Oct. 11, 1938. K. ZWICK 2,132,452

ENGRAVING MACHINE

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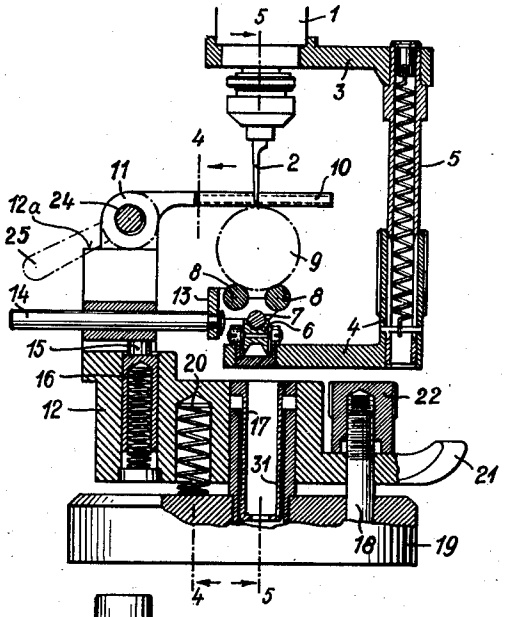

Fig. 1

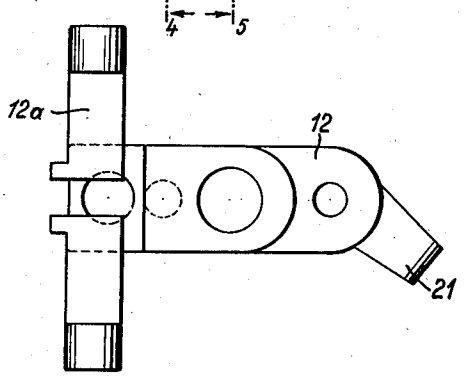

Fig. 2

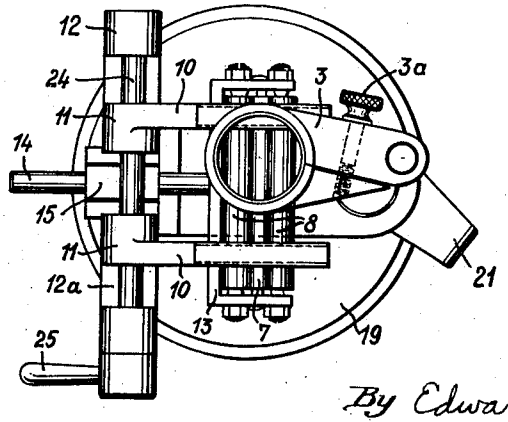

Fig. 3

Inventor
Kurt Zwick
By Edward H. Cumpston
his Attorney

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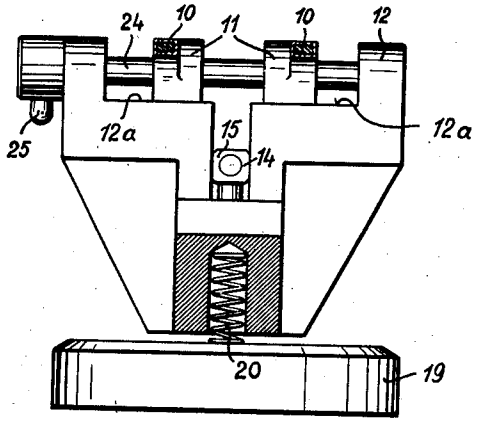
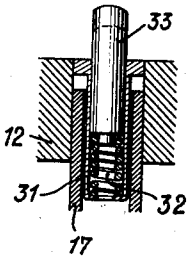


Fig. 4

Fig. 7

Fig. 6



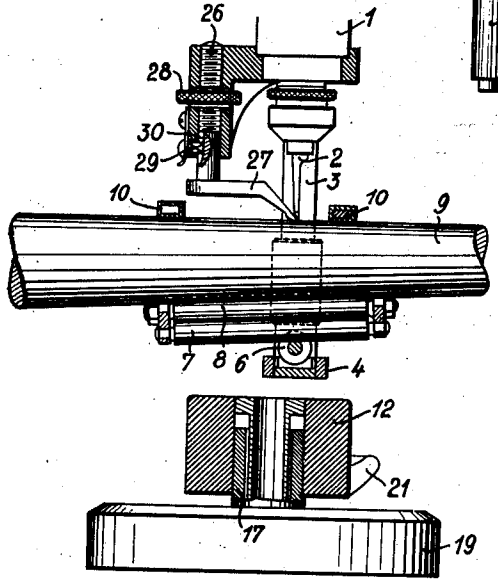


Fig. 5

Inventor
Kurt Zwick
By Edward H. Cumpston
his Attorney

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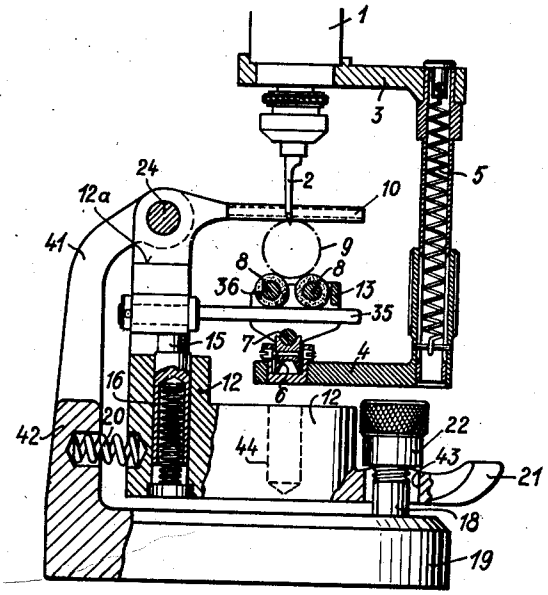

Fig. 8

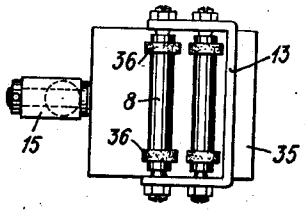

Fig. 9

Inventor
Kurt Zwick
By Edward H. Cumpston
his Attorney

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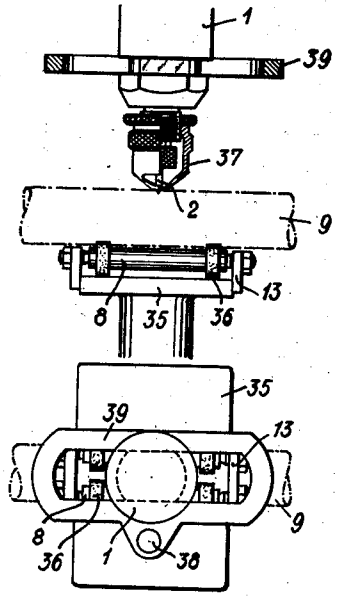

Fig. 10

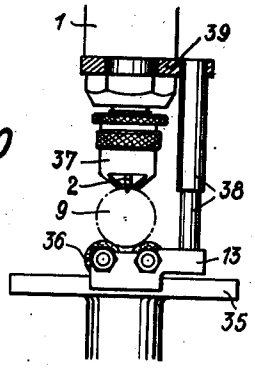

Fig. 11

Fig. 12

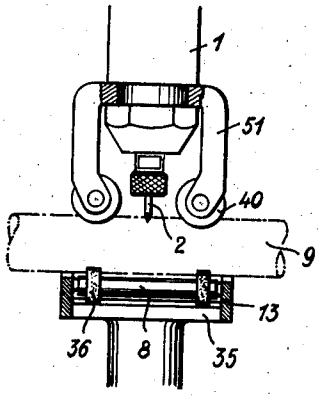

Fig. 13

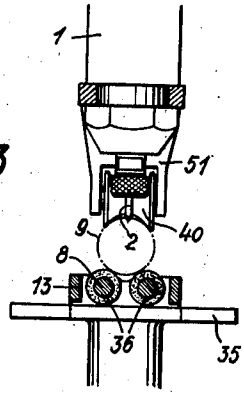

Fig. 14

Inventor
Kurt Zwick
By Edward H. Cumpston
his Attorney

Patented Oct. 11, 1938 2,132,452

UNITED STATES PATENT OFFICE

2,132,452

ENGRAVING MACHINE

Kurt Zwick, Munich, Germany, assignor to Friedrich Deckel, Munich-Prinz Ludwigshohe, Germany

Application July 26, 1933, Serial No. 682,309
In Germany August 1, 1932

15 Claims. (Cl. 33—22)

This invention relates to engraving machines, and particularly to engraving machines adapted for engraving upon work having curved surfaces, especially work which can be rolled such as cylinders, cones, and the like.

An object of the invention is the provision of a generally improved and more satisfactory machine of this character, of simple and sturdy construction, having few parts, not likely to get out of order, and which will operate easily and simply upon work of various kinds.

Another object is the provision of such a machine so designed and constructed that, while adapted for operating upon work which can be rolled, it may also be used when desired with flat work or work of other shapes not moved during the engraving operation.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a vertical section taken substantially centrally through an engraving machine constructed in accordance with one embodiment of the present invention;

Fig. 2 is a plan of the main body of the mechanism shown in Fig. 1;

Fig. 3 is an assembly view of the mechanism shown in Fig. 1, in plan, with parts omitted for the sake of clearness;

Fig. 4 is a vertical section substantially on the line 4—4 of Fig. 1;

Fig. 5 is a vertical section substantially on the line 5—5 of Fig. 1;

Fig. 6 is a view of a supplementary member to be used in holding work which is not to be rolled during the engraving operation;

Fig. 7 is a view of the member shown in Fig. 6 assembled with associated parts;

Fig. 8 is a view similar to Fig. 1 showing a slightly different form of construction;

Fig. 9 is a plan of part of the mechanism shown in Fig. 8;

Fig. 10 is an elevation with parts in section of still another embodiment of the invention;

Fig. 11 is an elevation with parts in section of the mechanism shown in Fig. 10, viewed from another direction;

Fig. 12 is a plan of parts shown in Figs. 10 and 11;

Fig. 13 is a view similar to Fig. 10 showing still a further modification of the invention, and

Fig. 14 is a view similar to Fig. 11 showing from a different direction the mechanism illustrated in Fig. 13.

The same reference numerals throughout the several views indicate the same parts.

Heretofore the production or reproduction by machine of an engraving on a curved surface, such as a cylindrical or conical surface for example, has usually required cumbersome and awkward apparatus, frequently involving movable tables, or complicated mechanism for turning the work. The present invention provides an improved arrangement of simple form whereby work pieces of cylindrical, conical, and other curved shapes may be easily engraved with a minimum of effort and time.

Referring now to Figs. 1 to 5 inclusive, which illustrate one satisfactory way of constructing the apparatus of the present invention, there is shown somewhat diagrammatically a tool carrier 1 of an engraving machine, which may be mounted in any suitable known way, as for example, on a pantograph of a known form of engraving machine. On the tool carrier 1 is mounted an engraving tool 2 rotated as usual in any suitable manner so that it will cut work with which it is in contact.

Means is provided for holding work to be operated upon by the tool 2, and the tool carrier and the work holding means are mounted for movement relatively to each other. This may be accomplished by making both of them movable, or by making either one movable and the other stationary. In the present preferred embodiment, the tool carrier is movable, as for example, being mounted on a pantograph or the like.

A bracket 3 is removably clamped to the tool carrier 1 by the clamping screw 3a, and has a downwardly extending arm which is telescopically formed, the lower part 4 of which is under the influence of a spring 5 which tends to draw it upwardly, but which is guided by a pin and slot or other suitable arrangement so that the lower part 4 can not turn relatively to the upper part 3. This lower part 4 extends laterally to a position substantially vertically beneath the tool 2 and at this point is provided with a grooved roller 6 for engagement with a rail 7 running longitudinally along the underside of a work supporting truck or carriage comprising a suitable frame work and a pair of rollers 8 rotatable therein for supporting work, as indicated diagrammatically at 9.

The spring 5 tends to draw the lower portion 4 upwardly and thus, through the roller 6 and

rail 7, tends to lift the work truck 8 until the upper edge of the work 9 comes into contact with the lower edge of a suitable track preferably formed by two spaced members 10 each mounted on a holder 11 having a flat bottom for engagement with a corresponding flat surface 12a on a body 12. The lower edges of the track members 10 lie substantially in the plane of operation of the cutting end of the tool 2, as is apparent from Fig. 1.

During operation, when the tool carrier 1 and tool 2 move in a direction axially of the work 9, the members 3 and 4 move with it and the roller 6 runs along the lower edge of the rail 7 without affecting the position of the work 9. When the tool carrier 1 and the tool 2 move transversely with respect to the work, however, the roller 6, partially embracing the rail 7, causes it to move in a transverse direction with respect to the work and thus moves the entire truck in a transverse direction, carrying the work bodily with it. Because the upper edge of the work is in contact with the track 10, the work will roll along the under surface of the track and thus will be turned, rotating on the truck rollers 8. In this way, when the work is of circular or substantially circular cross section, the work rolls back and forth on the lower surface of the track 10 in accordance with the transverse movements of the tool, but is not moved by longitudinal movements of the tool, and the tool always engages substantially that part of the work which is tangent to the track. Thus lines extending transversely or at any desired angle to the axis of the work may be readily engraved.

For certain kinds of work, especially soft materials, it may be sufficient if the work contacts with a metal portion of the track. Where the work is hard or is inclined to slip easily, the track surface in contact with the work is preferably made with a relatively high coefficient of friction, as by roughening the surface of the track or preferably by providing it with a layer or coating of rubber or the like, as illustrated in dotted lines in the drawings.

The guiding of the work is improved if the work supporting truck is guided by additional means. For example, one of the frame members 13 of the truck preferably has fixed to it a rod 14 movable longitudinally through a guiding piece 15, the rod 14 extending in a plane perpendicular to the axis of rotation of the work. The rod serves as an additional guide for the truck and prevents any possibility of accidental movement longitudinally of the work, without interfering with the movements of the truck transversely of the work. Furthermore, the guiding piece 15 may be pressed upwardly with relation to the body 12 by a spring 16, so that this arrangement helps to carry part of the weight of the work and the entire weight of it does not rest on the spring 5. The provision of the spring 16 also allows the elevation of the truck to be varied with relation to the track 10, so that work of different sizes may be accommodated between the track 10 and the truck rollers 8.

In the preferred construction provision is also made for controlling the height or elevation of the track 10 in order to control the depth of the engraving, particularly when the tool carrier 1 is mounted for movement only in a single plane (usually horizontal). To this end, the main body 12 is preferably made vertically movable, as for example sliding upwardly and downwardly on a guiding cylinder 17 fixed to a base 19. A spring 20 tends to raise the body 12 relatively to the base 19, while its upward movement is limited and its position is controlled by a nut 22 on the upper end of a stud 18 fixed to the base 19 and passing upwardly through the body 12. A handle 21 is also provided in convenient position, so that by pressing downwardly on this handle the body 12 may be lowered against the tension of the spring 20.

In order to accommodate the mechanism to work pieces of conical or other non-cylindrical shape, the truck which carries the work is capable of being turned or tilted slightly by turning the rod 14 in its guide 15, so that the truck rollers 8 need not lie exactly parallel to the plane of the track 10. For example, as shown in Fig. 5, a conical work piece may be placed between the truck and the track, and in that case the truck rollers 8 will be slightly inclined and the truck rail 7 will likewise be inclined, as plainly shown in the drawings, but the roller 6 may nevertheless run along the rail 7, causing the spring 5 to elongate slightly as the roller 6 runs toward the lower end of the rail and to contract slightly as it runs toward the upper end.

It is desirable that the space between the two track arms 10 may be varied at will, so that the arms may be brought relatively close together when short work is to be engraved and so that they may be movable farther apart when a long engraving is to be made on a larger piece of work. To this end, the holders 11 on which the arms 10 are mounted are provided with holes through which passes a shaft 24 the ends of which are mounted eccentrically on the body 12, and to one end of which is fixed an operating handle 25. Due to the eccentric mounting of the shaft 24, a turning movement of the shaft raises or lowers it slightly with respect to the body 12. Consequently by turning the handle 25 to raise the shaft 24 slightly, the track holders 11 are freed so that they may be moved longitudinally of the shaft to any desired position. Then by turning the handle 25 to lower the shaft 24, the track holders 11 are clamped firmly with their lower flat surfaces against the corresponding flat surfaces 12a of the body 12.

When the work has an irregular surface, the depth of the engraving can not be conveniently controlled merely by adjusting the elevation of the track with respect to the end of the tool 2, and in such cases, the apparatus may be provided with a depth limiter as shown in Fig. 5. In this construction, the bracket 3 mounted on the tool carrier 1 is provided with a lateral extension in which is vertically movable a bolt 26 having a laterally extending arm 27 the top end of which, as shown in Fig. 5, is adapted to rest on the work immediately adjacent the end of the tool 2. A nut 28 engages threads on the bolt 26 so that the bolt may be moved upwardly or downwardly when desired, to adjust the position of the end of the feeler arm 27. The bolt also carries a keyway 30 in which a key or latch 29 is engaged to prevent the bolt from turning about its own axis, to hold the end of the feeler arm 27 in proper position adjacent the tool, but the key 29 may be withdrawn when desired from the keyway 30, so that the arm 27 may be swung aside when it is not needed.

Although the mechanism thus far described is particularly adapted for engraving work having a curved surface which may be rolled on a track, nevertheless it is desired at times to use the mechanism also for engraving work which is not

turned during the engraving operation, as for example prisms, flat work pieces such as tooth brushes, combs, slide rules, and the like. To this end, the body 12 is provided with a suitable cavity or depression 31, which may be formed conveniently as a hollow cylinder extending downwardly into a hollow part of the guiding cylinder 17, as shown particularly in Figs. 1 and 7. A spring 32 may be placed in the bottom of the cavity 31 and on this spring may be placed a plunger 33 having a V-shaped notch in its upper end adapted to engage the rail 7 of the truck. When this is used, the bracket 3 is unclamped and removed from the tool carrier together with the parts 4, 5, and 6, so that the truck rail 7 instead of being supported by the roller 6, is supported by the spring plunger 33 which holds the truck stationary and does not cause it to move with the movements of the tool.

In the form of the invention illustrated in Fig. 1, it is seen that the turning of the work is due to the frictional engagement of the work with the track 10. When the work is of relatively soft material, such as silver, gold, hard rubber, etc., then the engagement with the track is usually sufficient for turning the work against the resistance of the tool, especially when the track has its coefficient of friction increased by a coating of rubber or a roughened surface. When particularly hard materials are being engraved, however, some additional means for turning the work is frequently necessary or desirable, and in such instances, the mechanism may be constructed in the modified form shown in Figs. 8 and 9. Here, as before, the work rolls on the track and is turned thereby, but in addition to this, means is also provided (other than the work itself) for turning the truck rollers so that the truck rollers assist in turning the work.

In this embodiment of the invention, the parts 1 to 7 inclusive may be constructed as before, and also the track 10 and associated parts may be as before described. The main difference, however, is that a second track is provided for engagement with the truck rollers 8. As the truck is moved in a direction transversely of the work, the truck rollers themselves are turned by frictional contact with the track, and the rollers in turn assist in rotating the work.

The track for engagement with the truck rollers is here shown as a flat plate 35 having at one side a rod which may be inserted through the holder or guide 15 just as the rod 14 in the previous embodiment was inserted through this holder. In this instance, however, the rod on the plate 35 is suitably held so that it may not move longitudinally in the holder 14, and thus the track 35 is kept from movement transversely of the work, although it may still be tilted to accommodate the parts to work of conical or other non-cylindrical shape. The truck frame 13 is arranged in such a way that the rail 7 lies below the track plate 35 and the rollers 8 lie above the track plate and roll on the upper surface of the plate. As before, movement of the tool carrier 1 in a direction transversely of the work 9 will be transmitted through the roller 6 to the rail 7 and cause corresponding transverse movements of the truck, and these movements will cause the truck rollers 8 to turn by reason of their engagement with the track 35. The work 9 will thus be turned, both by reason of its contact with the track 10, and by reason of its contact with the rollers 8.

To increase the friction tending to turn the work, the rollers 8 preferably have their coefficients of friction increased, as for example by providing each roller with a pair of rubber bands 36 so that the rubber engages both the track 35 and the work 9.

In this embodiment of the invention, the frame 13 of the truck preferably extends downwardly from the rollers 8 to the rail 7 closely adjacent and practically in contact with the sides of the track 35, so that the truck is guided by the sides of the track and prevented from accidentally running askew or obliquely on the track.

Fig. 8 also shows a modification of the mounting of the body 12 with respect to the base 19, which modification may obviously be applied equally well to the work holding arrangement shown in Fig. 1, and the work holding arrangement shown in Fig. 8 may also be applied to the mounting arrangement shown in Fig. 1. Instead of making the body 12 movable vertically on the cylinder 17, Fig. 8 illustrates an arrangement in which the body 12 is pivotally hung from the shaft 24 which is supported in arms 41 rising from a rear wall 42 of the base 19. The spring 20 is here arranged between the body and the base in such a manner as to tend to turn the body 12 in a direction counter-clockwise when viewed as in Fig. 8, and thus to raise the tracks 10 and 35. As before, the movement of the body 12 may be controlled and limited by a nut 22 on a stud 18 fixed to the base 19, and extending upwardly through a slot 43 in the body 12, to allow free movement of the body through a limited range. The body 12 may also be provided with a cavity or depression 44 for receiving the spring 32 and plunger 33 (Figs. 6 and 7) when it is desired to hold the work stationary.

It is to be noted that the axis 24 about which the body 12 oscillates is preferably in the plane of the lower surface of the track 10; that is, the surface with which the work 9 is in contact. With this arrangement, any oscillation of the body 12 produces practically no lateral movement of the track, but does produce a raising or lowering of the track 10, which is useful in controlling the depth of the engraving.

Another and somewhat simplified embodiment of the invention is illustrated in Figs. 10, 11, and 12 of the drawings, this embodiment being especially suitable for engraving on work of relatively soft material which does not offer great resistance to turning. As in the embodiment shown in Fig. 8, the track may be in the form of a flat plate 35 on which the truck rollers 8 may roll, the rollers preferably having rubber bands 36 as before. Likewise as in the previous embodiment, the truck frame 13 engages closely with the side edges of the track 35 to guide the truck on the track and prevent lateral displacement or improper alinement thereof. The rail 7 is omitted, however, and in place of it a different form of connection to the tool carrier is provided. For instance, a telescopic arm 38 (similar to the telescopic part of the arms 3, 4, and 5 of the preceding embodiment) rises from the truck 13, and at its upper end is provided with a frame 39 having an elongated slot extending in a direction longitudinally or axially of the work, in which slot the tool holder 1 slides. The tool holder is also provided with any suitable form of depth limiter 37 encircling the tool 2, for contact with the work to hold it down firmly on the truck rollers 8 and to limit the depth to which the engraving tool may penetrate the work.

With this arrangement, the work itself does not roll directly on a track, but is turned by con-

tact with the rollers 8 (or with the rubber bands 36 which form part of the rollers) which are turned by contact with the track 35. As the tool carrier 1 moves in a direction axially of the work, it slides along the slot in the member 39 without causing any displacement of the work. As the tool carrier moves transversely of the work, however, the truck 13 is moved transversely by reason of the connection 38, and the truck rollers are turned by contact with the track 35 and they in turn cause rotation of the work.

In Figs. 13 and 14 there is illustrated still a further simplification of the invention, for use on work of relatively soft material or of relatively small size. The track 35 and the truck running on it may be constructed as in the preceding embodiment and the truck may, as before, be guided by portions of its frame 13 engaging with the side edges of the track 35. Here, however, there is no direct connection between the truck and the tool carrier 1, but the movements of the truck are caused by lateral pressure exerted on the work itself, by a suitable depth limiter capable of exerting transverse force on the work. For instance, a pair of rollers 40 may be provided, of grooved shape as shown in Fig. 14, so that they partially embrace the work, and they may be mounted on opposite sides of the tool 2 for rotation in a bracket 51 fixed to the tool carrier 1. The rollers 40 rotate about axes parallel to each other and substantially perpendicular to the axes of the work 9 and the truck rollers 8. Thus, as the tool carrier moves axially or longitudinally of the work, the rollers 40 simply roll on the top of the work and do not cause any displacement of it. When the tool carrier moves transversely of the work, however, then the grooved rollers 40, partially embracing the work, push the work transversely to a corresponding extent. This causes corresponding transverse movement of the truck 13, which turns the truck rollers 8 by reason of their engagement with the track 35, and the turning of the truck rollers turns the work 9, causing it to slide on the rollers 40 which are of smooth metal or other material with a low coefficient of friction. The rollers 40, in addition to serving as means for moving the work, act also as depth limiting means to determine the maximum extent to which the tool may penetrate the work, and also hold the work firmly in place on the truck.

With both of the arrangements shown in Figs. 10 to 14 inclusive, the engraving of work pieces of conical or other non-cylindrical form is possible because the track 35 may be tilted out of a horizontal plane to accommodate it to the tapered shape of the work.

To summarize, it is seen that in all the various embodiments of the invention above described, work of circular cross section or other cross section capable of being rolled, is rolled by relative movement between the work and a track. In the embodiment shown in Fig. 1, the rolling of the work is accomplished by direct contact of the work with the track. In the embodiments illustrated in Figs. 11 and 14, the rolling of the work is accomplished by contact of the work with the truck or carriage rollers which, in turn, roll on the track. In the embodiment of Fig. 8, rolling of the work is accomplished both by direct contact with the track and also by contact with truck rollers which roll on another track.

It is also seen that in all of the embodiments (except when using the parts shown in Figs. 6 and 7), there is relative movement between the tool carrier and the track and also between the work and the track, whether this track be one with which the work directly contacts, or one with which the truck rollers contact. Furthermore, in all of these embodiments, the relative movements between the track and the work are controlled by the relative movements in a certain direction (transversely of the axis of rotation of the work) between the track and the tool carrier, the connection in Figs. 1, 8, and 11, being from the tool carrier to the truck, and in Fig. 14 from the tool carrier to the work.

In the embodiments shown in Figs. 11 and 14, the depth limiter overlies the work and holds it firmly against the truck, while in the embodiments shown in Figs. 1 and 8 it is the upper track 10 which overlies the work and holds it against the truck. In all cases, the work is firmly held so that it is kept properly alined and has only the movements which it is intended to have, without accidental movements or vibration which might be detrimental to the quality of the engraving.

The above described arrangements, with the tool 2 on the same side of the work as the track 10, permit the engraving to be reproduced to correspond directly with a model or pattern, in accordance with which model or pattern the tool carrier 1 is moved, by pantograph mechanism or in any other suitable way. When the engraving on the work is to be the reverse of that on the model or pattern, then the relative arrangement of the parts is simply reversed, and the tool engages the work on the opposite side from the track 10, or on the same side as the truck rollers 8, as will be readily apparent to those skilled in the art.

The apparatus, in all of the various embodiments disclosed, is simple, compact, and effective, enabling the production of engraving on curved surfaces more easily and with less expense than has heretofore been possible.

I claim:

1. An engraving machine particularly adapted for engraving on work capable of being rolled, comprising a track and a tool carrier mounted for movement relatively to each other, and means operatively connected to said tool carrier for holding said work against the side of said track which is remote from said tool carrier and for causing relative movement between said work and said track in accordance with relative movements between said tool holder and said track in one direction, so that said work during said relative movements will roll on said track, and so that a tool held by said tool carrier may operate upon that side of the work which is toward said track.

2. An engraving machine particularly adapted for engraving on work capable of being rolled, comprising a track and a tool carrier mounted for movement relatively to each other, and means operatively connected to said tool carrier for holding said work against said track and for causing relative movement between said work and said track in accordance with relative movements between said tool holder and said track in one direction, so that said work during said relative movements will roll on said track, the surface of said track on which said work rolls lying substantially in a plane of operation of an engraving tool mounted on said carrier.

3. Apparatus according to claim 1 in which said track comprises two members spaced from each other, at least one of said members being

mounted for adjustment toward and away from the other to vary the space between them.

4. Apparatus according to claim 1 in which said track is mounted for movement substantially in the direction of the axis of a tool mounted on said carrier.

5. Apparatus according to claim 1 in which said means for holding said work against said track is mounted for adjustment to different angular relations with respect to said track, so that substantially conical work as well as substantially cylindrical work may be accommodated between said track and said holding means.

6. An engraving machine particularly adapted for engraving on work capable of being rolled, comprising a track and a tool carrier mounted for movement relatively to each other, a work supporting truck movable relatively to said track, said truck including a plurality of rollers on which said work is adapted to rest and on which it may roll, and means operatively connected to said tool carrier for causing relative movement between said truck and said track and concomitant turning of said work in said truck when said tool carrier and said track move relatively to each other in a direction transverse to the axes of rotation of said truck rollers, said means for causing relative movement between said truck and said track including a roller operatively connected to said tool carrier for bodily movement therewith and having its axis of rotation substantially perpendicular to the axes of rotation of said truck rollers and cooperating with a part associated with said truck to maintain said truck in predetermined position relatively to said tool carrier in a direction axially of said roller while allowing said truck and said tool carrier to move freely relatively to each other in a direction axially of said truck rollers.

7. An engraving machine particularly adapted for engraving on work capable of being rolled, comprising a track and a tool carrier mounted for movement relatively to each other, a work supporting truck movable relatively to said track, said truck including a plurality of rollers on which said work is adapted to rest and on which it may roll, and means operatively connected to said tool carrier for causing relative movement between said truck and said track and concomitant turning of said work on said truck when said tool carrier and said track move relatively to each other in a direction transverse to the axes of rotation of said truck rollers, said means for causing relative movement between said truck and said track including a rail mounted on said truck and extending in a direction substantially parallel to the axes of rotation of said truck rollers, and a grooved roller operatively connected to said tool carrier and running on and partially embracing said rail.

8. An engraving machine particularly adapted for engraving on work capable of being rolled, comprising a track and a tool carrier mounted for movement relatively to each other, a work supporting truck movable relatively to said track, said truck including a plurality of rollers on which said work is adapted to rest and on which it may roll, and means operatively connected to said tool carrier for causing relative movement between said truck and said track and concomitant turning of said work on said truck when said tool carrier and said track move relatively to each other in a direction transverse to the axes of rotation of said truck rollers, said means for causing relative movement between said truck and said track including a rail mounted on said truck and extending in a direction substantially parallel to the axes of rotation of said truck rollers, roller means running on and partially embracing said rail and movably connected to said tool carrier for movement in a direction axially of an engraving tool mounted on said carrier and restrained against movement relatively to said tool carrier in directions transverse to the axis of said tool, and resilient means tending to move said roller means in a direction toward said tool carrier.

9. An engraving machine comprising a track against which work may rest and on which work of substantially circular cross section may roll, an engraving tool movable with respect to said track for operating upon work in contact with said track, means operated by movement of said engraving tool with respect to said track for rolling said work along said track, and means for holding non-rolling work against said track in stationary position relatively thereto.

10. An engraving machine comprising a track against which work may rest and on which work of substantially circular cross section may roll, an engraving tool movable with respect to said track for operating upon work in contact with said track, means operated by movement of said engraving tool with respect to said track for rolling said work along said track, and resilient means for pressing non-rolling work against said track to hold it in stationary position relatively thereto.

11. An engraving machine comprising a track with which work may contact and on which work of substantially circular cross section may roll, an engraving tool carrier movable with respect to said track so that a tool mounted thereon may operate substantially in the plane of the track upon that side of a piece of work which is in contact with said track, and roller means pressing against the periphery of said work on the opposite side thereof from said track for holding work against said track while allowing it to roll along said track.

12. An engraving machine comprising a track with which work may contact and on which work of substantially circular cross section may roll, an engraving tool carrier movable with respect to said track so that a tool mounted thereon may operate substantially in the plane of the track upon that side of a piece of work which is in contact with said track, roller means pressing against the periphery of said work on the opposite side thereof from said track for holding work against said track while allowing it to roll along said track, and resilient means tending to move said roller means to press said work firmly against said track.

13. An engraving machine comprising a track with which work may contact and on which work of substantially circular cross section may roll, an engraving tool carrier movable with respect to said track so that a tool mounted thereon may operate upon work in contact with said track, roller means movable substantially in a plane parallel to said track for holding work against said track while allowing it to roll along said track, and means for rotating said roller means otherwise than through the rolling of the work itself, to assist in rotating said work.

14. An engraving machine particularly adapted for engraving on work capable of being rolled, comprising a track and a tool carrier mounted for movement relatively to each other, a work supporting truck movable relatively to said track,

said truck including a plurality of rollers on which said work is adapted to rest and on which it may roll, and depth limiting means including a roller mounted on said tool carrier for contact with said work, said roller rolling along said work during movements of said tool carrier in one direction and thrusting said work laterally during movements of said tool carrier in another direction, to move said work supporting truck and thereby to turn said work.

15. An engraving machine comprising means for holding work, a tool carrier movable with respect to said work, an engraving tool mounted on said tool carrier for cooperation with said work, a depth limiter mounted on said tool carrier for oscillation about an axis spaced from and substantially parallel to said tool, said depth limiter including an arm extending laterally from said axis and having a portion adapted to rest upon said work closely adjacent the end of said tool and to be oscillated about said axis to a position removed from said tool, and means for holding said arm against oscillation in position with said portion closely adjacent said tool.

KURT ZWICK.