May 18, 1965 W. J. BARRON 3,183,745

THRUST BEARING MEANS FOR ELECTRONIC ENGRAVING MACHINES

Filed Dec. 29, 1961 2 Sheets-Sheet 1

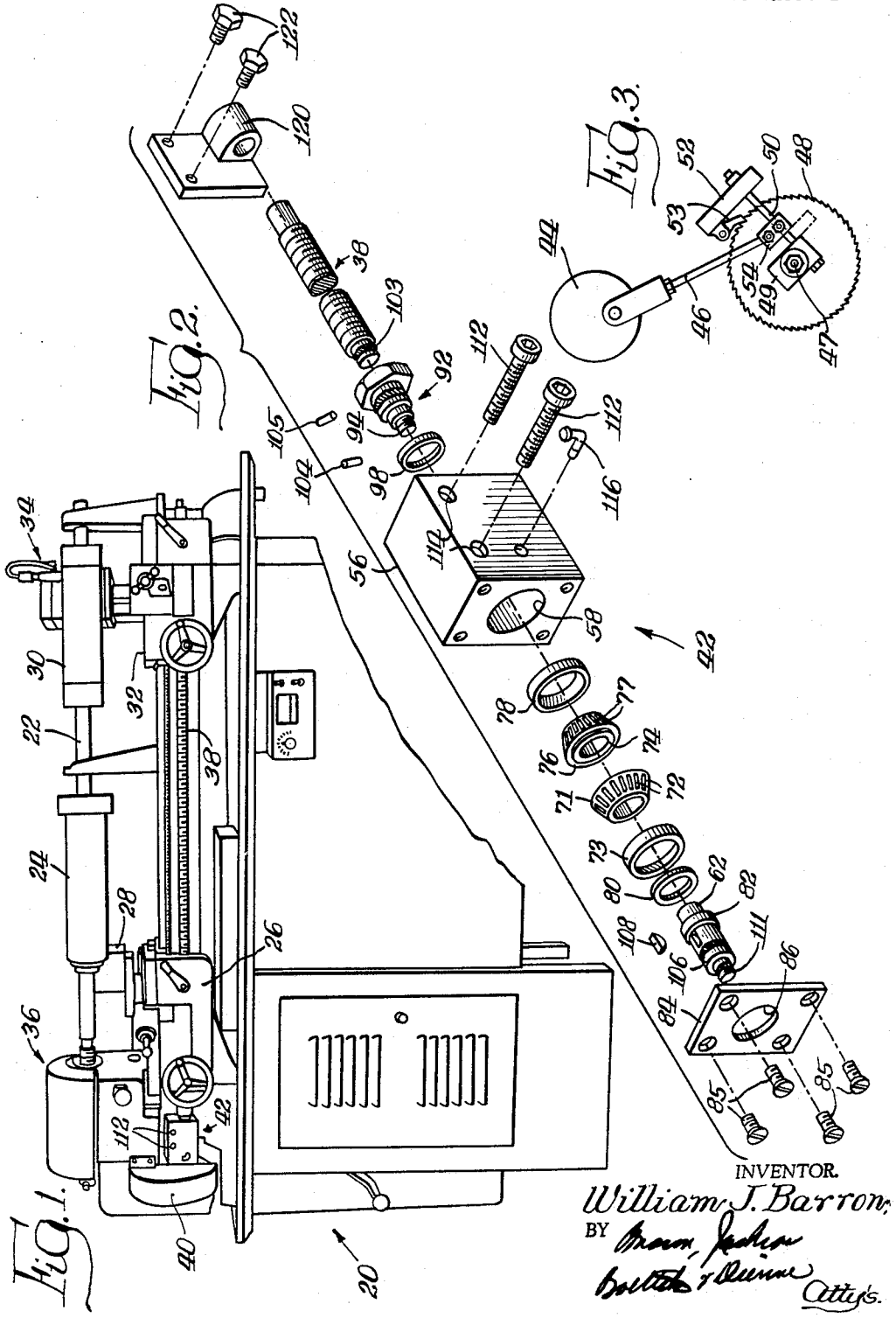

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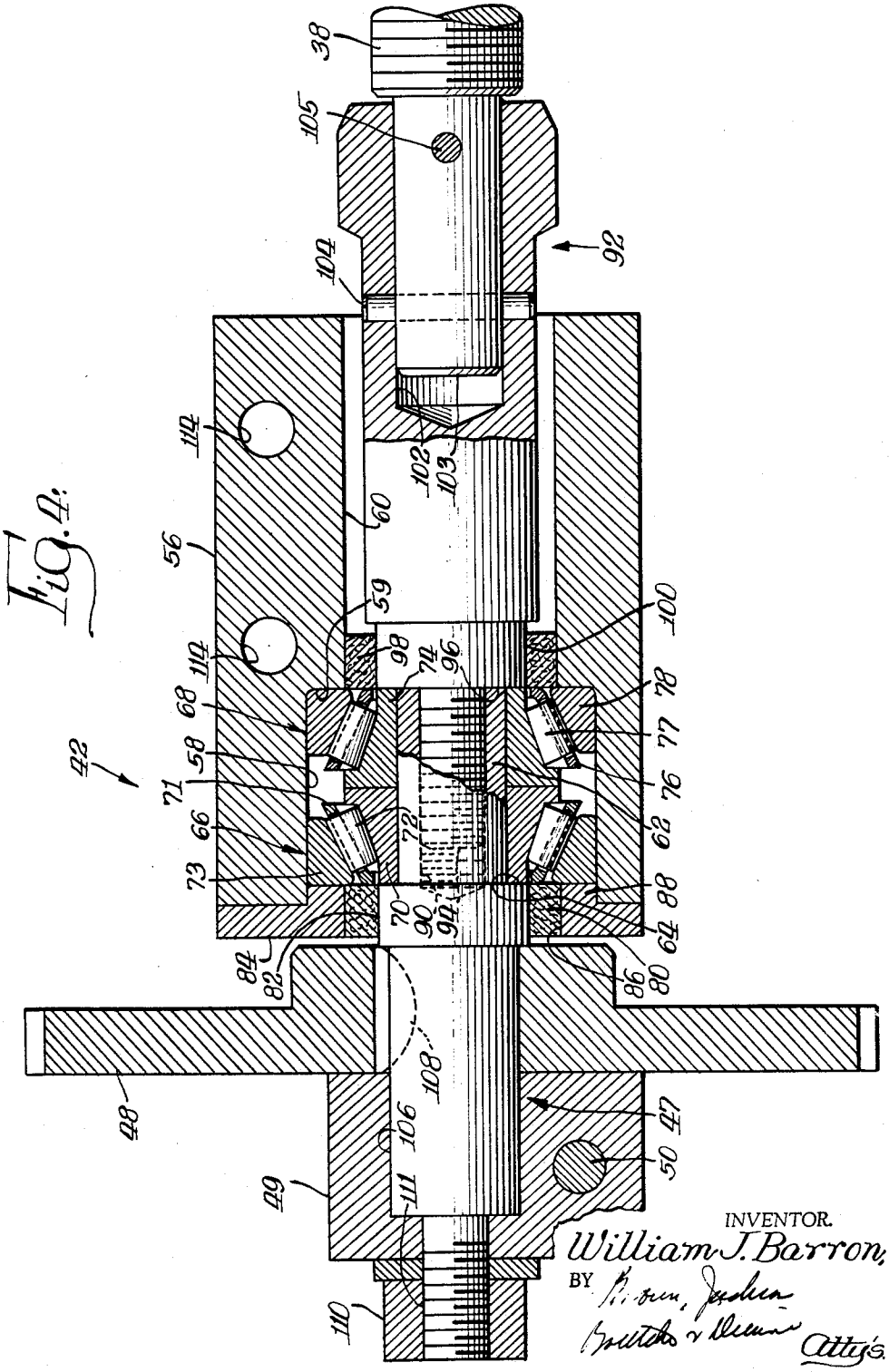
Fig. 4.



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THRUST BEARING MEANS FOR ELECTRONIC ENGRAVING MACHINES

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The present invention relates to an electronic engraving machine for making engravings directly from copy. More specifically, the invention relates to an electronically controlled lathe having a lead screw for simultaneously advancing scanning and engraving components, and to thrust bearing means for anchoring the lead screw to the lathe chassis, thereby preventing axial movement of the lead screw when the latter is rotated during an engraving operation.

Electronic engraving machines of the general type with which the present invention is concerned are known in the art. Such machines may comprise a scanning cylinder on which a photograph or other copy is mounted, an engraving cylinder on which a metal or plastic plate to be engraved is mounted, a cutter for engraving the plate, and scanning apparatus for sensing the light reflected from the copy and transmitting electrical impulses proportional thereto to the cutter apparatus, whereby upon rotation of the scanning and engraving cylinders and simultaneous axial advancement of the scanner and cutter along their respective cylinders, the plate will be engraved with lines varying in width according to the tones of the copy.

Various types of electronic engraving machines are presently on the market, and such machines are ordinarily quite expensive. For this reason, small newspapers and other potential users with limited funds available find it difficult to make the high initial investment necessary to acquire one or more engraving machines, although the utility of such machines in automatically producing engravings directly from copy renders them almost a necessity in many such businesses.

The present invention is based in part on the insight that an electronic engraving machine can be produced using for its basic chassis a standard machine tool lathe, and that a machine can thus be produced at a substantial reduction in cost, which machine will effect results fully comparable to those of the more expensive machines, and in many instances substantially improved results.

One of the principal problems encountered in manufacturing an electronically controlled lathe for making engravings is the design of the mechanism for advancing the cutter head axially along the engraving cylinder. A lead screw is commonly provided for advancing the cutter head, but I have found that the normal means for mounting a lead screw as embodied in substantially all machine tool lathes is not satisfactory for the design of an engraving machine.

In the manufacture of a lathe, the lead screw is commonly supported axially against one or more mounting blocks, the lead screw having elements integral therewith or secured thereto which bear against the side faces of the mounting blocks during rotation of the screw. For example, one end of the lead screw may be held by being threaded into an adapter shaft which is positioned within a mounting block and has a large diameter end portion which bears against the side face of the mounting block so as to support the lead screw axially. Similarly, the other end of the lead screw may extend into a mounting block and have washers or the like keyed thereto which bear against the side faces of the mounting block.

Regardless of the particular structure employed, substantially all lathes embody a lead screw to advance a carriage member, and the lead screw is supported axially

by being fixed with respect to one or more flat-faced members which rotate with the lead screw and bear against the flat sides of corresponding mounting blocks.

Extensive experimentation has shown that such known means for mounting the lead screw of a machine tool lathe is not satisfactory when adapting the lathe for use as a component of an engraving machine. Where a flat-faced rotating member bears against the flat sides of a mounting block, any inaccuracy in the machining of such mating parts produces a slight camming action which will cause axial shifting of the lead screw. Thus, even if such mating parts are machined to within an accuracy of 0.0001 inch, there can still result axial shifting of 0.0002 inch during each revolution of the lead screw. It was determined that such shifting of the lead screw is transmitted to the cutter head carriage and is the cause of streaks which appear in an engraved plate and render the same defective. It will thus be understood that while very slight axial movement of a lead screw is not detrimental when a lathe is utilized as a metal turning machine, even the slightest shifting of a lead screw presents a serious problem when a lathe or the like is utilized as the chassis of an electronic engraving machine.

The foregoing problems can be partially alleviated by substantially increasing the size and strength of the lead screw and all elements which serve to mount the same, but such an approach will increase considerably the cost of the engraving machine, and will not eliminate shifting of the lead screw to the extent necessary for optimum results.

The principal object of the present invention is to provide an engraving machine comprising an electronically controlled lathe, suitable for making engravings directly from copy, which embodies thrust bearing means associated with the lead screw and anchored to the body of the lathe for eliminating axial shifting of a lead screw, the latter serving to advance scanning and engraving components of the machine.

In furtherance of the foregoing object, I provide a mounting block which houses a pair of opposed angular roller bearings in such a manner that said bearings are rigidly held against axial movement within the block. I further provide a pair of rotatable adapted members, each of which bears against a corresponding one of the inner races of the angular roller bearings, and I secure a lead screw to one of said adapter members and secure said members to one another whereby the lead screw is rigidly held against axial movement relative to the mounting block, while being free to rotate and thereby advance a cutter carriage and a scanner carriage associated therewith. The mounting block is firmly anchored to the frame or body portion of my engraving machine.

The above and other objects and advantages will be apparent from the following description of a preferred embodiment of the invention.

Now in order to acquaint those skilled in the art with the manner of utilizing and practicing my invention, I shall describe in conjunction with the accompanying drawings a preferred embodiment thereof.

In the drawings:

FIGURE 1 is a perspective view of the front portion of an electronically controlled lathe manufactured in accordance with the present invention and suitable for making engravings directly from copy material;

FIGURE 2 is an exploded perspective view of elements which comprise thrust bearing means for mounting a lead screw, the bearing means serving to prevent axial shifting of the lead screw as the latter rotates and thereby advances scanning and cutting components associated therewith;

FIGURE 3 is a reduced elevational view of a ratchet advance mechanism adapted to be associated with motor

means for effecting the desired intermittent rotation of the lead screw; and

FIGURE 4 is an enlarged vertical section illustrating the thrust bearing means and related elements for supporting and driving the lead screw.

Referring now to FIGURE 1, there is shown an electronic engraving machine comprising a base 20, a cylinder axle 22, an engraving cylinder 24, a cutter carriage 26, a cutter head 28, a scanning cylinder 30, a scanner carriage 32, a scanner 34, motor means 36, a lead screw 38, a housing 40 for enclosing a ratchet advance mechanism for connecting the motor means to the lead screw, and thrust bearing means 42 for supporting the lead screw.

The motor means 36 is adapted to rotate the axle 22 and the cylinders 24 and 30 mounted thereon, and the ratchet mechanism (to be described more fully hereinafter) is utilized to connect the motor to the lead screw 38 for intermittent rotation of the lead screw, the latter having oppositely formed threads at its two ends whereby upon rotation it will advance the cutter carriage 26 and the scanner carriage 32 towards one another. In this manner, the scanner 34 will scan copy mounted on the scannings cylinder 30 and transmit electrical impulses to the cutter head 28 for engraving a plate mounted on the engraving cylinder 24.

FIGURE 3 shows a ratchet mechanism for intermittently rotating the lead screw 38. An eccentric 44 is driven by the motor means 36 so as to reciprocate a connecting rod 46. An adapter shaft 47 is connected to the end of the lead screw 38, and said shaft has a ratchet wheel 48 keyed thereto and a mounting block 49 rotatably carried thereon. A rod 50 has one end secured in the block 49 and has mounted on its other end an arm 52 which carries a pawl 53, the latter being adapted to engage the teeth on the ratchet wheel. The connecting rod 46 is fixed to the rod 50 by a slide connector 54, whereby upon reciprocation of the rod 46 the pawl will, during its clockwise stroke, rotate the ratchet wheel 48 and the lead screw 38 to which the ratchet wheel is drivingly connected by adapter means. The position of the slide connector 54 can be adjusted along the rod 50 in order to determine the stroke of the pawl 53 and the resultant degree of rotation of the lead screw.

Reference is now made to FIGURES 2 and 4 which illustrate the thrust bearing means 42 for supporting the lead screw 38, and also the adapter means for connecting the lead screw to the ratchet wheel 48. There is shown a housing block 56 which is rectangular in cross section and is provided with a bore 58 of relatively large diameter which extends horizontally into the block 56 from the left end thereof and terminates at a peripheral shoulder or ledge 59. The bore 58 communicates with a smaller diameter bore 60 which extends through the remainder of the length of the block 56 to the right end thereof.

A stepped adapter shaft 47 has a reduced diameter end portion 62 which terminates at a peripheral ledge or shoulder 64, and a pair of angular roller bearings 66 and 68 are mounted on the portion 62. The roller bearing 66 comprises an inner race 70 which is forced on the shaft 62 so as to bear against the shoulder 64, a cage or retainer 71 for holding a plurality of inclined rollers 72, and an outer race 73. The roller bearing 68 is similar in construction to the bearing 66, but has its rollers oppositely inclined to the rollers 72. Thus, the bearing 68 comprises an inner race 74 which is forced on the shaft 62 so as to abut against the end of the inner race 70, the outer end of the race 74 being substantially flush with the end of the shaft 62. The bearing 68 further comprises a cage 76 for retaining a plurality of inclined rollers 77, and an outer race 78.

The adapter shaft 47, with the angular roller bearings 66 and 68 mounted thereon, is partially inserted into the bore 58, the outer diameter of the outer races 73 and 78 being slightly smaller than the bore 58, thus being adapted to be housed therein. In assembling the shaft 47 within

the housing block 56, the outer race 78 is positioned within the bore 58 so as to bear against the peripheral shoulder 59, and the shaft 47 with the bearings 66 and 68 mounted thereon is then positioned within the bore 58 so that the rollers 77 bear against the outer race 78. A leather gasket or the like 80 is mounted on the shaft 47 so as to be positioned on an enlarged diameter portion 82 thereof, and a cover plate 84 is secured to the end of the housing block 56 by a plurality of screws 85. The cover plate is provided with a bore 86 dimensioned to accommodate the shaft 47 and the gasket 80.

It will be seen that the cover plate 84 has an integral peripheral flange 88 which is received within the bore 58 and bears tightly against the outer race 73 when the cover plate is secured to the block 56. In this manner, the angular roller bearings are rigidly held against axial displacement, their inner races 70 and 74 being disposed in abutting relation on the shaft portion 62, and the outer races 73 and 78 being supported by the peripheral flange 88 and the shoulder or ledge 59, respectively.

The adapter shaft end portion 62 is provided with an axial threaded bore 90, and a stepped adapter shaft 92 has a threaded end 94 of reduced diameter which is screwed into the shaft 62, the end portion 94 terminating at a peripheral shoulder 96 which substantially abuts the inner race 74 and the end of the shaft 62. A leather gasket or the like 98 may be mounted on a portion 100 of the shaft 92 so as to substantially fill the annular space surrounding the shaft section 100.

The right end of the adapter shaft 92 is provided with an axial bore 102 for accommodating the end of the lead screw 38, the lead screw having an end portion 103 of reduced diameter which is received within the bore 102 and secured to the shaft 92 by means of a pair of pins 104 and 105.

Referring again to the adapter shaft 47, this member includes a shaft portion 106 which projects outwardly through the cover plate 84, the ratchet wheel 48 being mounted on said shaft and keyed thereto by key means 108. The mounting block 49, which also comprises an element of the ratchet mechanism for rotating the lead screw 38, is rotatably carried on the shaft portion 106 and held thereon by a nut 110 which is threaded onto a reduced diameter end portion 111 of the adapter 47. It will now be understood that rotation of the ratchet wheel as previously described will effect rotation of the adapter 47, the adapter 92, and the lead screw 38, thereby to intermittently advance the cutter carriage 26 and the scanning carriage 32.

The mounting block 56 is rigidly secured to the body of the engraving machine by a pair of cap screws 112 which extend through apertures 114 in the block and into threaded engagement with the body or chassis of the machine, as shown in FIGURE 1.

With reference to FIGURE 4, it will now be understood that the thrust bearing means 42 rigidly supports the rotatable lead screw 38 against axial displacement in either direction, while permitting a driving connection between the ratchet wheel 48 and the lead screw. An axial force, tending to move the lead screw to the right, will be transmitted from the peripheral shoulder 64 to the abutting inner races 70 and 74 so as to be resisted by the angular roller bearing 68, the outer race 78 of the latter abutting the shoulder 59 formed within the mounting block 56. Furthermore, an axial force tending to move the lead screw 38 to the left will be transmitted from the peripheral shoulder 96 through the abutting inner races 70 and 74 to the angular roller bearing 66, the outer race 73 of the latter being rigidly held by the flange 88 on the cover plate 84. An oil spout 116 as shown in FIGURE 2 is provided to permit lubrication of the pair of roller bearings.

It is important to note that the cutter carriage 26 produces an axial load on the lead screw 38 as the latter advances the carriage along the engraving cylinder 24,

such load depending upon the frictional resistance offered by the carriage as determined by proper adjustment of gibs associated therewith. In order to avoid bending of the lead screw and completely eliminate the formation of streaks on an engraved plate, it is preferable that the thrust bearing means be positioned as near as possible to the movable cutter carriage **26**. It is also highly preferable that the right end of the lead screw **38** be supported by mounting means which do not resist axial movement of the screw, thereby minimizing the possibility of bending of the latter. For example, the right end of the screw may be supported in the mounting bracket **120** (see FIGURE 2) which is secured to the frame of the machine by screws **122**.

Through use of the foregoing thrust bearing means, I have been able to provide an electronically controlled lathe for making engravings which embodies a lead screw and means for mounting the same which are relatively light in weight and comparatively inexpensive, and which produces engravings free from streaks and other like imperfections such as have been found to be caused by slight axial movements of the lead screw.

It will be understood that various modifications and rearrangements may be made in the embodiment selected for disclosing my invention without departing from the spirit and scope thereof.

I claim:

1. In an electronic engraving machine of the type having a rotatable lead screw for axially advancing scanning and cutting components past corresponding rotatable cylinders having copy material and a plate to be engraved mounted thereon, respectively, the improvement comprising, in combination, a housing block rigidly anchored to a fixed body portion of the engraving machine, said block having a horizontal bore therein, a pair of opposed angular roller bearings housed side by side within said bore and supported therein against axial displacement, adapter means extending into said bore in abutting relation with said bearing means whereby said adapter means are rigidly supported against axial displacement in either axial direction, and a horizontally disposed rotatable lead screw in substantial alignment with said adapter means and secured thereto whereby axial thrust on said lead screw will be transmitted through said bearing means to said mounting block and said body portion.

2. In an electronic engraving machine of the type having a rotatable lead screw for axially advancing scanning and cutting components past corresponding cylinders having copy material and a plate to be engraved mounted thereon, respectively, the improvement comprising, in combination, a housing block rigidly anchored to a fixed body portion of the engraving machine, said block having a horizontal bore therein, thrust bearing means comprising a pair of opposed angular roller bearings housed side by side within said bore and supported therein against axial displacement, first adapter means extending into one end of said bore in abutting relation with said bearing means, a horizontally disposed rotatable lead screw in substantial alignment with said first adapter means and secured thereto, second adapter means extending into the opposite end of said bore in abutting relation with said bearing means, said first and second adapter means being connected to one another at their inner adjacent ends, and a ratchet wheel fixedly mounted on said second adapter means for rotating said lead screw, whereby axial thrust in either axial direction developed on said lead screw during rotation thereof will be transmitted through said bearings means to said mounting block and said body portion.

3. In an electronic engraving machine of the type having a rotatable lead screw for axially advancing scanning and cutting components past corresponding cylinders having copy material and a plate to be engraved mounted thereon, respectively, the improvement comprising, in combination, a housing block rigidly anchored to a fixed body portion of the engraving machine, said block having a horizontal bore therein, thrust bearing means comprising

a pair of opposed angular roller bearings housed side by side within said bore and supported therein against axial displacement, first adapter means extending into one end of said bore in abutting relation with said bearing means, a horizontally disposed rotatable lead screw in substantial alignment with said first adapter means and having one end connected thereto, and the other end of said lead screw being axially free and being supported against radial displacement, second adapter means extending into the opposite end of said bore in abutting relation with said bearing means, said first and second adapter means being connected at their inner adjacent ends to one another, and a ratchet fixedly mounted on said second adapter means for rotating said lead screw, whereby axial thrust in either axial direction developed on said lead screw during rotation thereof will be transmitted through said bearing means to said mounting block and said body portion.

4. In an electronic engraving machine of the type having a rotatable lead screw for axially advancing scanning and cutting components past corresponding cylinders having copy material and a plate to be engraved mounted thereon, respectively, the improvement comprising, in combination, a housing block rigidly anchored to a fixed body portion of the engraving machine, said block having a stepped horizontal bore extending therethrough and providing a peripheral shoulder portion, a pair of adapter members extending into said bore from opposite ends thereof, a pair of opposed inner and outer angular roller bearings mounted on the inner end of one of said adapters in side by side abutting relation and housed within a larger diameter portion of said bore with an outer race of the inner one of said bearings engaging said shoulder portion, said adapter members being connected to one another at their inner adjacent ends and each having a peripheral ledge portion abutting an inner race of a corresponding one of said bearings, a cover plate secured to said block for axially supporting an outer race of the outer one of said bearings, and a lead screw in axial alignment with said adapter members and having one end secured to the outer end of the other one of said adapter members.

5. The invention of claim 4 wherein the inner end of one of said adapter members is screwed into a threaded bore in the inner end of the other of said adapter members.

6. The invention of claim 5 wherein one of said adapter members has a ratchet wheel keyed thereto to permit rotation of said lead screw.

7. In an electronic engraving machine of the type having a scanning cylinder for mounting copy material and an engraving cylinder for mounting a plate to be engraved, the improvement comprising, in combination, a housing block rigidly anchored to a fixed body portion of the engraving machine, said block having a large diameter horizontal bore in one end which terminates in a first peripheral shoulder portion and a smaller diameter bore communicating therewith and extending horizontally to the opposite end of said block, a first stepped adapter shaft having a reduced diameter end portion terminating in a second peripheral shoulder portion, a pair of angular roller bearings each comprising an inner race, a cage for retaining a plurality of rollers, and an outer race, said bearings being mounted on said end portion with their inner races in abutting relation, said end portion extending into said large diameter bore with the outer race of the inner one of said bearings engaged against said first peripheral shoulder, and with the inner race of the outer one of said bearings engaged against said second shoulder portion, a cover plate apertured to accommodate said first adapter shaft and rigidly secured to said one end of said housing block so as to bear against the outer race of said outer bearing, a ratchet wheel mounted on said first adapter shaft for rotating the same, a second stepped adapter shaft extending into the opposite end of said housing block and threaded into the end of said first adapter member so as to be secured thereto, said second adapter having a peripheral shoulder portion which bears against the inner race of

said inner bearing, and a lead screw having oppositely formed threads on its respective ends for axially advancing scanning and cutting components past said cylinders, respectively, said lead screw having one end adjacent said cutting components connected to the outer end of said second adapter member with its other end axially free while supported against radial displacement.

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