

June 18, 1935.

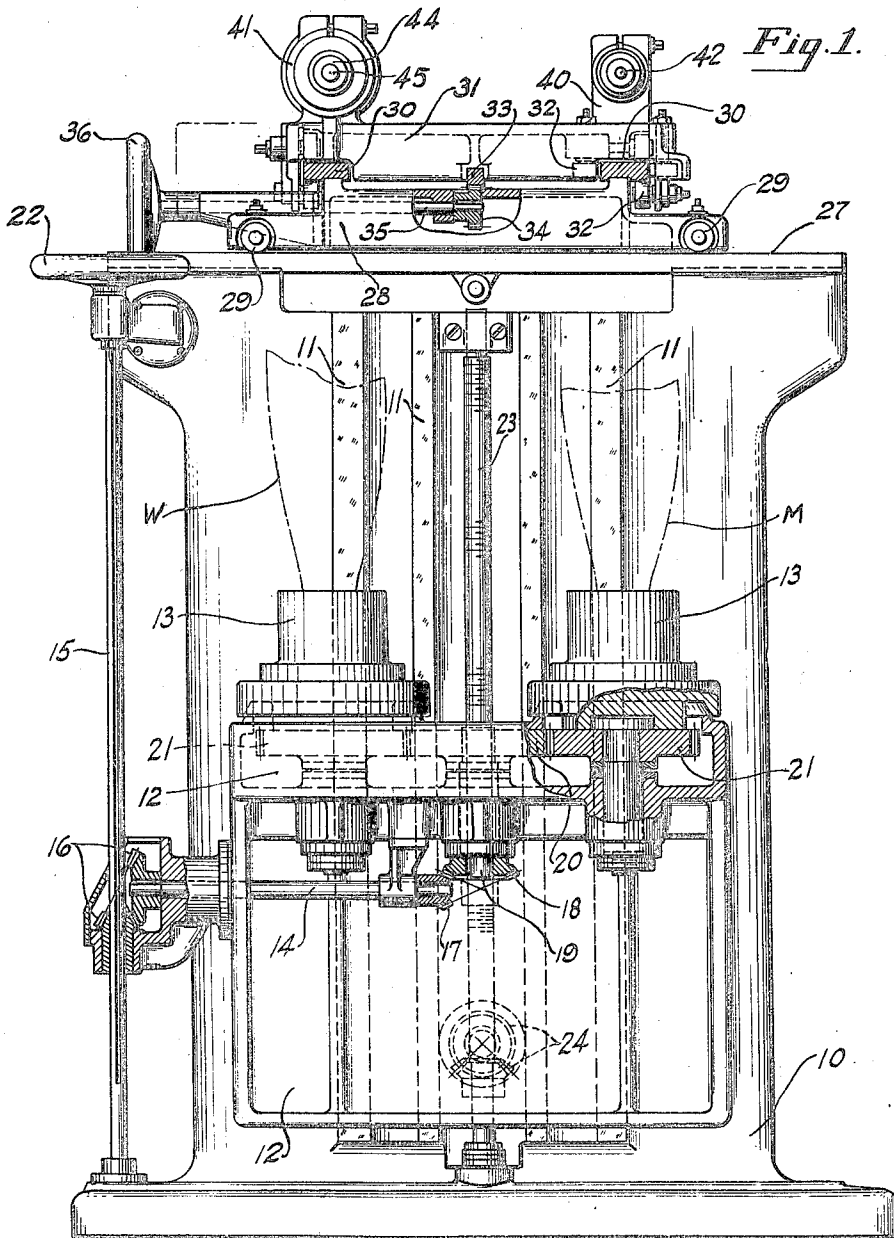
R. D. SHAW

2,005,508

SCREEDING MACHINE

Filed July 3, 1933

3 Sheets-Sheet 1



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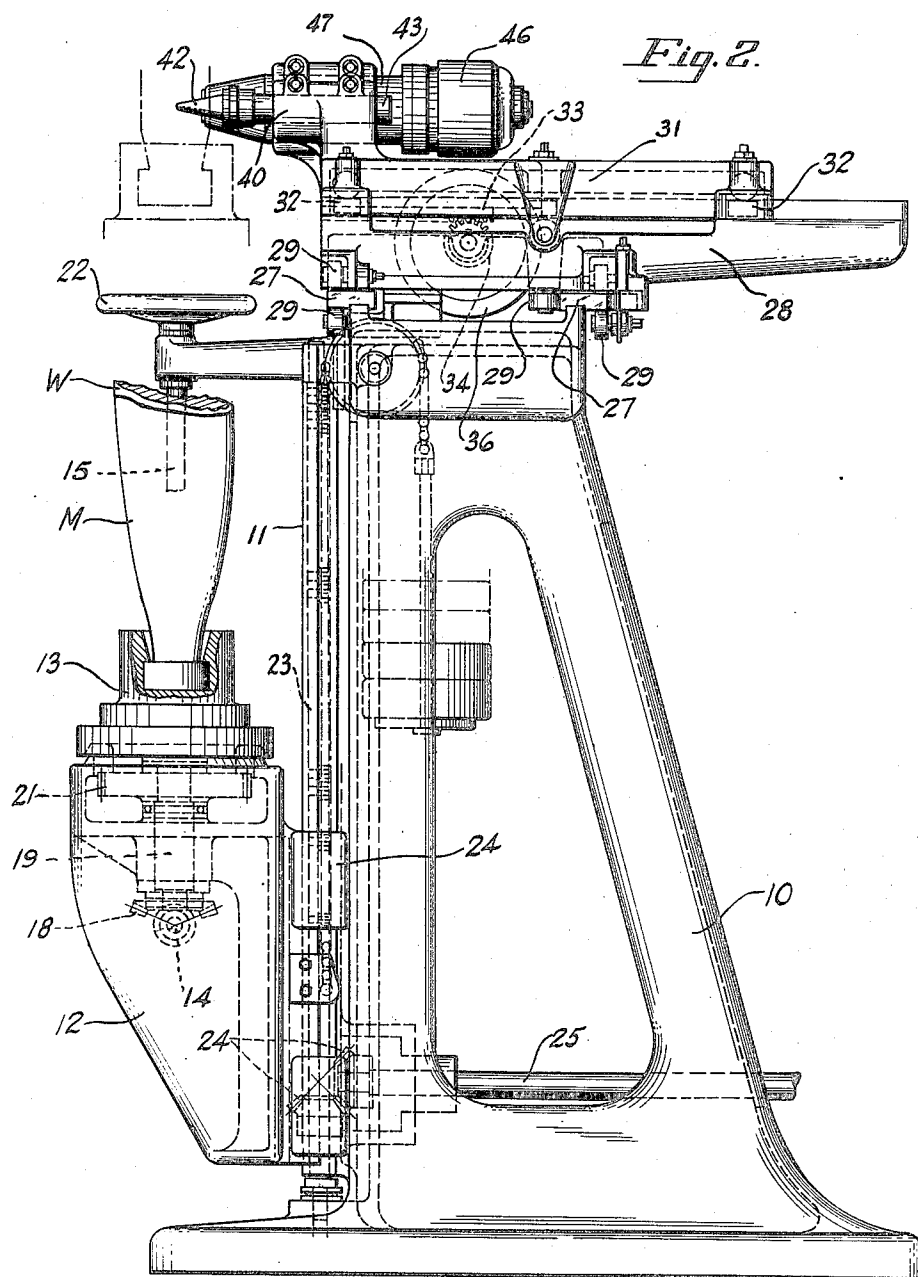
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3 Sheets-Sheet 2



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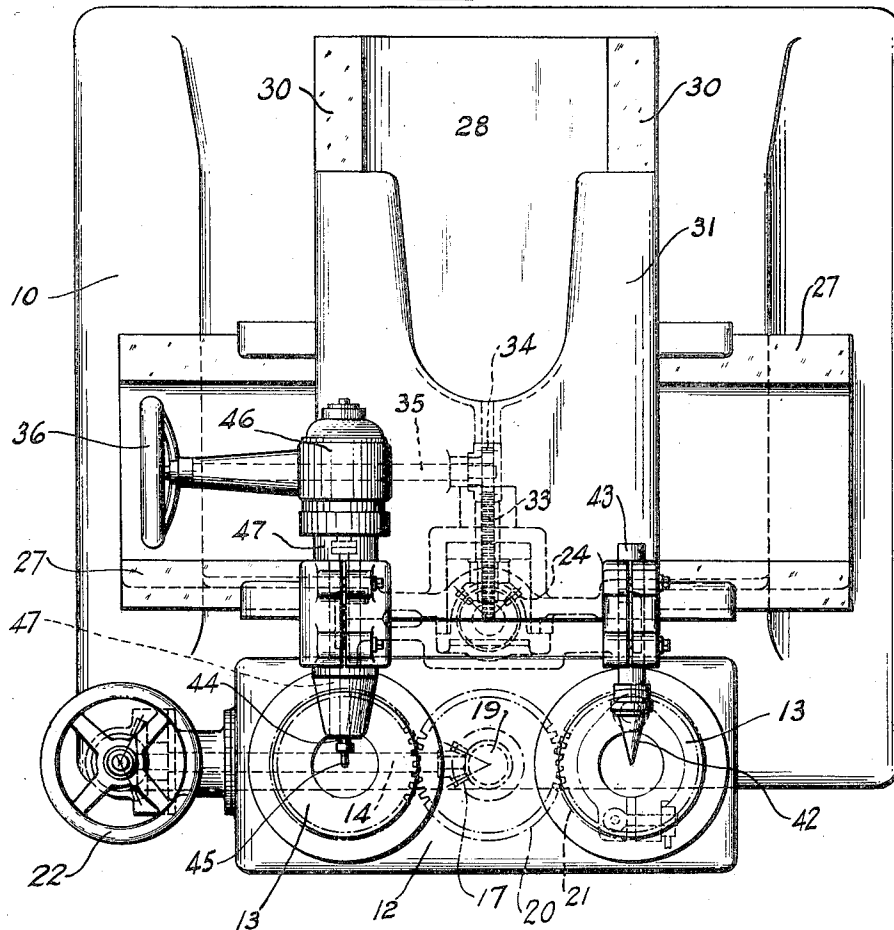
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Fig. 3.



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SCREEDING MACHINE

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Application July 3, 1933, Serial No. 678,756

5 Claims. (Cl. 90—13.4)

This invention relates to a copying machine and particularly to a machine for duplicating aeroplane propeller blades by a milling operation.

5 A primary object of the invention is to provide improved, simple, convenient and rapidly operating mechanism for generating correct cross sectional contours upon a blank for aeroplane propeller blades to correspond with portions of surfaces of a model blade.

10 A feature which enables me to accomplish the above named object is that a model and work blank for the desired blade are simultaneously rotated in the same direction and at the same speed by suitable manually operated means and during this rotation a tracer point engages the surface of the model and a milling cutter engages and cuts into a similar portion of the work piece.

20 Another object of the invention is to provide an improved carriage mounting the tracer and cutting tool enabling the cutting tool and tracer to be manually adjusted directly toward and from the work piece and model during the rotation thereof, the carriage being mounted on a saddle which may be traversed laterally relative to the model and work piece during its forward and back movement.

30 And finally it is an object to provide rapid traversing means for reciprocating the table supporting the rotating means for the work piece and model past the cutter and tracer to position the work piece and model so that different portions of the work blank may be operated on by the cutter.

40 With the above and other objects in view, my invention includes the features of construction and operation set forth in the following specification and illustrated in the accompanying drawings.

45 In the accompanying drawings annexed hereto and forming a part of this specification, I have shown and described my invention embodied in a machine specifically designed for operation upon elongated metal blades for aeroplane propellers but it will be understood that the invention can be otherwise embodied and that the drawings are not to be construed as defining or limiting the scope of the invention, the claims appended to this specification being relied upon for that purpose.

In the drawings:

55 Figure 1 is a front elevation of the complete machine, the work and model supporting and

rotating means being shown approximately in mid position.

Fig. 2 is a side elevation of the complete machine, a part being sectioned to more clearly illustrate the construction, and

Fig. 3 is a plan view of the complete machine.

In the above mentioned drawings I have shown but one embodiment of the invention which is now deemed preferable, but it is to be understood that changes and modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

Briefly, and in its preferred aspect, my invention may include the following principal parts: 15 First, a base having vertical ways upon its front surface; second, a knee or bracket mounted for reciprocatory movement thereon; third, supporting and rotating means on the upper surface of said bracket for a model and work blank 20 respectively; fourth, driving means for simultaneously rotating these means in the same direction and at the same speed; fifth, a carriage supported on the upper surface of the base and movable toward and from the supporting and 25 rotating means for the model and work blank; sixth, a tracer on the carriage; seventh, a cutting tool, both tracer and cutter being mounted in fixed relation to each other on the carriage; and eighth, a saddle on which the carriage is supported upon the upper surface of the base, this saddle being movable laterally relative to the model and work blank and in a direction normal to the direction of movement of the carriage.

In the manufacture of metal blades for aeroplane propellers, it is the practice to form the surfaces thereof in accordance with predetermined contours. Preferably and usually a metal propeller blade is made so that it will conform accurately to desired specifications and it is the particular object of this invention to provide means for copying a blade from a complete model blade previously made by any well-known or standard methods. Usually metal blades for aeroplane propellers are made of relatively soft 45 metals such as aluminum or magnesium alloys which may be cut at a relatively high surface speed relative to a cutter. It is not usually necessary to generate the entire surface of the blade being made by the machine described but the present machine may preferably be used to cut a plurality of successive contour lines extending completely around the periphery of the blade in planes at spaced distances from the hub and milled to the proper depth to define the 55

proper contour at each successive plane. These lines are scribed or cut by an end mill, and, after a number of these lines have been thus cut into the work piece the blade may be removed from the machine and intermediate portions may be finished by hand operations. The scribed peripheral lines determine the contours at the particular planes along the length of the blade and so indicate to what depth intermediate portions of the blade are to be cut to produce smooth continuous helicoidal or warped surfaces including the contours cut by the machine.

Referring more in detail to the figures of the drawings, I provide a base 10 having vertical ways 11 upon its front surface. Along these ways 11 is adapted to be vertically traversed a bracket or knee 12 having work supporting and rotating means 13 upon its upper surface. Preferably these means 13 are in the form of rotatable chucks, one of which may engage a model M and the other a work blank W shown in Fig. 2 to be milled to conform to the model.

Within the bracket 12 are driving means for the supporting members 13, these means being in the form of a laterally extending shaft 14 which may be driven by any means from the side of the machine, as by means of the vertical shaft 15 having a hand wheel at its upper end. Bevel gears 16 are mounted upon these shafts 14 and 15 in intermeshing relation, the one upon the vertical shaft engaging a suitable spline therein so that the bracket 12 may be traversed vertically while the transverse shaft 14 is being rotated. Meshing with a bevel gear 17 on the inner end of this transverse shaft is a bevel gear 18 on the lower end of a vertical centrally disposed shaft 19 having a spur gear 20 upon its upper end. This spur gear 20 engages with corresponding spur gears 21 having equal tooth numbers on opposite sides thereof. One of these gears 21 is drivingly connected to one of the work supports 13 and the other to the opposite work support 13. By means of this mechanism the two work supports 13 are rotated in the same direction and at the same speed. As the present machine embodying the invention is designed primarily for propeller blades the rotation of the supporting members 13 is controlled manually. For that purpose the vertical shaft is provided with the hand wheel 22 conveniently disposed for the operator to slowly rotate the same during operation of the machine. Preferably this hand wheel 22 is at the upper end of the shaft and the shaft is rotatable within bearings in members attached to the base 10. The bevel gears 16 drivingly connecting the vertical shaft 15 to the transverse shaft 14 may be enclosed within a housing mounted on and moving vertically with the bracket or knee.

In order to traverse the bracket 12 vertically, a screw 23 is provided disposed vertically and centrally of the machine which engages a nut 24 in the bracket member 12 so that rotation of the screw 23 will raise or lower this bracket 12 and the work supports 13 mounted thereon. To rotate the screw 23 a bevel gear 24 is provided on the lower end of the screw 23 engaging a corresponding bevel gear 24 upon the forward end of a horizontal rearwardly extending shaft 25 mounted within the base 10. This horizontal shaft 25 may be rotated by a suitable motor or other means (not shown) to traverse the bracket and work supports rapidly up or down.

Mounted upon the upper surface of the base 10 on laterally extending guideways 27 thereon

is a saddle 28. Preferably this saddle is provided with a number of rollers 29 engaging upper and lower bearing surfaces of the ways 27 so that the saddle 28 may be moved laterally of the machine with a minimum of resistance. Mounted on the upper surface of this saddle 28 upon suitable guideways 30 provided therefor is a tool supporting carriage 31. This carriage 31 is adapted to move on its ways 30 directly toward and from the work supporting and rotating means 13. Rollers 32 similar to those for the saddle 28 are provided engaging the ways 30 on the saddle 28 to eliminate friction and to facilitate movement thereof. By means of this construction the carriage 31 may be moved in any direction in a horizontal plane within the limits of the machine. In order to manually control the position of the carriage 31 toward and from the axes of the work supporting and rotating means 13, a rack 33 extending forward and rearward of the carriage 31 is mounted on the lower surface of the carriage. This rack 33 meshes with a small gear 34 mounted on the inner end of the transversely extending shaft 35 rotatably supported within the saddle 28. Rotation, therefore, of the gear 34 will advance the carriage 31 directly toward or from the axes of the work supporting and rotating members 13. Lateral movement of the carriage 31 with the saddle 28 may take place simultaneously with forward movement of the carriage 31 on the saddle 28. In order to operate this gear 34 to control the position of the carriage 31 toward or from the work rotating members 13, a hand wheel 36 is mounted on the outer end of shaft 35.

Mounted on the upper surface of the carriage 31 are brackets 40 and 41, one of which is directly in back of the axis of the model mounted in one of the supporting and rotating members 13 and the other bracket directly in back of the supporting and rotating member 13 for the work piece being operated on. In the first bracket 40 is adjustably mounted a tracer point 42 preferably on the forward end of a bar 43 slidably mounted and clamped within a recess provided in the bracket 40. The other bracket 41 houses a milling cutter spindle 44 having a cutting tool 45 at its forward end and preferably driven by a small electric motor 46. The spindle 44 is housed within a sleeve 47 on the rear end of which may be mounted the motor 46. This sleeve 47 may be adjusted within its bracket 41 and clamped in adjusted position therein so that the distances of the tracer point 42 and milling cutter 45 from the axes of the model and work rotating means will be equal.

In operation a model M of the blade or other article to be duplicated is mounted in one of the work supporting members 13 and a work blank W is mounted in the other. With a tracer point 42 in the bracket 40 in rear of the model M and a milling cutter 45 in the other bracket, the knee 12 is raised or lowered to a desired position and the model M and work blank W rotated slowly by manual operation of the wheel 22. While rotating the model M and blank W with one hand the operator also operates the carriage 31 mounting the milling cutter 45 and tracer point 42 by continuously forcing it toward the model and work blank. This may be done by rotating the wheel 36 on the saddle 28, and, by forcing the wheel 36 laterally the cutter 45 and tracer 42 may be moved laterally

to traverse these members over the work blank and model. After traversing the tracer 42 and cutter 45 entirely around the model and work blank respectively at one setting of the knee 12, the knee is raised or lowered a short distance and the traversing about the model and work blank repeated in the same manner. After repeated operations on the work blank at successive distances apart, the work blank may be removed from the machine and the intermediate portions finished by hand, the scribed contours being made use of to determine the surface of the blade at their respective distances along the blade.

It will be understood that in setting up the machine the distances of the milling cutter 45 and the tracer 42 from the axis respectively of the support for the work piece W and the model M will be equal. Also the rack 33 is positioned equidistant from the axis of the milling cutter 45 and tracer 42 so that the pressures of the milling cutter and tracer exerted by forward operation of the carriage 31 by hand wheel 36 will be substantially equal.

What I claim is:

1. A copying machine comprising in combination, a base, a table movable thereon, a pair of work supporting and rotating members thereon, means to simultaneously rotate said members upon parallel axes in the same direction and at the same speed, means to traverse said table on said base parallel to the axes of rotation of said members, a carriage having a tracer adapted to contact with a model mounted in one of said members and a cutting tool mounted for engagement with a work piece mounted in the other of said members, a saddle on said base on which said carriage is mounted, means to adjust the position of said saddle laterally of said members, means to manually adjust said carriage on said saddle toward and from said members, and a single manually operated member for controlling movements of said carriage and saddle.

2. A copying machine comprising in combination, a base, a table vertically movable thereon, a pair of parallelly mounted work supporting and rotating members thereon, means to simultaneously rotate said members at the same speed, means to traverse said table on said base, a carriage having a tracer adapted to contact with a model mounted in one of said members and a cutting tool mounted for engagement with a work piece mounted in the other of said members, a saddle on which said carriage is mounted, said carriage and saddle having ways disposed at right angles to each other whereby said carriage may be moved toward and from and laterally relative to the work supporting members during operation and a single manually

operated member for controlling movements of said carriage and saddle.

3. A copying machine comprising in combination, a base, a table movable vertically thereon, a pair of work supporting and rotating members thereon, means to simultaneously rotate said members about parallel vertical axes, manual means to traverse said table, a saddle on said base movable in one direction, a carriage on said saddle movable in a direction normal thereto and having a tracer adapted to contact with a model mounted in one of said members and a cutting tool mounted for engagement with a work piece mounted in the other of said members, said carriage being manually movable in any direction in a horizontal plane whereby said tracer and cutter are freely movable toward and from said members and laterally thereof during operation of the machine and a single manually operated member for controlling movements of said carriage and saddle.

4. A copying machine comprising in combination, a base, a table movable vertically thereon, a pair of work supporting and rotating members thereon, means to simultaneously rotate said members, means to traverse said table on said base, a saddle movable in one direction upon the base, a carriage thereon movable in a direction normal thereto, said carriage having a tracer adapted to contact with a model mounted in one of said members and a cutting tool mounted for engagement with a work piece mounted in the other of said members, said carriage and saddle being manually movable, and controlling means for said saddle and carriage comprising a rotatable shaft extending laterally through said saddle and connected to said carriage, whereby said shaft controls movement of said carriage in any direction in a plane.

5. A copying machine comprising in combination, a base, a table movable vertically thereon, a pair of work supporting and rotating members thereon, means to simultaneously rotate said members, means to traverse said table on said base, a saddle movable in one direction upon the base, a carriage thereon movable in a direction normal thereto, said carriage having a tracer adapted to contact with a model mounted in one of said members and a cutting tool mounted for engagement with a work piece mounted in the other of said members, said carriage and saddle being manually movable, and controlling means for said saddle and carriage comprising a rotatable shaft extending laterally through said saddle and having rack and gear connection with said carriage, whereby said shaft controls movement of said carriage in any direction in a plane.

ROBERT D. SHAW.