March 6, 1951 C. M. HATHAWAY 2,544,156

PEN NIB SLOTTING APPARATUS

Filed May 28, 1947

Fig. 1

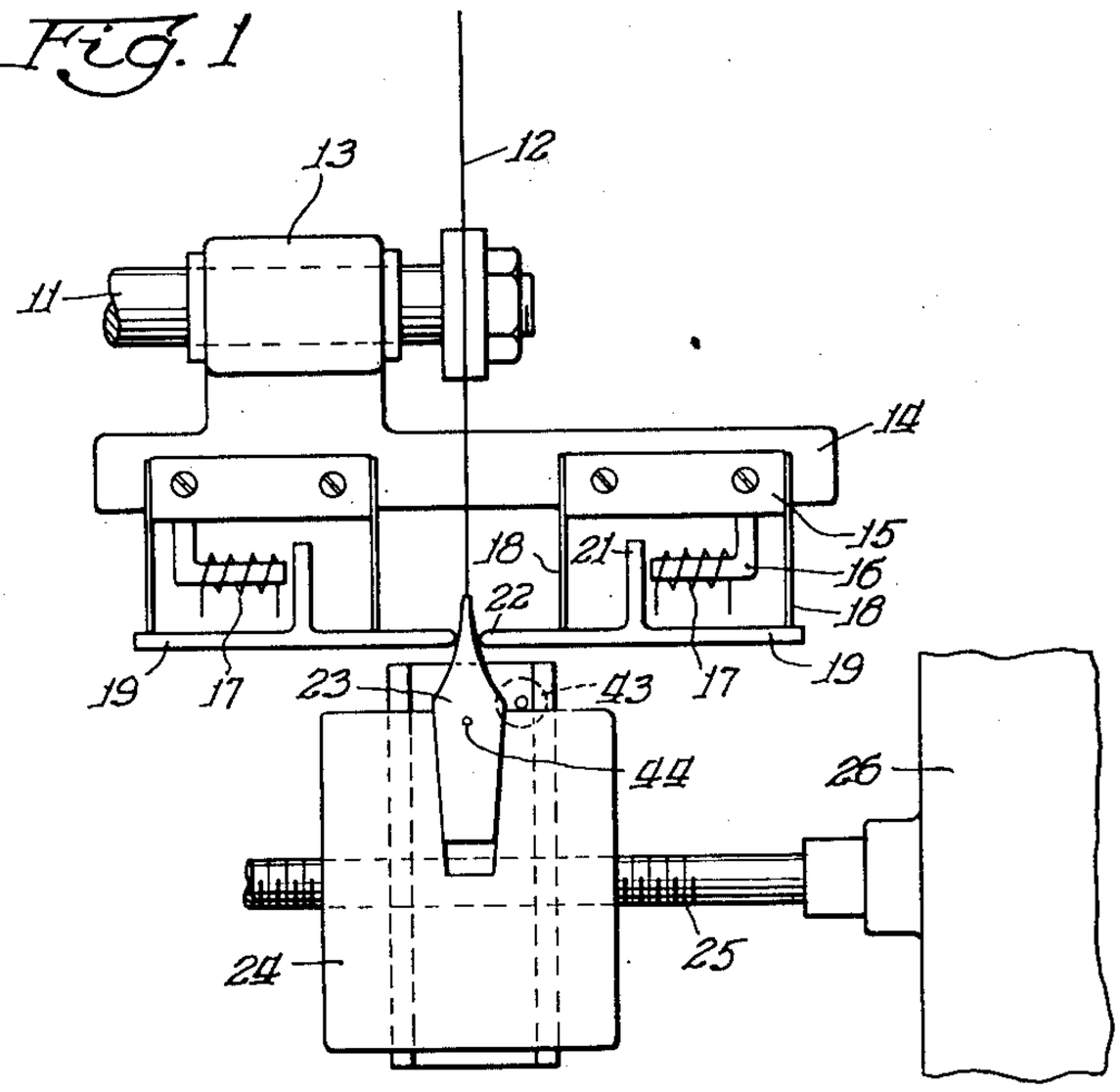
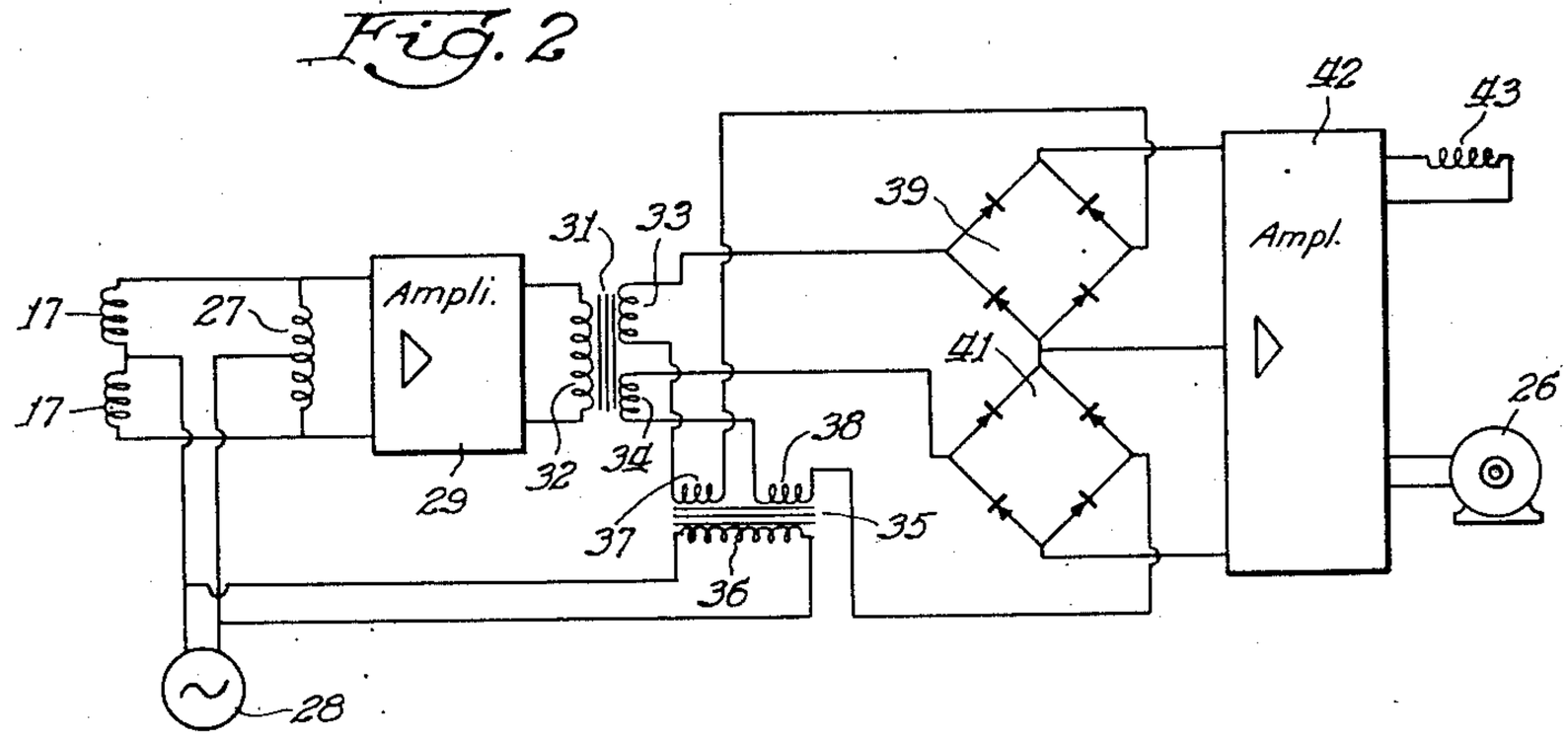


Fig. 2



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PEN NIB SLOTTING APPARATUS

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7 Claims. (Cl. 51—2)

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The present invention relates to an apparatus and circuit for controlling the slotting of pen nibs.

The principal cost involved in the manufacture of good quality fountain pens centers about the pen nib. The pen nib blank is mounted in a jig or fixture positioned in front of a slotting wheel which consists of a high speed paper disc which has been impregnated with an abrasive. This paper disc operates as a saw to cut a fine slot in the nib blank. The tip of the pen nib is made of osmium, iridium or some other analogous metal. In order to produce a good pen point or nib it is essential that the slot be in the exact center of the point of the nib. Any deviation to the right or left will produce an unequal writing effect.

In the past it has been found that about forty per cent of the slotted nibs are satisfactory when first slotted. About eighty per cent of the remainder can be salvaged by hand correcting which consists of grinding and polishing the heavier side of the pen nib until the slot is in the center. This inspection and handwork is the primary factor which results in the high cost of pen nibs for the high quality pens. Those pen nibs which cannot be salvaged by hand polishing must have the tip cut off and the metal must then be melted, refined and re-used. It, therefore, would be desirable to provide some means for increasing the accuracy with which pen nibs are slotted.

In accordance with the present invention this is accomplished by the use of an electric circuit connected to a pair of gauging devices accurately positioned on opposite sides of the slotting wheel so that the pen nib blank is engaged by the gauging devices. The electric circuit is connected to control motor means for orienting the jig or supporting device for the pen nib so as to center it with respect to the slotting wheel or saw.

It, therefore, is an object of the present invention to provide means for accurately slotting pen nibs.

It is a further object of the present invention to provide a gauging device and control circuit therefor for slotting pen nibs.

Other and further objects of the present invention subsequently will become apparent by reference to the following description taken in conjunction with the accompanying drawings wherein:

Figure 1 is a plan view of the gauging unit and pen nib slotting wheel; and

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Figure 2 is a circuit diagram of the control system for the apparatus shown in Figure 1.

Referring more particularly to Figure 1 there is seen a shaft 11 which carries a slotting wheel or disc 12 which usually is an abrasive impregnated paper disc. The shaft 11 is mounted in a suitable bearing support 13 which has a forward extension frame 14. Mounted on the extension frame 14 are a pair of gauges adapted to engage the pen nib blank. Each gauge consists of a frame 15 carrying a fixed magnetic core 16 having an induction coil 17. At each end of the frame 15 there is mounted a flexure plate 18 connected at its outer extremity to an armature 19. The armature 19 has an inwardly arranged projection 21 arranged adjacent to the end of the magnetic core 16. One portion of the armature 19 has a rounded tip 22 adapted to engage the pen nib blank 23.

The pen nig blank 23 is mounted in a support fixture or jig 24. The support fixture or jig 24 is arranged for movement in two directions at right angles to each other. The jig 24, therefore, may be moved upwardly toward the wheel 12 as seen in Figure 1. The fixture 24 furthermore may be moved to the right or to the left by means of a screw threaded shaft 25 driven by a motor 26.

When the pen nib 23 is in the center position with respect to the slotting wheel or saw 12, the armatures 19 each will be same distance from their respective magnetic cores 16 so that the coils 17 each have the same impedance. The coils 17 are connected in a control circuit shown in Figure 2. The coils 17 are connected in a bridge circuit which includes a center tap inductor 27. The center tap of the inductor 27 and the common juncture between the two coils 17 are connected to a source of alternating current 28 which preferably is of the order of several thousand cycles per second. The opposite corners of the bridge circuit which includes the inductors 17 and 27 are connected to an amplifier 29 which in turn is connected to a transformer 31. The transformer 31 has a primary winding 32 and two secondary windings 33 and 34. The alternating current source 28 is connected to a transformer 35 having a primary winding 36 and two secondary windings 37 and 38.

Two bridge rectifiers 39 and 41 are provided for energization by certain of the secondary windings of the transformers 31 and 35.

Opposite diagonals of the bridge rectifier circuit 39 are connected to the secondary windings

33 and 37 of the transformers 31 and 35. Similar opposite terminals of the bridge rectifier circuit 41 are connected to the secondary windings 34 and 38 of the transformers 31 and 35. The remaining connections to the bridge rectifier circuit 39 and 41 are connected to a differential amplifier 42 which controls the operation of the motor 26. The amplifier 42 also controls a solenoid 43 which actuates a lockout pin on the under side of the jig fixture 24. The lockout pin precludes the inward movement of the fixture 24 toward the slotting wheel 12 until the pen nib 23 has been accurately centered by the motor 26. Thus, the only manual operation to be performed by the operator is the inward movement of the jig carriage 24 toward the slotting wheel 12 until the slot has been cut to the hole 44 which is punched in the nib blank 23 as a terminus for the slot.

The differential amplifier 42 may employ any suitable circuit as is well known by those skilled in the art. Numerous suitable circuits have been employed in connection with Servo mechanisms particularly in conjunction with the control of air craft. Many suitable circuits of this type have also been disclosed in literature and in handbooks such as "The Electronic Control Handbook" by Batcher and Moulic, published in 1946. The principles of such circuits as are shown on pages 162, 225 and 297 of this handbook may be used in constructing the amplifier 42.

The circuit shown in Figure 2 provides for the alternating current energization of the impedance coils 17 which are arranged to be responsive to the movement of their associated armatures 19. Any variation of the impedances of the coils 17 from a balanced condition will produce an alternating current voltage which is applied to the amplifier 29 and which has a phase relation dependent upon the direction of the inequality of the impedances 17. This alternating current is amplified by the amplifier 29 and supplied to the transformer 31. The secondary windings of the transformer 31 are connected in series with secondary windings of the transformer 35 from which they receive equal energization. The phase of the current supplied by the transformer winding 32 is such as to aid the current in one secondary winding and oppose the current in the other secondary winding thereby to vary the alternating current potential impressed upon the bridge rectifiers 39 and 41. By supplying alternating current to the bridge rectifiers from the secondary windings 37 and 38 each of the bridge rectifiers 39 and 41 is continually energized so as to be responsive to slight changes in voltage variations which are introduced by variations or inequalities in the impedances of the coil 17. The bridge rectifiers, therefore, operate at their greatest sensitivity. The amplifier 42 is responsive to the differential output of the rectifiers 39 and 41 so as to control the direction of rotation of the motor 26.

While for the purpose of explanation certain specific embodiments and circuit arrangements have been shown, it of course, is to be understood that I do not wish to be limited thereto since such variations in the instrumentalities employed and in the circuit arrangement are contemplated without departing from the spirit and scope of the appended claims.

What I desire to protect by United States Letters Patent is claimed as follows:

1. A control circuit for orienting a work piece relative to a tool comprising a pair of electro-magnetic members having movable armatures for varying the effective impedance of said members, means connected to each of said armatures for independently engaging said work piece, means resiliently biasing said armatures toward predetermined positions, means for supplying current to said electro-magnetic members, and means responsive to the difference in the effective impedances of said members for orienting said work piece.

2. A control circuit for orienting a work piece relative to a tool comprising a pair of electro-magnetic members having movable armatures for varying the effective impedance of said members, means connected to each of said armatures for independently engaging said work piece, means resiliently biasing said armatures toward predetermined positions, means for supplying current to said electro-magnetic members, and a differential circuit responsive to the effective impedances of said members for orienting said work piece.

3. The combination comprising a pair of variable impedances, arranged to be varied in accordance with the position of a work piece relative to a tool, a pair of fixed impedances, a source of alternating current, means connecting each of said variable impedances in series with one of said fixed impedances, means for producing equal energization of said series connected impedances from a source of alternating current, a pair of bridge rectifiers, a control circuit differentially connected to the output of said rectifiers, and means for energizing each rectifier from said source and in accordance with current proportional to one of said variable impedances.

4. A control circuit for orienting a work piece relative to a tool comprising a pair of variable impedances arranged to vary in opposite senses in accordance with the position of said work piece relative to said tool, a pair of fixed impedances, a source of alternating current, means connecting one of said variable impedances in circuit with one of said fixed impedances, means connecting the other of said variable impedances in circuit with the other of said fixed impedances, means for producing equal energization of said circuit from said source of alternating current, a pair of bridge rectifiers, a differential amplifier connected to said rectifier, means controlled by said amplifier for orienting said work piece relative to said tool, and means for energizing said rectifiers from said source of alternating current and simultaneously energizing each rectifier in accordance with the impedance of a different one of said first mentioned circuits.

5. A control circuit for orienting a work piece relative to a tool comprising a pair of variable impedances arranged to be varied in accordance with the position of said work piece relative to said tool, a pair of fixed impedances, a source of alternating current, means connecting one of said variable impedances in circuit with one of said fixed impedances, means connecting the other of said variable impedances in circuit with the other of said fixed impedances, means for producing equal energization of said circuit from said source of alternating current, a pair of bridge rectifiers, means for energizing each of said rectifiers from said alternating current source to produce equal current therethrough, means for simultaneously energizing each bridge rectifier in accordance with the current condition in a different one of said first mentioned circuits, and means responsive to the differential output

of said rectifier for shifting said work piece relative to said tool.

6. A control circuit for orienting a pen nib relative to a slotting wheel comprising a pair of electro-magnetic coils each having armatures arranged to be actuated by said pen nib to vary the effective impedance of said coils, a motor for shifting said pen nib relative to said slotting wheel, and a differential control circuit for said motor arranged to be actuated in accordance with the difference in the impedances of said coils.

7. The combination for orienting a pen nib relative to a slotting wheel comprising a pair of electro-magnetic coils having movable armatures arranged to be actuated by said pen nib to vary the effective impedances of said coils, means resiliently biasing said armatures toward opposite

sides of said pen nib, a differential circuit responsive to the effective impedances of said coils, and means for shifting said pen nib to balance the impedances of said electro-magnetic coils.

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