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TRACER MECHANISM

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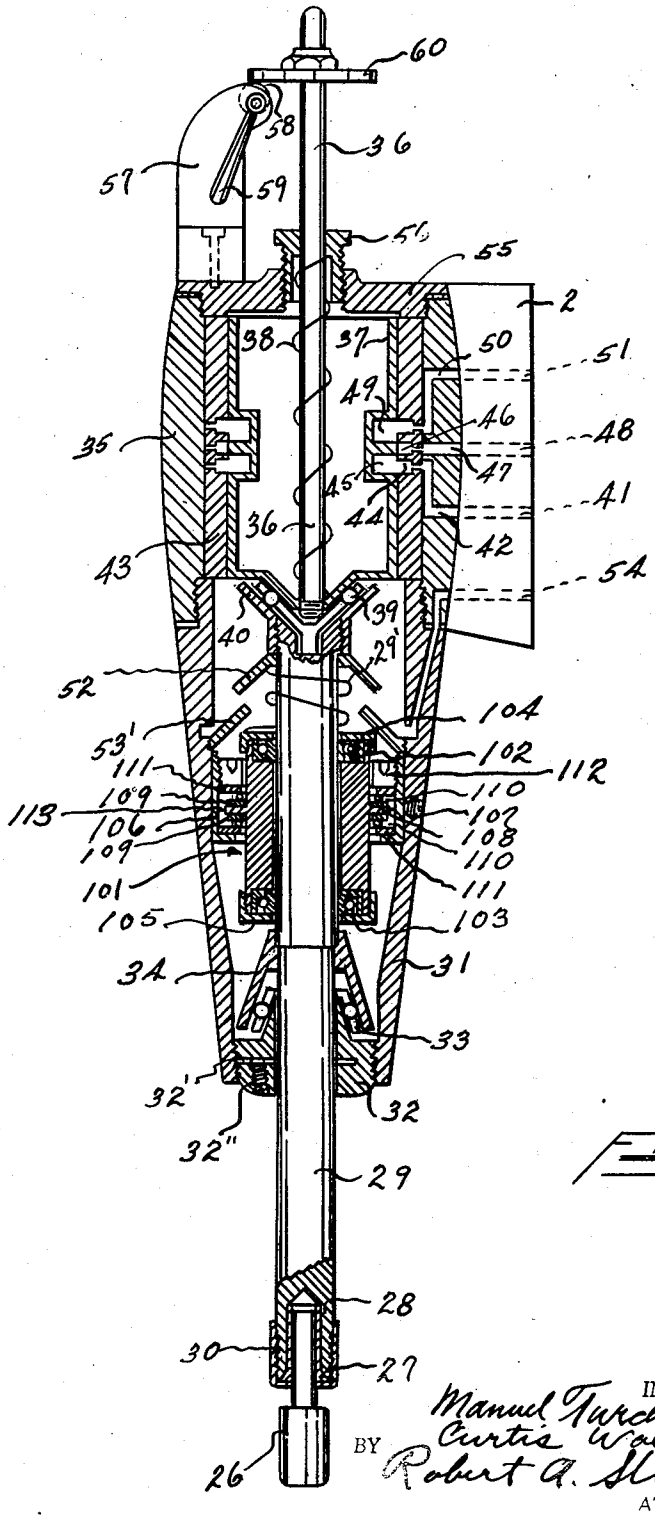


FIG. 1

INVENTOR.
Manuel Turchan
Curtis Walker
BY Robert A. Sloman
ATTORNEY.

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TRACER MECHANISM

Manuel Turchan, Dearborn, and Curtis Walker, Detroit, Mich.

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9 Claims. (Cl. 90—62)

The present application is a substitute for applicant's abandoned application Serial No. 322,150, filed March 4, 1940.

This invention relates to tracer mechanisms, and more particularly to a tracer mechanism adapted to hydraulic duplicating devices wherein the tracer hydraulically controls the movement of a milling cutter, or lathe, or the like for reproducing a templet or pattern of any shape in metal.

The invention relates to a novel tracer mechanism with a surface following tracer stem which reciprocally actuates a fluid control valve, for regulating the fluid flow governing the reciprocation of a cutting device, whereby a facsimile of a templet or design or any shape may be reproduced in metal.

This application is a continuation in part of our prior pending application Serial No. 307,754, now Patent No. 2,301,719, dated November 10, 1942, which relates to an Attachment for high speed heads.

Heretofore some tracer mechanisms utilized for the above purposes have not been accurate in operation; similarly in these mechanisms the tracer action heretofore has been a deflecting action caused by lateral thrusts of a pattern moved against the stem of a tracer. In that type of mechanism it was necessary to vary the diameter at the tracer tip with variations in the length at the tracer spindle. The stem therein has been supported upon an anvil whereby the deflecting action of said stem causes a raising of the upper edge of said tracer stem with the consequent raising of the fluid control valve seated thereon.

It is the object hereof to provide a tracer mechanism which is novel in operation and which produces more accurate results than heretofore obtained in a tracer mechanism of this class.

It is the object hereof to provide in a tracer mechanism means whereby lateral thrusts upon the tracer tip or stem are immediately translated into upward axial movements of the tracer stem. Consequently the valve is controlled by a direct upward movement of the tracer stem rather than by a deflecting movement. By preventing any deflection of the tracer tip, it is not necessary to vary the diameter thereof to correspond to variations in the length of the tracer spindle, as has been the practice heretofore.

It is the further object herein to provide in a tracer mechanism of this class means whereby there is no lateral deflecting movement of the tracer stem, said movement being transmitted entirely to longitudinal movement.

It is the further object hereof to produce a tracer of great sensitivity requiring only the slightest pressure to actuate hydraulic means causing reciprocation in either a cutting tool or a work table.

Another object of the invention is the provision in a tracer mechanism of an axially movable spindle, a valve mechanism operable upon the movement of said spindle, and manually controlled means for operating said valve mechanism.

Another object of the invention is the provision in a duplicating mechanism of this type a tracer spindle and housing provided with a plurality of inclines operating on rotatable curvilinear members for effecting axial movement of the spindle upon delivery of a lateral thrust thereto, and means for adjusting said mechanism for regulating and controlling the initial axial movement of said spindle.

Another object of the invention is the provision in a tracer mechanism of this type embodying a housing and a spindle, of a guide means for said spindle so arranged and constructed as to afford a means of adjustment and at the same time being a self-locking mechanism.

It is the still further object hereof to provide in a tracer mechanism of this class means whereby a vacuum producing means may scavenge any oil leakage from the valve of said tracer mechanism.

Still another object of the invention is a provision in a tracer mechanism of this class of a stabilizing device provided with thrust bearings whereby any deflecting action of the tracer stem is absolutely prevented.

The invention however resides in the arrangement of parts and combinations hereinafter set out by way of description and illustration, it being expressly understood that the preferable embodiment shown is merely by way of example, and is not intended to limit the scope hereof.

For a better understanding of our invention reference should be had to the following description, claims and appended drawing of which:

The single figure is a sectioned elevational view of the tracer mechanism.

Referring to the drawing, the tracer mechanism which is an improvement upon the tracer device covered in Patent No. 2,130,109, dated September 13, 1938, is designed to register with a pattern, a duplicate of which is sought to be reproduced by a cutting tool.

The tracer tip 26 provides an extremely sensitive point of contact to register with a pattern, said tip and stem being designed for slight longi-

tudinal reciprocation, whereby the valve within the tracer body is actuated for controlling the high pressure fluid flow into a cutter actuating cylinder in the manner described in detail in our copending patent application Serial No. 307,754.

The tracer tip 26 is adjustably journaled within the spliced collet 27, said collet being in turn held by the bifurcated portions 28 of the tracer spindle 29 and rigidly secured therebetween by means of the knurled nut 30 threaded thereon.

Said spindle is designed for slight axial reciprocation, being journaled within the tracer barrel 31, through the adjusting cone 32 threaded within said barrel, the ball bearing retainer 33, and cooperating cone race 34 rigidly secured to said spindle at approximately a 10 degree angle preferably with respect thereto. However this angle is variable between 5 degrees and 45 degrees, the smaller the angle the greater will be the axial movement of said spindle. It will be noted that adjusting cone 32 is split at 32', and a set screw 32'' employed to spread the adjusting cone for locking same in place. Said cone performs the further function of acting as a guide means for the spindle 29 journaling the same for a sliding fit.

Centrally disposed within the tracer body 35 and valve cylinder 43 is the piston stem 36 longitudinally and resiliently disposed through the piston 37 and wire spring 38. Said spring governs the downward pressure on valve 37 and spindle 29 upon which it is supported, so that the high pressure fluid supply through conduit 41 is cut off until the spindle and valve are caused to rise by movement of tracer tip 26 as translation of the pattern produces longitudinal or lateral pressure thereon. This spring 38 is manually regulated by an adjusting nut 56 increasing or decreasing its compression, whereby the sensitivity of the tracer tip 26 is governed.

The lower end of stem 36 is threadably secured to the central lower portion of piston 37. The ball bearing retainer 39 cradled in the top of spindle 29 non frictionally registers with the cone race 40 which is fixedly secured at approximately a 45 degree angle with respect to tracer spindle 29.

The tracer valve piston 37 is non frictionally positioned upon the conical ball retainer 39 and threaded to stem 36 so as to be actuated by said ball retainer and stem as the tracer spindle 29 slightly rises and falls.

A compensating spring 29' is interposed around said spindle extending between the umbrella member 52 and resting upon the stabilizer assembly as will be described hereinafter. The purpose of spring 29' is to take the entire weight of piston, spindle, and valve assembly off of the pattern sought to be reproduced so as to obtain a light and sensitive touch in tracer tip 26. Adjustable spring 38 compensates and acts against spring 29' to obtain the correct amount of pressure on valve piston 37 for enabling operation thereof for any required pressure on the tracer tip.

For example in doing contouring work at high speed, a much greater pressure is required upon the tracer tip. In other cases where reproducing sharp angles and corners, nut 56 is adjusted to obtain a light and very sensitive touch by the tracer tip in registering with the surface of a pattern.

The oil flowing into the lower portion of a cutter controlling cylinder as described in detail in our co-pending application Serial No. 307,754 relating to Hydraulic duplicating attachments for high speed milling heads, is constantly urging downward the cutter positioning cylinder, and tracer secured thereto. While the tracer is positioned over a smooth level surface, the pressure exerted upon the tracer tip raises the spindle 29 and valve piston 37 only slightly allowing enough high pressure fluid to flow through conduit 41 of the tracer arm 2, and channel 42 into recess 44 where communication is made with recess 46, channel 47 and conduit 48, by means of interconnecting annular opening 45 in piston member 37.

Conduit 43 also in tracer arm 2 conducts said high pressure fluid into the top portion of said cutter controlling cylinder tending to force said cylinder up whereby an equilibrium is reached and is maintained as long as the tracer remains in contact with the level surface of the pattern.

As the pattern is manually fed past the tracer tip 26 or by any standard feed, any lateral pressure on the tracer tip received by contact with an obstruction or raised surface causes an instantaneous slight axial movement of the tracer spindle 29 as it rests against the two ball bearing supports 33 and 39. It is this feature of the tracer which makes it so sensitive and readily responsive to the slightest lateral pressure upon the tracer tip 26.

Consequently by increasing the opening to the high pressure return conduit 48 to a cutter controlling cylinder additional high pressure fluid immediately enters the top of said cylinder, causing same and the cutter quill attached thereto to rise and continue rising, carrying with it the tracer head 1 until all lateral pressure on the tracer tip 26 is removed, and by action of the spring 38, the piston 37 again assumes a normal position and an equilibrium is again reached above and below the piston in said cylinder.

Any declivity in the pattern on the other hand causes downward movement of a tracer spindle 29 due to gravity and spring action 38 which consequently shuts off the high pressure flow entirely.

The constant low pressure acting below a cutter controlling cylinder piston immediately causes the cylinder and tracer head to move downward depending upon the depth of said declivity in the pattern. This action forces out the oil in the top of said cylinder causing it to flow back to the tracer head through conduit 48 where it enters recess 49 in the tracer piston 37 and passes out through openings 50 and 51 communicating with the exhaust conduit leading back to the sump of a hydraulic unit.

The umbrella means 52 and trough 53' threaded within barrel 31 provide for disposal of any oil seepage so that the same may be drawn out of the tracer head 1 through the vacuum conduit 54 communicating with the vacuum source in a hydraulic unit. By this means, oil is prevented from seeping down the tracer spindle onto the pattern.

The cap 55 threaded into the top of the tracer body 35 has threaded through its central portion the spring adjusting nut 56, a suitable gasket being provided between said cap and tracer body.

Suitably secured to said cap is a manual regulator consisting of a control bracket 57 having operatively journaled therein a cam 58 actuated by the hand lever 59 whereby the adjusting disk 60 threaded to stem 36 and bolted thereto may be raised or lowered thereby raising or lowering the piston 37, with the consequent raising and

lowering of the tracer head and cutter in the same manner as heretofore described. Said regulator is desirable and useful in setting up a job, for inspection, for replacing the cutter, or for cleaning out metal chips. The hand control thus enables operator to raise or lower a cutting tool and tracer member or manually stop its longitudinal motion in any position.

It will be noted that the tracer arm 2 is bolted to the tracer head or otherwise secured thereto and is provided with the several longitudinal openings 41, 48, 51 and 54 heretofore described. This feature provides the means whereby the various conduits to and from a hydraulic unit can be attached to the end of the tracer arm nearest the cutter controlling cylinder, whereby their weight is taken off the tracer itself.

A spindle stabilizer 101 substantially cylindrical in shape and longitudinally disposed within tracer barrel 31, is journaled around tracer spindle 29.

Magneto bearings 102 and 103 inserted within the annularly recessed ends of the stabilizer and held thereon by threaded cap members 104 and 105 are interposed between said stabilizer and the tracer spindle which is axially journaled therethrough.

Housing member 106 disposed within tracer barrel 31 is retained by the walls thereof and secured in place by means of the set screw 107 threaded through barrel 31.

Annular flange member 108 on stabilizer 101 is provided above and below with thrust bearings consisting of plates 109 having a small clearance with respect to said stabilizer, intermediate bearing retainers 110, and plates 111, the latter having large clearances and extending outwardly to the inside walls of housing member 106.

Large clearances are also provided within housing 106 for said stabilizer member, said thrust bearings being adjustably retained by nut 112 threaded within the top of housing 106.

A leaf spring 113 radially looped in a plurality of places to engage both the side wall of housing 106 and the edge of member 108 provides means tending to center the stabilizer mechanism with respect to said housing.

Spindle 29 journaled through stabilizer 101 and the aforementioned thrust bearings is continuously maintained in a fixed axial position, and the longitudinal valve actuating movement is always maintained in a plane through the tracer axis. Consequently by employing said stabilizer mechanism, the tracer spindle is not deflected or tipped from a plane through its longitudinal axis by lateral pressures exerted thereon.

By utilizing the bearing retainers 110 above referred to, any stresses applied to the tracer spindle 29 can result in only transverse movement of the stabilizer 101 with respect to the tracer housing 31. The annular flanged portion 108, designed to support said stabilizer is provided with a practically frictionless support itself within member 31 of the tracer housing by means of the plate members 111 which engage said housing and are secured thereto, with said bearing retainers 110, respectively interposed between the stabilizer support 108 and said plates. In other words, the stabilizer 101 may move radially of the housing but cannot move axially or into a tilting position and, thus the spindle is always maintained axially directed of the housing. The only movement of the spindle possible being a slight radial movement and a longitudinal movement.

Bearings 102 and 103, providing a minimum amount of friction between the stabilizer and the tracer spindle, permit the latter to move therethrough unimpeded.

Consequently, any movement of the spindle secured within said stabilizer is entirely axial of the tracer housing, because no deflection of said spindle is possible.

With no deflection of said spindle, the object hereinbefore set out is accomplished. Namely, it will not be necessary to vary the diameter of the tracer-tip to correspond to variations in the length of the tracer spindle, as has been the practice heretofore.

It is also contemplated as within the scope of this invention that there be additional annular stabilizer supporting flanges with thrust bearings corresponding thereto.

It will be noted further that satisfactory tracer action may be accomplished by eliminating the lower cones 33 and 34, and substituting a stabilizer mechanism operable substantially as hereinbefore described.

In the normal course of operation with a pattern engaging the tracer tip 26, and with a relative feeding movement therebetween, there is a tendency for the spindle 29 itself to rotate within the tracer housing 31 and stabilizer 101. With the pattern rigid and with a certain amount of friction between the same and the tracer tip, there is nothing to prevent rotation of said spindle. In so doing wear on the pattern is minimized or eliminated.

The stabilizer above referred to is adapted to prevent tilting of the spindle upon the latter receiving a lateral thrust from the pattern. By eliminating tilting of the spindle, it is unnecessary to vary the diameter of the tracer tip for varying lengths of the tracer spindle, corresponding to varying lengths of the cutter.

Magneto bearings 102 and 103 supported within the stabilizer engage the longitudinally reciprocable spindle and at the same time maintain a spaced relation between said spindle and the stabilizer housing 101. Bearings 102 and 103 perform two important functions.

By maintaining a spaced relation between the spindle and the stabilizer housing 101 frictional force resisting longitudinal movement of said spindle is minimized, being limited merely to the sliding contact of the bearings 102 and 103.

But said bearings also perform the further function namely of rotating freely independent of the stabilizer housing. In other words the innermost portions of bearings 102 and 103 frictionally engage the spindle and are adapted to rotate therewith as said spindle rotates in the manner above described.

Said inner portions of the bearings are adapted to rotate with a minimum of friction with respect to the outer portions of said bearings which are secured within the stabilizer housing.

Thus the stabilizer functions to prevent tilting of the spindle, and at the same time bearings 102 and 103 therein facilitate rotation of said spindle which is disposed longitudinally through said stabilizer. This rotation of the spindle would tend to rotate the stabilizer placing a substantial unnecessary burden on the spindle. Thus bearings 102 and 103 can turn with the spindle and at the same time maintain a spaced relation between said spindle and the stabilizer housing 101.

It will be understood however, that the novel

tracer mechanism herein is readily adaptable to the single pressure duplicating attachment disclosed in Fig. 7 of our co-pending parent application Serial No. 307,754. This is accomplished merely by removing the self-aligning bearing 81 and substituting therefor the stabilizing unit.

Having described our invention reference should now be had to the claims which follow for determining the scope thereof.

We claim:

1. In a tracer mechanism of the class described, a tracer head having an inlet port and an outlet port in spaced relation, an intermediate port positioned between said inlet and outlet ports, a valve mechanism in said head for controlling a communication of said intermediate port with said other ports and movable into positions for alternately establishing communication between said intermediate port and said inlet port and said outlet port, and a conduit-bearing arm mounted on said head and having a plurality of non-communicating passages, each of said ports being in communication with one of said passages.

2. In a tracer mechanism of the class described, a tracer head having an inlet port and an outlet port in spaced relation, an intermediate port positioned between said inlet and outlet ports, a valve mechanism in said head for controlling a communication of said intermediate port with said other ports and movable into positions for alternately establishing communication between said intermediate port and said inlet port and said outlet port, and a conduit-bearing arm mounted on said head and having a plurality of non-communicating passages, each of said ports being in communication with one of said passages, there being a drain pipe communicating with said head below said valve mechanism and communicating with a drain passage formed in said arm.

3. In a tracer mechanism of the class described, the combination of a housing; a tracer spindle projected at one end into said housing and projected at its opposite end beyond said housing; a radially movable bearing in said housing for said spindle, said spindle being projected through and longitudinally movable of said bearing; means for limiting said bearing to radial movement; an inclined bearing member mounted on said spindle within said housing and movable in unison with said spindle; an inclined bearing member carried by the lower end of said housing and nesting with said inclined bearing member on said spindle; a plurality of anti-friction members positioned between and engaging and spacing said inclined bearing members apart; and means for mounting said inclined bearing member on said housing for adjustment inwardly and outwardly of said housing for regulating and determining the axial movement of said spindle coordinately with the radial movement thereof.

4. In a tracer mechanism of the class described, a housing; a tracer spindle projected at one end inwardly of said housing and movable longitudinally thereof; a hollow guide means for said spindle carried by said housing and having an inclined surface in spaced relation thereto, said guide means being adjustable inwardly and outwardly of said housing; means on said guide means for locking the same against movement relatively to said housing and inclined means carried by said spindle disposed intermediate said guide means and said housing, cooperable with the inclined surface of said guide means providing a support for said spindle.

5. In a tracer mechanism of the class described, a housing; a tracer spindle projected at one end inwardly of said housing; and a stabilizer mechanism within said housing cooperating with said spindle intermediate its ends for limiting said spindle to transverse axial movement relatively to said housing said stabilizer consisting of a hollow bearing member having an annular flange, and bearings supported by said housing adapted to slidably support said flanged member.

6. In a tracer mechanism of the class described, a housing; a tracer spindle projecting at one end inwardly of said housing and at its opposite end outwardly of said housing; a stabilizer means engaging with said spindle in said housing intermediate the ends of said spindle; means for mounting said stabilizer in said housing for limiting said stabilizer to radial transverse movement relatively to said housing, said stabilizer being freely movable within predetermined limits radially of said housing.

7. In a tracer mechanism of the class described, a housing; a tracer spindle projected at one end inwardly of said housing and at its opposite end outwardly of said housing; a bearing member within said housing, said spindle being projected through said bearing member; an annular flange on said bearing member; bearings engageable with said flange for supporting said bearing, said bearing member being movable radially on said bearings; and adjusting means for regulating the pressure of said bearings on said flange.

8. In a tracer mechanism of the class described, a housing; a valve mechanism in said housing and movable longitudinally thereof; a tracer spindle projected at one end inwardly of said housing and at its opposite end outwardly of said housing and adapted, through engagement at its inner end with said valve mechanism, for moving said valve mechanism in one direction; a spring for moving said valve mechanism in the opposite direction; means for imparting axial movement to said spindle, upon delivery of a radial thrust thereto; and means in said housing for limiting said spindle to transverse axial movement relatively to said housing, said means consisting of a hollow bearing member having an annular flange carried by said spindle, and bearings supported by said housing adapted to slidably support said flanged member.

9. In a tracer mechanism, a housing, a tracer spindle movable therein, a radially movable bearing in said housing through which said spindle is slidably movable, means for limiting said bearing to radial movement, an inclined bearing member mounted on said spindle within said housing, an inclined bearing member carried by said housing, a plurality of anti-friction members positioned between said inclined bearing members, and means for mounting said inclined bearing member on said housing for longitudinal adjustment therein for regulating the axial movement of said spindle co-ordinately with the radial movement thereof.

MANUEL TURCHAN.
CURTIS WALKER.