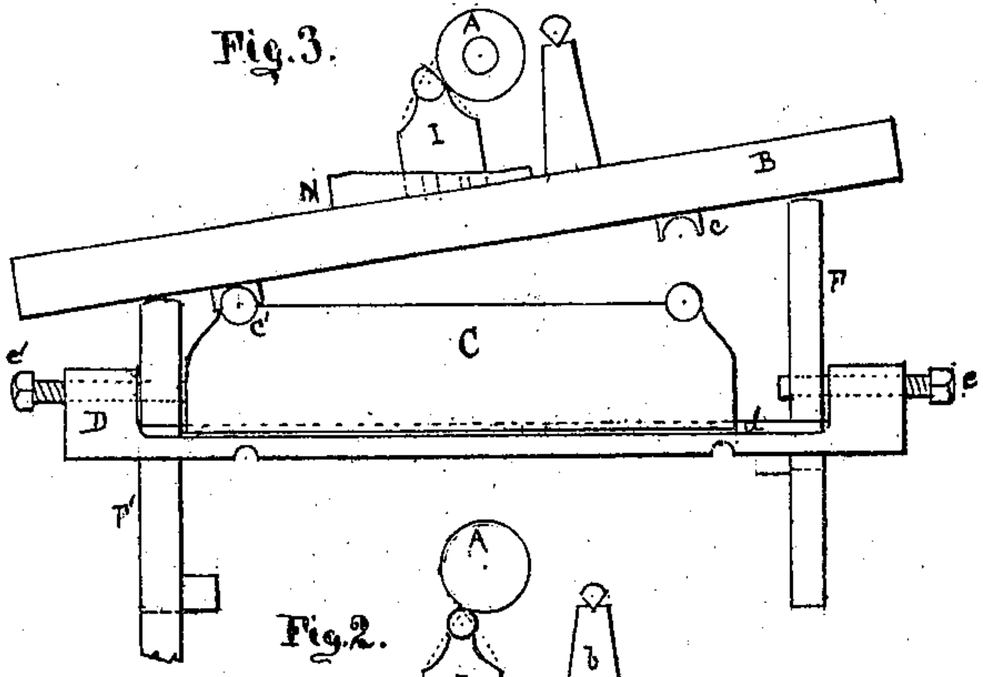



Fig. 2.

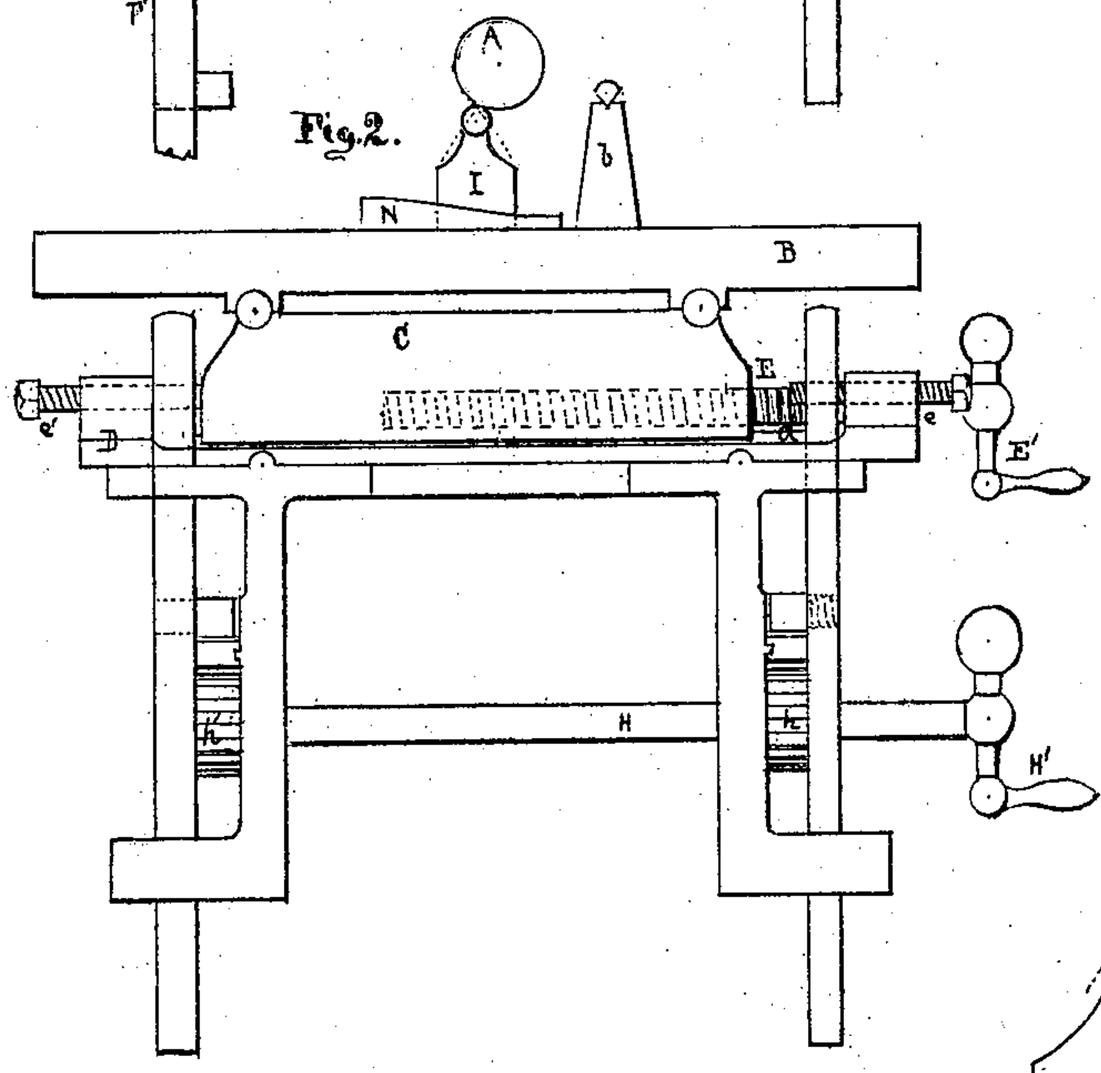



Fig. 4.

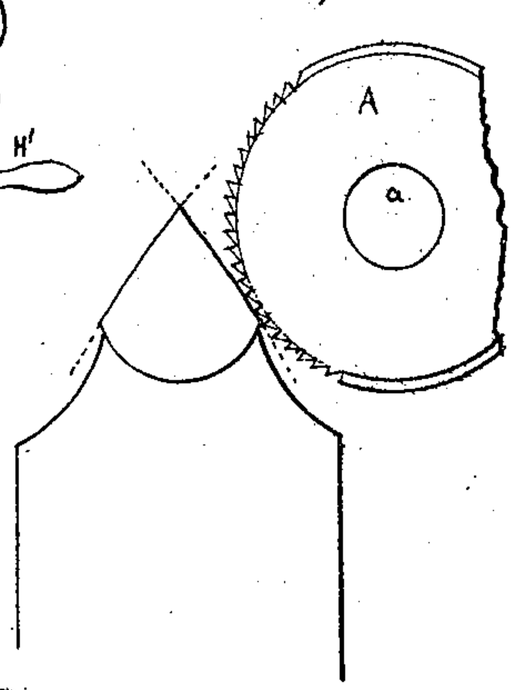
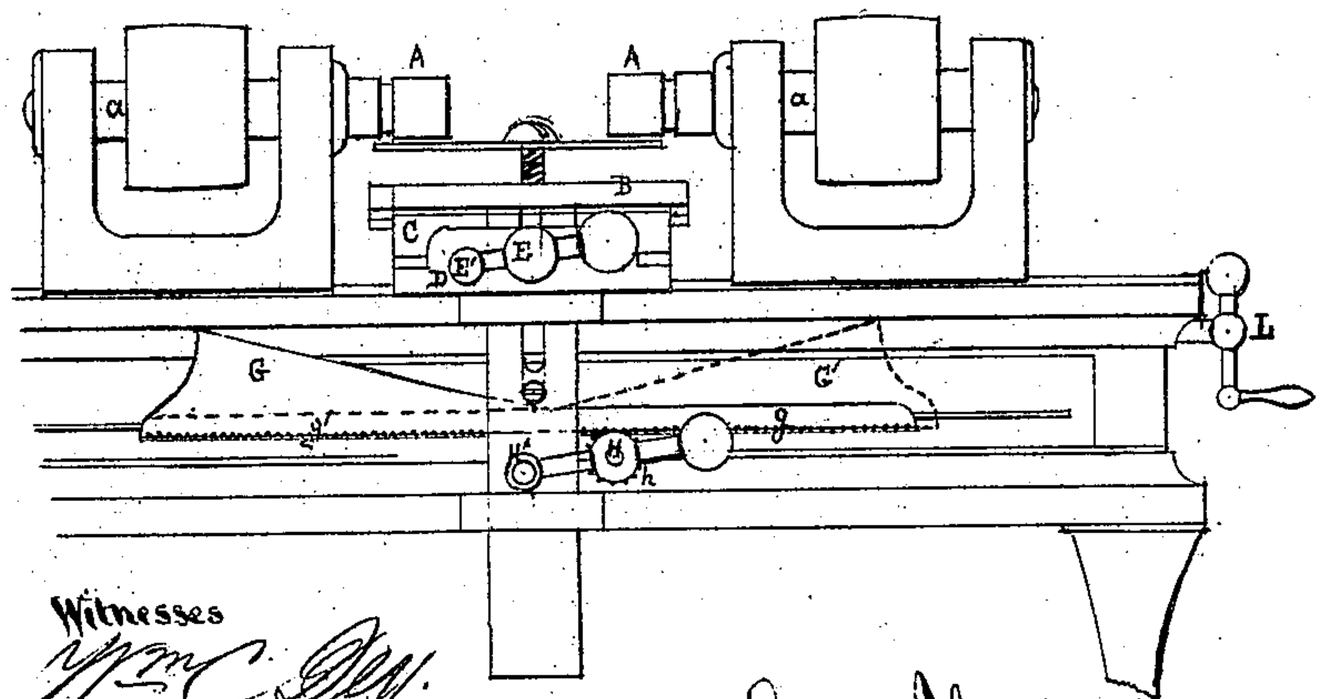



Fig. 1.

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# United States Patent Office.

HENRY FAIRBANKS, OF ST. JOHNSBURY, VERMONT.

*Letters Patent No.* 98,363, *dated December* 28, 1869.

## IMPROVED MACHINE FOR MILLING KNIFE-EDGES OF SCALE-BEAMS.

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, HENRY FAIRBANKS, of St. Johnsbury, in the county of Caledonia, and State of Vermont, have invented certain new and useful Improvements in Machines for Milling the Knife-Edges of Scales; and I do hereby declare that the following is a full and exact description thereof.

My invention provides simple and convenient means for milling the knife-edges with rounded, instead of plane or hollowed sides, as heretofore.

I will first proceed to describe what I consider the best means of carrying out my invention, and will afterward designate the points which I believe to be new therein.

The accompanning drawings form a part of this specification.

Figure 1 is a front elevation.

Figure 2 is a cross-section, on a larger scale.

Figure 3 shows the relations of certain parts before commencing to act on a pair of knife-edges.

Figure 4 shows the same on a magnified scale.

Similar letters of reference indicate like parts in all the figures.

I provide a substantial fixed frame-work of cast-iron, and mount two housings so that they carry the milling-tools in line with each other, and at adjustable distances apart, the proper, powerful, and rapid rotary motion being communicated to each by belts from shafts above.

A A are the milling-tools.

The shafts *a a*, on which they are carried, are mounted on stands, which are separately adjustable on ways on the fixed framing.

The levers to be treated are mounted successively upon a tilting table, B, and are held, with their knife-edges accurately in position by resting in gauge-notches in blocks *b*. The strain on the knife-edge resting in the notch is partially relieved by means of the wedges or other supports, not represented, under the levers. This portion of the apparatus, as also suitable supports and clamps at other points, to hold the lever firmly in position on the tilting table B, may be modified at will, to adapt the machine to treat different levers, and will offer no difficulty to mechanics accustomed to this kind of work. Their function is to hold the lever very solidly in place upon the tilting table B.

On the under side of the tilting table, are four half-cylindrical cavities to form bearings. The bearings *c c* are in line with each other, and the bearings *c′ c′* are also similarly in line. The lines *c c* and *c′ c′* are parallel to each other, and at a considerable distance apart. The table B tilts sometimes upon one set of bearings, *c c*, and sometimes upon the other set, *c′ c′*.

C is a cross-slide, supported upon cross-ways *d*, on a massive centre-piece, D, which latter is fixed upon, and forms, in effect, a portion of the fixed frame-work of the machine. The cross-slide C carries cylindrical bearings, which are adapted to match in the bearings *c c* and *c′ c′*. When either side of the table B is raised, the table B and its attached lever are supported on the opposite set of bearings, and all the parts thereof describe curves, of which the axis of the opposite set of bearings forms the centre.

This motion is illustrated in fig. 3, in which the front edge of the tilting table B is represented as elevated, and the front bearings *c c* are out of use. As the front edge is raised or lowered, the entire tilting table B, and any lever clamped thereon, describe a curve around the axis of the bearings *c′ c′*. When the front is lowered until h front bearings *c c* come into use, when the rear edge of the tilting table is elevated, all the parts of the table B, and of any lever clamped thereon, describe curves, not around the axis *c′ c′*, as before, but around the different and parallel axis *c c*. In practice, I so conduct the operation that the lever is tilted on one axis, *c′ c′*, to mill one side of any given knife-edge, and on the other axis, *c c*, to mill the other side. The motion thus induced, leaves the knife-edge with the sides slightly full or circular, as indicated in fig. 4.

I move the tilting table B and the lever mounted thereon, forward and backward, by means of the screw E and hand-wheel or crank E′. This moves the cross-slide C forward and backward on the transverse ways, and correspondingly moves forward or backward the tilting table B, and any lever mounted thereon, so as to bring the knife-edges into the proper desired relations to the milling-tools.

It is common to treat the knife-edges on a great number of similar levers in succession; that is to say, before commencing to treat the levers of a certain size or style of scale, we prepare a whole lot of levers, say one hundred or a thousand, and then commence to treat them in succession.

As the levers are necessarily to be finished all exactly alike, the cross-slide C is required to move backward and forward to exactly the same extent at each movement. I provide adjusting-screws *e e*, tapped through the centre-piece D at the front, and corresponding screws *e′ e′* at the back, to aid each movement. After rightly adjusting these screws *e′ e′*, I move the cross-slide C and its connections, bodily forward or backward, until they strike the front adjusting-screws *e e*, or the back adjusting-screws *e′ e′*, as the case may be.

I will now describe my means for slowly and strongly tilting the table B and the lever carried thereon.

H is a cross-shaft, mounted in bearings in the fixed frame-work, and turned by a hand-crank, H′.

It carries two pinions, *h* and *h′*, the former at the front and the latter at the back of said machine.

The front pinion *h*, gears in a rack, *g*, which is

guided by a projecting ridge or way on the front of the frame, and carries a wedge or long incline, G, which extends about half of its length, as shown in strong lines in fig. 1.

The back pinion *h'*, gears into a corresponding rack, *g'*, which, in its turn, carries a corresponding incline, G'. The back incline G', is inclined in the opposite direction, and is fixed on the opposite end of its rack. As the shaft H is turned in one direction or the other, the racks *g* and *g'* are moved simultaneously to the left or the right, and the inclines G and G' come successively into play, to elevate the corresponding end of the tilting table B.

The elevating-motion is received by small rollers, or, if preferred, plain pins, and communicated through vertical slides F F'. The front slide F is mounted in front of the rack *g*, and the rear slide F' is mounted in the rear of the rear rack *g'*.

When the racks are moved to the right, the incline G acts under the pin *f*, which may have a small roller upon it if preferred, and lifts the slide F, and causes it to lift the front edge of the tilting table B. I clamp on a fresh lever while the tilting table is inclined to its greatest extent. Assuming, for example, that the front edge is thus raised and the transverse slide C moved back until it strikes the rear adjusting-screws *e' e'*, I clamp on a new lever, and commence to turn the crank H' slowly and steadily, so as to move the racks *g g'* to the left. This motion lowers the knife-edges slowly across the line of action of the milling-tools, in a curve, of which the axis of the bearings *c'* is the centre.

After the milling-tool has thus completely milled one side of each knife-edge, the motion of the racks *g g'* to the left still gradually progressing by the continuous and steady turning of the hand-crank H', the front edge of the table B continues to descend. After a little period, the table B rests fairly on all its bearings, *c c c' c'*, but the motion of the hand-crank H', and consequently of the racks *g g'*, still progressing to the left, the rear incline G' soon comes into action, and commences to lift the rear edge of the table B, and consequently of the lever clamped thereon. I now give a few turns to the crank E', so as to move the whole table and its connections bodily forward, by traversing the transverse slide C forward until it strikes the front screws *e e*; and now, by continuing the slow rotation of the hand-crank H', I gradually raise the rear edge of the table B, traversing the knife-edges in contact with the cutting-teeth of the milling-tools, until the rear faces are nicely milled. This finishing of each rear face will be on a curve, of which the axis *c c* is the centre. After this cutting is finished, the parts are restored to their original position by rapid reverse movements, and the lever is removed, and a fresh one applied.

It will be readily seen that by adjusting the front screws *e e*, and the back screws *e' e'*, so as to allow a greater motion of the transverse slide C, and its connections, I can move the latter so as to treat different knife-edges at a considerable distance apart. It will also be seen that these adjusting-screws are capable of being set with great delicacy, so that I can, by their means, determine the paths in which the knife-edges traverse along the cutting-edges of the milling-tools, so as to move, more or less, and to raise or lower the finally-finished edges of the knife-edges.

By setting the levers at different heights, by means of the wedges N N, or equivalent supports for the levers, and changing the positions of the front and back adjusting-screws, and adjusting all the parts of the machine to correspond, as will be readily understood by a good workman, I can not only change the elevation of the finished edges, but also the angle, and various other conditions of the entire lever, as may be required with each variety of lever.

In practice, I fork, or divide my vertical slides F F', so that the screw-shaft E may extend across through the centre of each. This, and a great many other details of the machine, may be varied without sacrificing or seriously affecting any of the advantages of the invention.

I propose to adjust the milling-tools independently, outward and inward, by means of the screws L, as represented. I can provide means, also, for adjusting the table B and its connections, at various heights, and can use any improved means of holding the levers thereon. I can hold the tilting table B and its connections down, with great firmness, upon its tilting bearings, by means of one or more weights or strong springs, attached either to the middle or to both ends, or other convenient points.

My improved machine is susceptible of all the improved means of adjusting the milling-tools, and all the other parts which are described in my previous patents, or which are known or used in the arts. I will not occupy space by describing, in detail, such obvious modifications.

I support the knife-edges directly, while being cut. I do this by means of two pieces, I I, each formed as represented, by having a concavity in its top, adapted to match the rounded back of the knife-edge, and the material of the pieces I is cut away on each side, so as to afford a clear path for the teeth of the mills, under all circumstances.

The wedges N may be adjusted inward or outward with great nicety, so as to raise or lower the pieces I, as required. The lower ends of the pieces I may be secured by nuts tapped thereon, or by other analogous means, so as to hold the whole very firmly, when rightly adjusted.

Some of the advantages due to certain features of my invention may be separately enumerated as follows:

First, by reason of the fact that my table, B, on which the levers are clamped, is rocked on two different axes, *c c* and *c' c'*, I cut or mill the two faces of each knife-edge with a slight fulness or rounding, which contributes very greatly to the strength of the knife-edge, without interfering with its action in other respects.

Second, by reason of the fact that the traverse motion of the piece C is controlled by the set-screws *e e e' e'*, as specified, I am able to move the work forward and backward rapidly, and to determine the proper distance to which it shall be moved, with absolute certainty, and to an easily and delicately-adjustable extent. I am also able to thus determine the elevation of the finished edges above the plate B, and to govern the range as well as the distance of the knife-edges with absolute uniformity, and with a necessity for very little labor or skill.

Third, by reason of the employment of my cross-shaft H, pinions *h h'*, racks *g g'*, and inclines G G', the latter being arranged so as to incline in opposite directions, and to act on the vertical slides F F', and tilting table B, as represented, I am able to give the proper tilting-motion with the force and moderation required, and to vary the motion to any extent required in practice, with very simple and reliable mechanism.

Fourth, by reason of the employment of the vertical slides F F' operating as represented, relatively to the transverse shaft H, the inclines G G', and cross-slide C, I am able to communicate the proper tilting-motion in any position of the cross-slide, and to induce the two motions, the tilting and transverse sliding, almost independently of, and unaffected by each other.

Fifth, by reason of the fact that my supports, I, are adapted to match the under side of the knife-edges, and to apply thereto directly, actuated by the wedges

N, as represented, I am able to offer a firm support immediately adjacent to the milling-tools, and without interfering with their action. There is less tremble and spring in the work when the knife-edges are thus directly supported, than when, as usual, the knife-edges are supported indirectly through the medium of wedges, or other appliances, under the main body of the lever.

I claim—

1. In a knife-edge-milling machine, substantially as herein specified, the rocking table B, tilting upon two axes, substantially as and for the purposes herein set forth.

2. In combination with milling-tools A A, and a tilting table, B, carried on a transverse slide, C, the employment of one or more adjusting-screws, *e e'*, arranged and adapted to serve, relatively to the other parts, substantially in the manner and for the purposes herein set forth.

3. The within-described combination and arrangement of the tilting table B, cross-shaft H, and inclines G G', with their connections, adapted to operate together, as and for the purposes herein set forth.

4. In combination, the vertical slides F F', the reversed inclines G G', and cross-shaft H, arranged to transmit the proper tilting-motion to the tilting table B, without interfering with its transverse motion, substantially as and for the purposes herein set forth.

5. In a knife-edge-milling machine, the combination of a carrying-table, B, adapted to feed the work to the milling-tools, the supporting-pieces I, and adjusting-means N, adapted to apply directly under the knife-edges, all substantially as and for the purposes herein set forth.

In testimony whereof, I have hereunto set my name, in presence of two subscribing witnesses.

HENRY FAIRBANKS.

Witnesses:

DAN. J. NOYES,

T. FAIRBANKS.