June 12, 1945. R. R. LOBOSCO 2,378,021

MAGNETIC TEMPLET-FOLLOWING MACHINE

Filed April 1, 1943 2 Sheets-Sheet 1

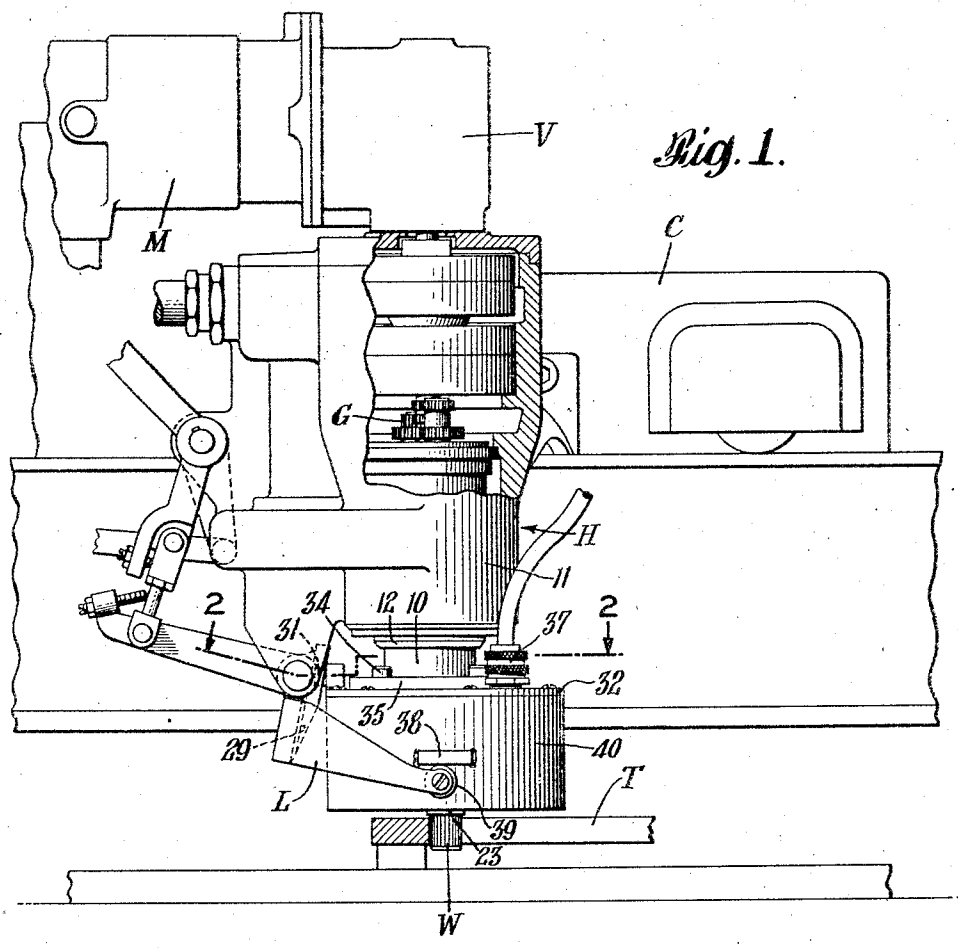


Fig. 1.

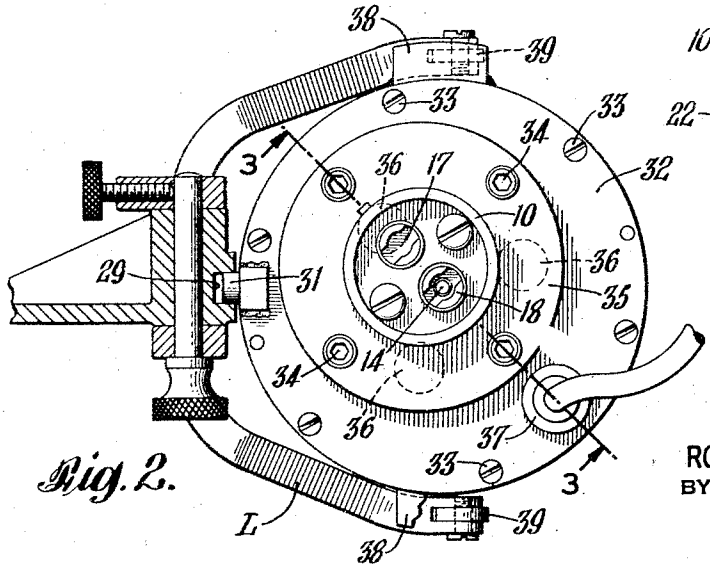


Fig. 2.

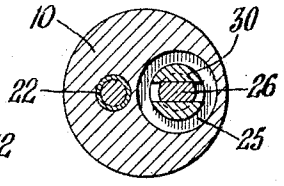


Fig. 4.

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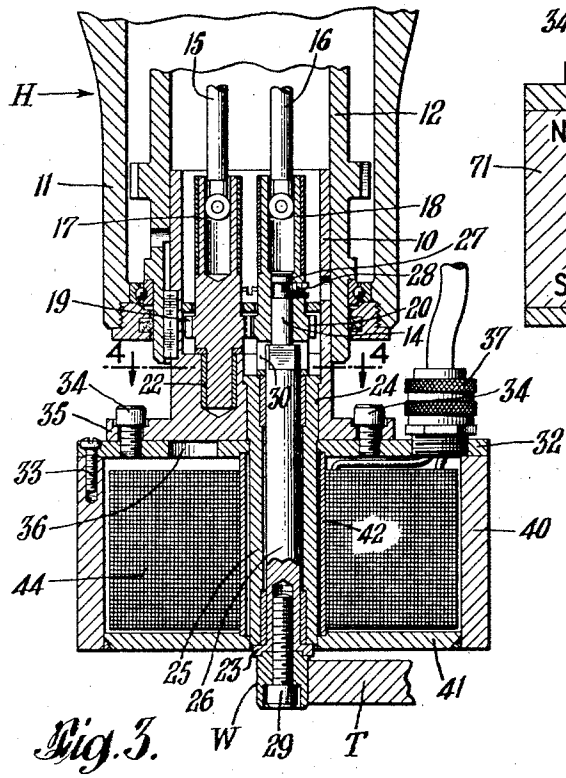
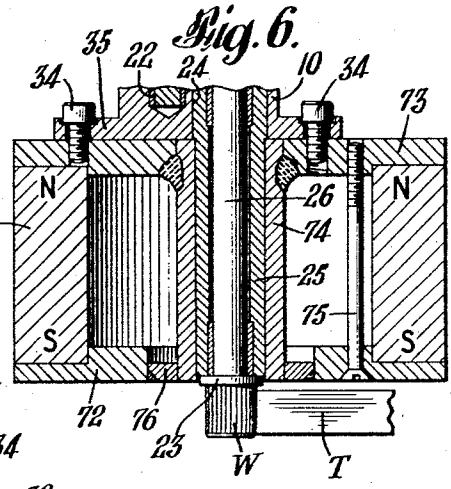
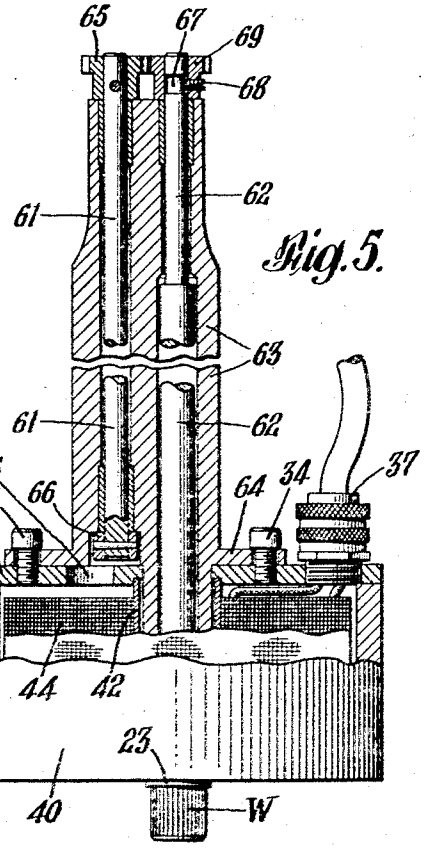


Fig. 3.





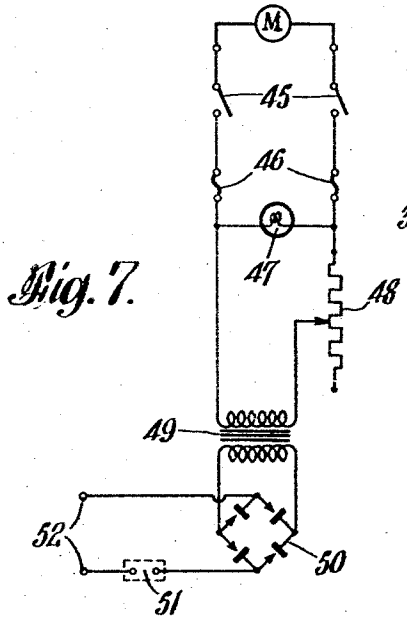


Fig. 7.

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MAGNETIC TEMPLET-FOLLOWING MACHINE

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Application April 1, 1943, Serial No. 481,398

15 Claims. (Cl. 33—23)

This invention relates to a magnetic templet-following machine in which the follower roller is held against the edge of a templet by magnetic force. Such templet followers are used extensively in the metal working art to guide an oxy-gas cutting machine in shape-cutting operations.

Previous magnetic tracers have required a source of direct current for the magnetizing coil, although alternating current has been generally used for the drive motor. It has therefore been necessary to have both an alternating current and a direct current source of power, or to have an alternating current source of power and to use a motor generator to supply the direct current. Using a motor-generator for the direct current supply is both expensive and cumbersome and it is another unit which must be serviced from time to time. Consequently, it has generally been found more satisfactory to employ a mechanical tracer comprising a tracing wheel and a pair of templet-follower rollers disposed on opposite sides of the templet, as shown in Oldham Patent 2,279,338.

It is desirable in tracing devices which actuate cutting machines to provide some means for preventing jerky operation due to backlash in the drive system. In some tracer devices a mechanical brake is provided for this purpose, while in others, such as those having follower rollers on both sides of the templet, the knurling action of the drive rollers on the templet provides sufficient friction.

Among the objects of this invention are: to provide a magnetic tracer which can be interchanged with the present tracing wheel and trunnion drives, which can be operated from the same alternating current lines as the drive motor by using a simple power pack, and which will have means for preventing jerky operation due to backlash in the drive system. It is a further object of this invention to provide a means for readily dismantling the magnetic structure so that damaged coils can be quickly replaced, so that coils for a different voltage can be substituted, and so that a permanent magnet structure can be used to replace the electromagnetic structure.

How these and other objects of this invention are attained will be evident from a study of the following drawings and explanation:

Fig. 1 is a front elevational view of the tracer head of a shape-cutting machine, showing the magnetic tracer unit according to the present invention;

Fig. 2 is a top plan view of the removable magnet unit, and associated parts of the machine in horizontal section taken along the line 2—2 of Fig. 1;

Fig. 3 is a vertical section taken along the line 3—3 of Fig. 2;

Fig. 4 is a horizontal section taken along the line 4—4 of Fig. 3;

Fig. 5 is similar to Fig. 3, showing the magnet tracer unit according to the present invention, mounted on a different type of shape-cutting machine from that shown in the preceding figure;

Fig. 6 is a vertical sectional view of a modification, showing a permanent magnet structure; and,

Fig. 7 is a wiring diagram of the electric power supply for the electric magnet form of Figs. 1 to 5.

While the present invention is of general application to various types of shape-cutting or similar contouring machines, it is shown in Fig. 1 for example, as applied to a machine of the type disclosed in S. R. Oldham Patent No. 2,279,338. Of such a machine, there is shown the tracing head H adapted to be connected to the universally movable carriage C. A traction wheel W engages a templet T mounted on a suitable supporting surface. An alternating current motor M mounted on the carriage C provides motive power for the wheel W, the motion being transmitted through a transmission V and through gearing G.

As shown in Fig. 3, the head H comprises a housing 11 of generally cylindrical shape, in which is journalled a steering sleeve 12. A pair of shafts 15 and 16 are housed within the sleeve 12 and are suitably driven in opposite directions by the gearing G. These shafts couple with a pair of splined sleeves 17 and 18 which have intermeshing gears 19 and 20 respectively integral therewith.

According to the present invention, an extension 10 is slidably inserted in the sleeve 12, and provides a bearing 22 for the lower end of the sleeve 17, and a through bore 24 in which is mounted a bearing sleeve 25 receiving the lower drive shaft 26. The lower shaft 26 has a shoulder 23 just above the knurled portion which constitutes the roller or wheel W. This shoulder 23 is in contact with the bottom face of the bearing sleeve 25.

The shaft 26 has an upper extension 14 received in a lower central bore of the sleeve 18. This upper extension of the shaft 26 has a groove 27 to receive a set screw 28. Power is delivered to the roller drive shaft 26 by means of the dog

30 shown in section in Fig. 4, thus driving the shaft 26 directly from sleeve 18, and from sleeve 17 through gears 19 and 20. The roller W is keyed to the shaft 26 and held in place by a set screw 28, for ready removal and replacement when worn.

Thus there is provided a removable and replaceable magnetic tracer unit which can be interchanged with present tracing units. The removable and replaceable adapter unit comprises the magnet device, the extension 10, the shaft 26, and the two sleeves 17 and 18 journalled in the extension 10. The extension 10 is keyed into the steering sleeve 12 and may be removed through the lower end thereof.

The housing for the electromagnetic structure shown in Fig. 3 comprises a housing cover 32 which is made of steel or other magnetic material and is provided with four tapped holes so that the magnetic structure can be quickly attached to the remainder of the magnetic tracer by screws 34 passing through a flange 35 on the extension 10. The cover 32 is also provided with three large holes 36 for use when filling the housing with potting compound. In assembly these holes are covered by the flange 35. A tapped hole is provided for strain-relief bushing 37 which grips the external coil leads.

The main body 40 of the housing is a cylindrical wall of a magnetic material such as steel. The sole plate 41 of the housing is a flat disc made of non-magnetic material, preferably copper, and brazed to the main body 40 of the housing. The cylindrical wall 40 and the sole plate 41 together constitute a cup which in assembly is fitted into position under the cover plate 32 and secured thereto by screws 33.

It should be noted that in the general machine shown for example in Figs. 1, 2, and 3, the rotation of the steering sleeve 12 is not essential to the operation of the present invention, but merely shows an adaptation of an existing machine. But the vertically slidable mounting of the extension 10 is utilized to properly position the tracer. The extension 10 is supported by lugs 38 secured to the sides of the main body 40, and bearing on rollers 39 which are carried by lever mechanism indicated generally at L. Rotation of the magnet casing is prevented by a lug 31 on the cover 32 vertically slidable in a slot 29 formed in a suitable part of the lever mechanism L.

The magnetizing coil 44 shown in Fig. 3 is wound on a copper tube 42 with proper insulation between the winding and the tube. The extended ends of the tube 42 serve to position the coil in the housing 40, to help conduct heat from the inner part of the housing where it can be dissipated, and act as a seal for the potting compound. As will be explained later, this copper tube also acts as a lag coil.

The coil is assembled into the housing, as shown in Fig. 3. The extended ends of the barrel of the copper coil tube fit into recesses in the cover plate 32 and in the sole plate 41 and thus accurately position the coil in the housing. The space between the coil and the housing is filled with a potting compound. The purpose of this compound is to prevent oil or moisture from entering the coil and damaging it, and to provide the greatest possible transfer of heat from the coil to the case.

It should be noted that all of the metal parts of this unit except the coil assembly, the sole plate 41, and the bearings, are made of magnetic materials such as steel. When the coil is energized the resultant magnetic flux flows down through the roller shaft 26 and the bearing sleeve 25 through the knurled roller W into the templet T, across the templet, across the air gap, and into the main body 40 of the housing, up the main body of the housing and across the cover plate 32 and back to the starting point.

The shoulder 23 on the roller shaft 26 serves two purposes; First, the shoulder makes good magnetic contact with the bearing sleeve 25 and helps transfer flux from the bearing sleeve to the roller. This flux would otherwise have to cross the small air gap between the surface of the roller shaft and the inner surface of the bearing sleeve; second, the flux passing from the bottom face of the bearing sleeve 25 into the shoulder 23 causes the shoulder on the roller shaft to be pulled firmly against the bottom face of the bearing sleeve. The resultant friction between these surfaces acts as a small braking force on the roller shaft and reduces the undesirable effects of backlash in the drive system and inertia of the machine.

The coil of the magnetic tracer can be energized from a direct current source of power, or it can be energized from an alternating current source of power, preferably the same source as that for the motor M, by making use of a power unit or pack such as is shown in Fig. 7. This power unit is equipped with an on-off switch 45, a pair of fuses 46, a pilot light 47, a coil current adjusting resistor 48, a transformer 49, a dry plate rectifier 50, and a pair of terminals 51 by means of which a meter may be connected when adjusting the resistor 48. The coil is connected to a receptacle 52.

The output of this unit is pulsating direct current. The voltage goes from zero to maximum and back to zero 120 times a second, when a 60 cycle alternating source of power is used. With the usual type of construction, these power pulsations would cause a pronounced pulsation in the force of attraction between the templet and the roller, which in turn would cause chattering between the roller and the templet. These pulsations could be reduced by using one of the conventional inductance-capacity filters. These filters are both bulky and expensive and the electrolytic condensers which are usually used have a limited life and must be replaced at intervals.

The coil used in this embodiment makes use of lag devices to maintain the magnetic flux at sufficiently constant value to avoid chattering. The copper tube on which the coil is wound and the copper sole plate both serve to delay the decay of the magnetic flux.

The modification of the invention shown in Fig. 5 is directed to the driving arrangement, the construction of the magnet and housing therefor being identical with that shown in Fig. 3. The driving arrangement comprises a pair of spaced parallel shafts 61 and 62 journalled in the housing 63 provided with flanges 64 corresponding to the flanges 35 of Fig. 3.

The upper end of the shaft 61 has keyed thereto a gear 65 which bears on the top of the housing 63, and the lower end of the shaft 61 has keyed thereto an idler or holddown collar 66. The shaft 62 has a groove 67 receiving a set screw 68 for securing the same in the bore of a gear 69 which bears on the top of the housing 63 and meshes with the gear 65. The lower end of the shaft 62 is enlarged to form an integral roller drive shaft, which is journalled in an integral extension of the housing 63. This extension constitutes the bearing sleeve analogous to the member 25 of Fig. 3. The remaining parts shown in Fig. 5 are given the same reference characters as in Fig. 3, and

are not again described in detail. The shaft 62 may be removed for replacement by loosening the set screw 68 and sliding the shaft 62 down out of the gear 69, and on down out of the extension of the housing 63.

Fig. 6 shows the magnetic structure employing a permanent magnet, and the manner in which it is fastened to the magnetic tracer in place of the electromagnet. The permanent magnet 71 is ring-shaped or cylindrical, and is secured in position between an annular keeper plate 72 and a top plate 73, both of which are made of magnetic material, and are annularly recessed to form shoulders for positioning the permanent magnet 71. The top plate 73 is tapped to receive the screws 34 which secure it to the flange 35. Welded in a cylindrical aperture of the top plate 73 is a center pole collar 74 which fits over the bearing shaft 25, and is also made of magnetic material. Screws 75 which hold the assembly together, are made of a non-magnetic material.

A collar 76 of non-magnetic material, fills in the gap between the keeper plate 72 and the center pole collar 74.

Assuming that the flux goes from the north pole to the south pole, then the path of the flux will be as follows: from the north pole of the magnet 71, across the top plate 73, down the center pole 74, the bearing sleeve 25, and the roller shaft 26 to the roller W, from the roller to the templet T, across the templet, across the air gap between the templet and the keeper plate 72, and finally to the south pole of the magnet 71, thus completing the circuit.

I claim:

1. In a magnetic templet-following machine having a tracing head comprising a housing, a shaft in said housing, a templet-follower roller on said shaft, said machine having a motor and means for driving said shaft from said motor, a solenoid coil mounted in magnetic circuit with said shaft for magnetizing said roller, means for rectifying current from the same source of power as said driving motor for energizing said solenoid coil, and means in electrical circuit with said coil for reducing the pulsations in the force of attraction between the templet and the roller produced by said energization of said coil.

2. In a magnetic templet-following machine having a tracing head comprising a housing, a shaft in said housing, a templet-follower roller on said shaft, said machine having a motor, and means for driving said shaft from said motor, a magnet surrounding said shaft for magnetizing said roller, and means for preventing jerky operation due to backlash in said drive system, comprising friction drag means energized by said magnet.

3. In a magnetic templet-following machine having a tracer head provided with a housing, a shaft in said housing, a templet-follower roller on said shaft and means for rotating said shaft, a tube adapted to pass over said roller into position surrounding said shaft, a coil wound on said tube and movable therewith, and a separate casing enclosing said coil tube and secured to said housing.

4. A device as claimed in claim 3, in which said tube extends beyond said coil for spacing said coil in said casing.

5. In a magnetic templet-following machine having a tracing head provided with a shaft and means for rotating said shaft, a templet-follower roller on said shaft, a permanent magnet, and means for supporting said permanent magnet in stationary position relative to said shaft for magnetizing said roller.

6. In a magnetic templet-following machine having a tracing head provided with a housing, a shaft in said housing and means for rotating said shaft, a templet-follower roller on said shaft, a coil surrounding said shaft for magnetizing said roller, a casing enclosing said coil and having apertures through which potting compound is introduced, and a flange on said housing to which said casing is secured in position covering said apertures.

7. In a magetic templet-following machine having a tracing head provided with a housing and a sleeve in said housing, a shaft rotatable in said sleeve and means for rotating said shaft, a templet follower on said shaft, a magnet, and means for supporting said magnet in position relative to said shaft for magnetizing said roller, said shaft having a shoulder above the roller in contact with the bottom face of said sleeve for transmitting flux from said sleeve to said roller and effecting a small braking force on said shaft to reduce the effect of backlash in the drive system.

8. In a magnetic templet-following machine having a tracer head provided with a shaft and means for rotating said shaft, a templet-follower roller, a top plate, a sleeve passing through said top plate, a tube on said sleeve, means passing through said top plate and through said sleeve and said tube for driving said roller from said shaft, a coil wound on said tube, and a cup enclosing said coil and having an aperture receiving said sleeve, said cup having a rim secured to said top plate.

9. In a magnetic templet-following machine having a tracing head comprising a housing, a shaft in said housing, a templet-follower roller on said shaft, said machine having a motor and means for driving said shaft from said motor, a tube adapted to pass over said shaft into position surrounding said shaft, a coil wound on said tube, means for rectifying alternating current for energizing said coil, said tube serving for mechanically supporting said coil and also serving as a lag device to retard the decay of the magnetic flux produced by energization of said coil.

10. In a magnetic templet-following machine having a tracing head comprising a housing, a shaft in said housing, a templet-follower roller on said shaft, said machine having a motor and means for driving said shaft from said motor, a magnet coil adapted to pass over said shaft into position surrounding said shaft, means for rectifying alternating current for energizing said magnet coil, and a sole plate below said coil serving as a lag device to retard the decay of magnetic flux produced by energization of said coil.

11. In a device of the character described, a casing comprising a top plate, a bottom plate, and a wall joining said plates, a tube and a coil wound thereon adapted to be inserted in said casing, said tube having ends extending beyond said coil, said plates having recesses receiving said extending ends of said tube.

12. In a device of the character described, having a bearing sleeve and a shaft journaled therein, a removable permanent magnet structure comprising a center pole collar receiving said bearing sleeve, a top plate secured to said collar, an annular keeper plate, and a permanent magnet secured between said plates and surrounding said collar.

13. In a magnetic templet-following machine

having a tracing head comprising a housing, a shaft in said housing, a templet-follower roller on said shaft, said machine having a motor, and means for driving said shaft from said motor, a magnet surrounding said shaft for magnetizing said roller, and friction drag means energized by said magnet for preventing jerky operation due to blacklash in said drive system, comprising a surface rotatable with said shaft in frictional engagement with a surface stationary with said magnet.

14. In a magnetic templet-following machine having a tracing head comprising a housing, a shaft in said housing, and a sleeve rotatable in said housing; an extension slidable in said sleeve and having an internal bore and an external flange, a bearing sleeve mounted in said bore and journaling said shaft, a templet-follower roller on said shaft, said machine having a motor and means for driving said shaft from said motor, a magnet surrounding said shaft for magnetizing said roller, and a removable casing secured to said external flange for supporting said magnet for axial removal and replacement to permit interchange of said magnet.

15. In a magnetic templet following machine having a tracing head comprising a housing, a shaft in said housing, a templet follower roller on said shaft, said machine having an electric motor and means for driving said shaft from said motor, a solenoid coil surrounding said shaft for magnetizing said roller, means for rectifying current from the same source of power that supplies current to said electric motor for energizing said solenoid coil, and a lag device associated with said coil to retard the decay of the magnetic flux produced by energization of said coil, and thereby avoid chattering between said roller and the templet.

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