

Nov. 10, 1942.

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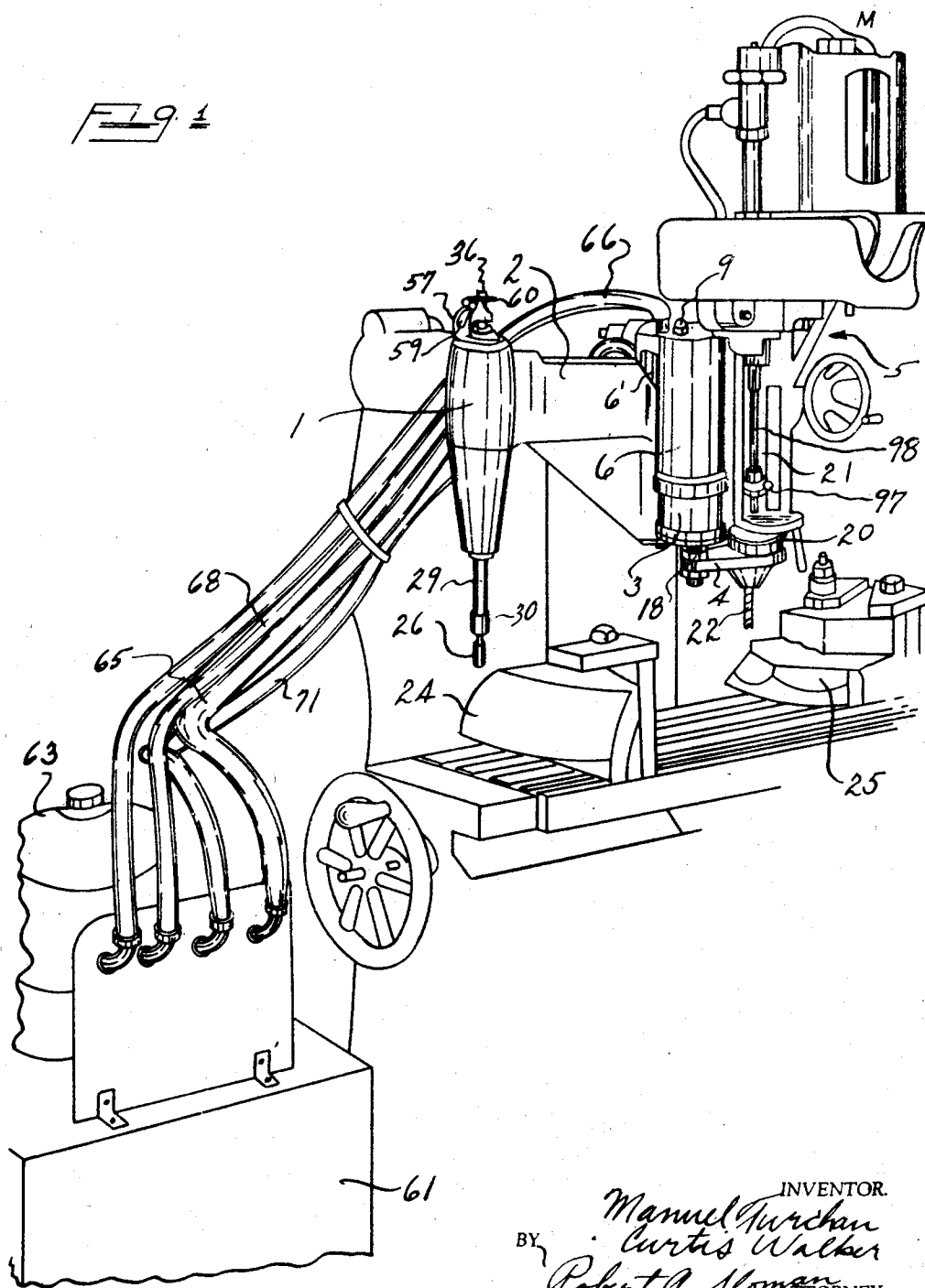
2,301,719

ATTACHMENT FOR HIGH SPEED HEADS

Filed Dec. 6, 1939

4 Sheets-Sheet 1

Fig 1



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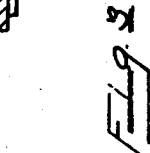
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ATTACHMENT FOR HIGH SPEED HEADS

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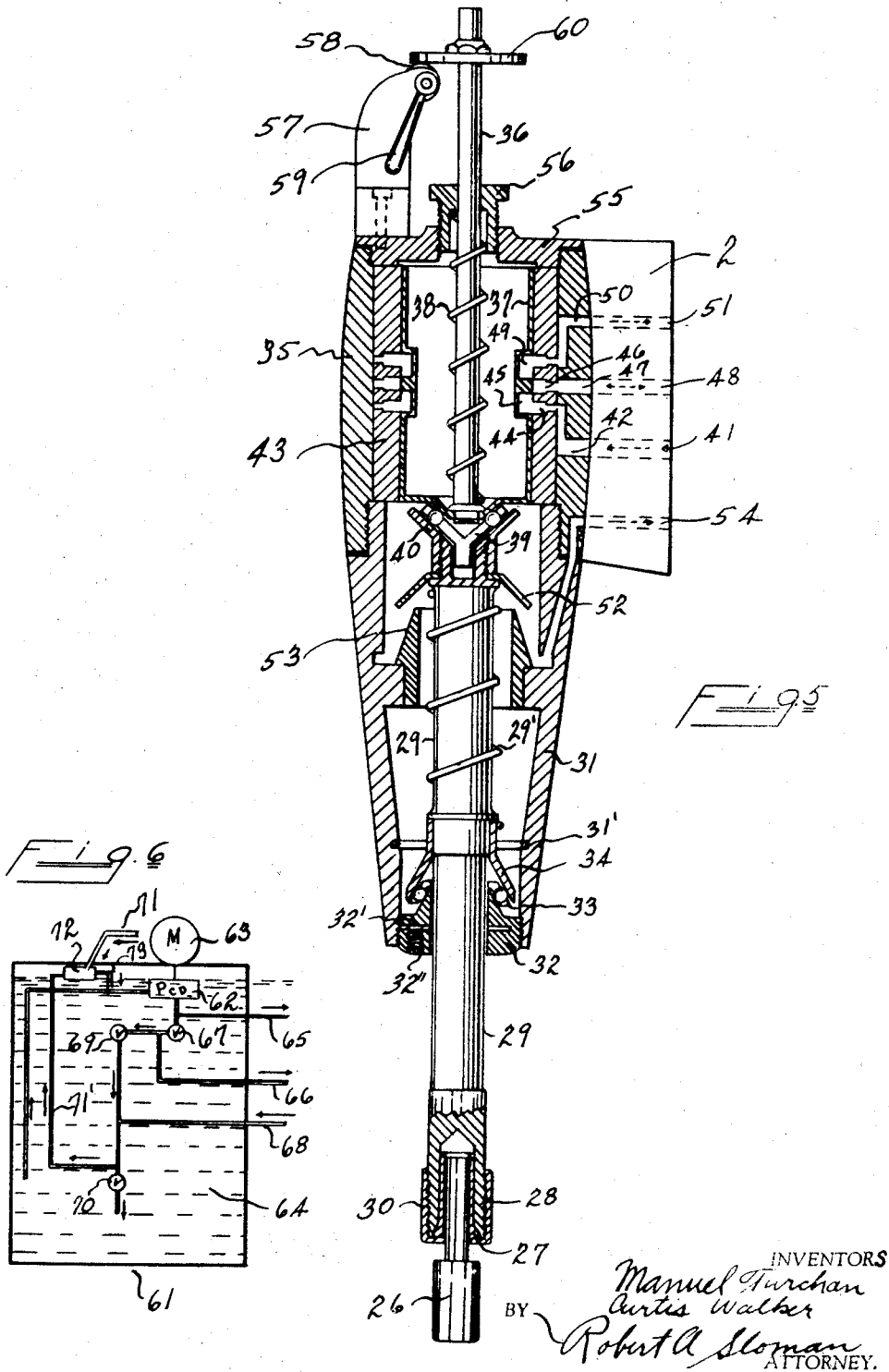
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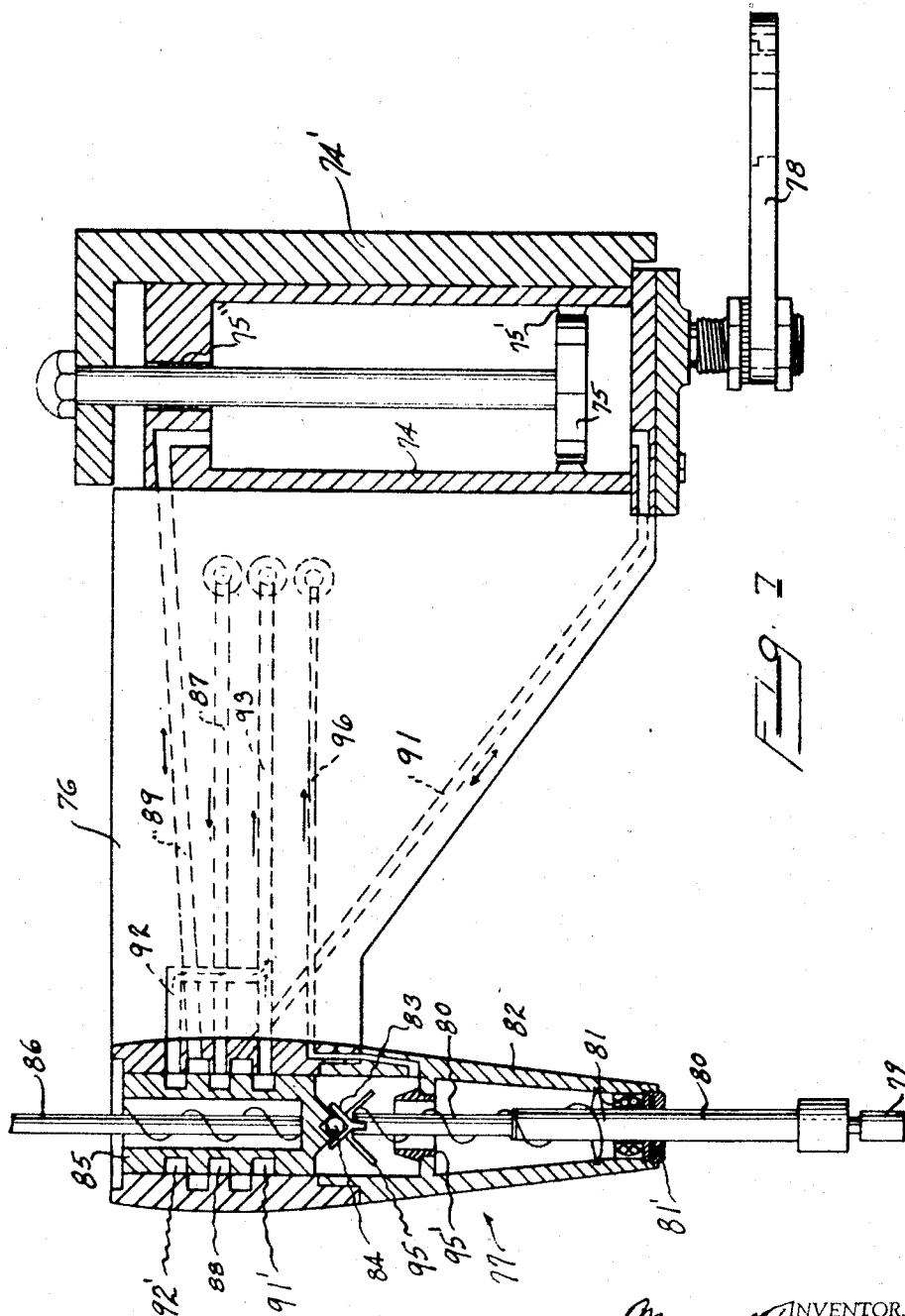
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4 Sheets-Sheet 4



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ATTACHMENT FOR HIGH SPEED HEADS

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Application December 6, 1939, Serial No. 307,754

21 Claims. (Cl. 90—13.5)

This invention relates to hydraulic duplicating attachments, and more particularly, to hydraulic duplicating attachments for high speed heads for milling machines.

It is the inventor's object to produce a relatively simple hydraulic duplicating attachment for high speed heads.

It is the further object hereof to produce hydraulic attachments at comparatively low cost which are readily adaptable to milling machines.

It is the further object hereof to produce an attachment with a tracer of great sensitivity requiring only the slightest touch to actuate hydraulic means causing reciprocation either of a cutting tool or a work table, it being noted that this application is not intended to cover feeding and cross feeding operations.

Another object of our invention is the provision, in a duplicating mechanism, of a stationary cylinder housing with a cylinder mounted therein and having a stationary piston associated therewith, together with means for adjusting the cylinder longitudinally of its housing.

Another object of the invention is the provision, in a duplicating mechanism of this class, of a tracer mechanism and a cylinder movable in unison therewith having a stationary piston in the cylinder relatively to which the cylinder is movable, and a stationary housing for enclosing and supporting the cylinder, together with means for adjusting the position of the cylinder axially of the supporting housing, and together with means for connecting the cylinder to a movable work tool.

Another object of the invention is the provision, in a duplicating mechanism adapted for use in a machine having a stationary part, of a cylinder enclosing housing, means for connecting the housing to the stationary part, and a cylinder carried by the housing and movable axially thereof, and a piston in the cylinder retained in fixed relation to the housing.

Another object of the invention is the provision in a duplicating mechanism of this class, of a tracer mechanism, a passage bearing arm for supporting the tracer mechanism, a cylinder supporting housing, a cylinder axially movable in said housing, and means for mounting the passage bearing arm on the cylinder for movement in unison therewith and for cooperation therewith.

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 con-

trolled means for operating said valve mechanism.

Another object of the invention is the provision in a duplicating mechanism of this class, of the combination with adjusting means for the cutter spindle for a high speed head; of micrometer means in the duplicating attachment for regulating the cylinder and tracer tip.

Another object of the invention is the provision in a duplicating mechanism of this type of a tracer spindle and a 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 an hydraulically operated duplicating mechanism of this type of a tracer mechanism and valve associated therewith, together with a cylinder controlled by the operation of said valve and associated with vacuum producing means for scavenging oil leakage from said tracer mechanism.

Another object of the invention is the provision in a duplicating mechanism of this type of a tracer mechanism, a longitudinally movable cylinder, an arm rigidly connecting said tracer mechanism to said cylinder, a housing for supporting said cylinder, and guide means on said housing for guiding said arm upon axial movement of said cylinder relatively to the housing.

Another object of the invention is the provision in an hydraulic duplicating mechanism of a pump, a source of liquid supply, a piping for delivering liquid to said pump, a piping for conducting liquid from said pump to a high pressure line, through a low pressure line, through an intermediate pressure line, through return line, and through a vacuum producing line, and a plurality of pressure relief valves interposed in said piping for regulating said pressure lines.

Another object of the invention is the provision in a tracer mechanism of the type illustrated of a bearing for the movable spindle, so arranged and constructed as to eliminate vibration and provide a self-aligning bearing.

Another object of the invention is the provision in a duplicating mechanism of this type of hydraulically operated mechanism embodying a tracer mechanism, a piston and cylinder mechanism for moving a tracer mechanism housing axially, and a connection between the tracer mechanism housing and the cylinder whereby the

operation of the cylinder may be effected in either direction by liquid at equal pressures.

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

The invention, however, resides in the arrangements of parts and combinations hereinafter set out by way of description and illustration; it being expressly understood that the preferable embodiments shown are merely by way of example, and are not intended to limit the scope thereof.

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

Figure 1 is a perspective fragmentary view of a high speed head with hydraulic duplicating attachment.

Figure 2 is a partially sectioned side elevation of the attachment.

Figure 3 is a plan view of the connecting bracket between the cylinder and cutter quill.

Figure 4 is a section of the tracer bar on line 4-4 of Figure 2.

Figure 5 is a detail sectional view of the tracer.

Figure 6 is a diagrammatic sketch of the hydraulic unit used with the attachment.

Figure 7 is a fragmentary partially sectioned side elevation of another form of attachment.

Referring to the drawings, it will be noted that the attachment consists of the subject matter illustrated in Figure 2 and preferably a hydraulic unit shown in Figure 6, the simplicity of which will become more obvious as the description proceeds.

The attachment as will be shown in further detail is operatively secured to the high speed head 5 as illustrated in Figure 1 with the electric motor therefore designated as M. The hydraulic unit 6 herein illustrated is connected to the attachment by flexible tubing as will be more fully described hereinafter.

This hydraulic duplicating attachment consists of a tracer head 1 with tracer arm 2 bolted thereto, a reciprocating cylinder 3, rigidly connected to said tracer head and arm, a cylinder housing 6 fixedly secured to a stationary part of the high speed head 5, and a bracket 4 rigidly secured to the cylinder providing operative attachment to the longitudinally movable quill 20 and cutter 22 of said high speed head.

More particularly, the cylinder housing 6 is rigidly secured by threaded bolts to the stationary part of the high speed head at points 7, while the cylinder 3 bolted to the tracer arm and head to operate as a single unit is adapted to reciprocate longitudinally within the housing 6. It will be noted that portions 2' are a part of and integral with the tracer arm casting 2. It will be further noted that the upper portion 2' of circular cross section is circumferentially bolted to the cylinder 3 by bolts 2'', a suitable gasket being interposed therebetween.

The piston rod 8 hollow substantially its entire length and rigidly bolted to the cylinder housing at 9 is provided at its opposite end with a piston 10 threaded thereto. Said piston being also stationary, the cylinder is given upward movement by means of a high pressure fluid source entering the top portion of the cylinder at 11. On the other hand, a low fluid pressure source is constantly present below piston 10 tending to cause downward movement of the cylinder

3, the low pressure fluid being conducted thereto through the intake opening 12 in the stationary housing, communicating with radially disposed side openings in the hollow piston rod 8. Cylinder 3 is sealed at the top by means of the packing gland 3' secured therein by a threaded nut 3''. It will be noted that cylinder 3 in Figure 2 is in its highest position.

The low pressure source is constantly actuated by the hydraulic unit hereinafter to be described, while the high pressure fluid is regulated by means of the tracer mechanism hereafter to be described in detail.

It will be noted that the piston 10 is provided with a ring 13 suitably bolted thereto, retaining two opposing cup leathers 13' between said piston, ring, and interior cylinder wall for maintaining a seal therebetween. It is to be further noted that the bolts securing the cup leathers, enter the piston so as to form an integral sealing unit.

The cylinder head 14, with suitable packing, fixedly secured to the cylinder 3 by bolts is provided with a spindle means 15 and a threaded stud 16 to which is pivotally attached the bracket 4 through opening 17 therein by means of the graduated micrometer nut 18 above said bracket and the plain nut 19 below the same. Reciprocation of cylinder 3 and tracer head 1 is communicated to the cutting tool 22 of the milling machine or high speed head 5 by means of the aforementioned bracket 4. The reciprocable quill 20 for the spindle 21 and cutter 22 of the high speed head 5 is secured to the aforesaid bracket 4 through the opening 23 therein.

The micrometer nut 18 provides a means for regulating the depth of cut of the cutting tool 22, said cutting tool being arranged in fixed relation to the aforementioned bracket 4. By turning the micrometer nut so that it descends, it is seen that the tracer tip 26 is raised with respect to the cutter 22. Consequently said tracer tip travels downward further before it contacts pattern 24. Thus the cutter 22 which moves with the tracer must also travel downward further, thereby obtaining a deeper cut in the work 25. By turning the micrometer nut in the opposite direction the depth of cut is correspondingly decreased.

As heretofore described, the attachment, including tracer head 1, tracer arm 2, and cylinder 3, is designed to reciprocate thereby causing reciprocation of the cutting tool, it being noted that the cylinder housing 6 remains stationary being rigidly secured to the stationary part of the high speed head independent of the movement of the cutting tool. The housing 6 has a longitudinal guide opening 6', (see Figure 1), on the side thereof through which the tracer arm 2 reciprocates vertically with cylinder 3. The sides of this opening 6' are machined to a sliding fit to the arm 2, thus enabling the tracer to always be in the same alignment with the cylinder, after adjusting or setting the cutter to different depths.

The tracer mechanism, which is an improvement upon the tracer covered in Patent #2,130,109, September 13, 1938, forming a part of the attachment herein is designed to register with a pattern 24 shown in Figure 1, a duplicate of which is sought to be reproduced by the cutting tool 22 on the work 25. It will be noted that for the purpose of this application, feeding and cross feed of the work is accomplished manually, it being the object herein of describing a hydraulic attachment which accomplishes no more than

the reciprocation of the cutting tool or the reciprocation of the work support.

The tracer tip 26 provides an extremely sensitive point of contact registering with a pattern, said tip being designed for slight vertical reciprocation, whereby a valve within the tracer is actuated for controlling the high pressure fluid flow into the cylinder 3. As heretofore described, the continuous low pressure fluid flow causes downward movement of the cylinder, tracer, and cutting tool; and the high pressure fluid flow causes the tracer, cylinder and cutting tool to rise as will be more particularly described hereafter.

Referring to Figure 5, 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.

Said spindle is designed for slight vertical reciprocation being journaled within the tracer barrel 31 through the adjusting cone 32, the ball bearing retainer 33, and cooperating cone race 34 rigidly secured to said spindle at approximately a 30 degree angle preferably with respect thereto. However this angle is variable between 10 degrees and 45 degrees, and the smaller the angle the greater will be the vertical 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 is caused to rise in the manner hereafter explained. This spring 38 is manually regulated by an adjusting nut 56, 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 nonfrictionally 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 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 52 and lower portion of barrel 31 retained by notch 31'. The purpose of spring 29' is to take the entire weight of piston, spindle and assembly off of pattern 24 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 a 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 26. 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 a pattern.

The oil flowing into the lower portion of cylinder 3 is constantly urging the cylinder and cutter downward. While the tracer is positioned over a smooth level surface, the pressure exerted upon the tracer tip raises the spindle 29 and piston 37 only slightly allowing enough high pressure fluid to flow through conduit 41 of tracer arm 2, and channel 42 into recess 44 where communication is made with recess 46, channel 47, and conduit 48, by means of the interconnecting annular opening 45 in piston member 37.

Conduit 48 also in tracer arm 2 communicates said high pressure fluid into the top portion of cylinder 3 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 24.

As the pattern is manually fed past the tracer tip 26 or by the standard feed of the machine upon which the high speed head is placed, any lateral pressure on the tracer tip received by contact with an obstruction or raised surface causes an instantaneous slight vertical 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 cylinder 3, 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 10 in cylinder 3.

Any declivity in the pattern on the other hand causes downward movement of the 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 piston 10 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 cylinder 3 causing it to flow back to the tracer head through conduits 11 and 48 where it enters recess 49 in the tracer piston 37 and passes through openings 50 and 51 communicating with the exhaust conduit leading back to the sump in the hydraulic unit 61.

The umbrella means 52 and trough 53 pressed within barrel 31 provide for disposal of any oil seepage so that the same may be drawn out of the tracer head through the vacuum conduit 54 communicating with the vacuum unit 72 in the hydraulic unit 61. By this means, oil is prevented from seeping down the tracer spindle.

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.

Secured to said cap is a manual regulator consisting of a control bracket 57 having operatively journaled therein a cam 58 actuated by means of the hand lever 59 whereby the adjusting disk 60 threaded to the 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 regu-

lator 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 the cutting tool, 22, or manually stop its vertical 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 the hydraulic unit can be attached to the end of the tracer arm nearest the cylinder, whereby their weight is taken off the tracer.

It is contemplated however, that attachment herein described may be operated with all conduits leading directly to the tracer head.

The hydraulic unit 61 shown in Figure 1 and diagrammatically in Figure 6 is a separate unit for providing necessary fluid pressure for reciprocating the cylinder 3.

The fluid pump 62 operatively coupled to the electric motor 63 withdraws oil from the sump 64.

High pressure oil is supplied at any convenient pressure such as 100 pounds to the square inch through conduit 65 which is suitably connected to conduit 41 in the tracer arm 2, pressure relief valve 67 being set for 100 pounds per square inch. The low pressure main 66 furnishing fluid pressure at approximately thirty to forty pounds per square inch, tapped off of said pressure relief valve 67 is suitably connected to the top of the cylinder housing 6 at inlet opening 12, valve 69 being set for thirty to forty pounds per square inch. The exhaust conduit 68 suitably connecting with the exhaust opening 51 on the tracer arm is interposed between the two pressure relief valves 69 and 70 which otherwise communicate with the low pressure conduit 66 and the sump 64.

The vacuum conduit 71 utilized for draining or scavenging oil seepage in the tracer head through passage 54, obtains its suction from a vacuum unit 72 placed at the top of the tank 61 just above the oil level. The overflow from the low pressure relief valve 69 and exhaust line 68 from the tracer is connected to the line 71' utilizing the pressure relief valve 70, which is set for approximately fifteen pounds to the square inch. Relief valve 70 is placed on this line 71' to obtain a low pressure for operating vacuum unit 72, the overflow from relief valve 70 returning to the oil sump. Relief valve 70 causes the exhaust from line 68 and the overflow from the low pressure relief valve 69 to enter line 71' entering the vacuum unit 72, from which it continues out through jet 73 entering the oil sump.

In this manner, a low pressure is created within the aforesaid vacuum unit 72 whereby oil seepage in the tracer head is withdrawn through conduit 71 and returned to the oil sump 64 through jet 73.

It will be noted that hydraulic unit 61 is preferably used with the hydraulic duplicating attachment herein described; however said hydraulic unit may also be adapted for other purposes.

Referring to Figure 7 which is a fragmentary side elevation of a different form of attachment, it will be seen that the same is a single pressure unit actuating the movable cylinder 74 from above or below in conjunction with the rigid piston 75, and stationary housing 74'. It will be noted that said piston is provided with suitable

sealing means 75' and 75'' for maintaining a seal within cylinder 74.

The tracer arm 76 is suitably secured to cylinder 74 to move therewith and is also secured to the tracer head 77 to form a single unit.

As heretofore described, reciprocation of cylinder 74, arm 76 and tracer head 77, is communicated to the quill, spindle and cutter of a milling machine or the like by means of bracket 78 secured to said cylinder in the same manner as before described with reference to Figure 2.

The tracer mechanism constitutes a tracer tip 79 and a spindle 80 with the latter journaled through a self aligning ball bearing 81 and adjusting nut 81' held within the end of the tracer barrel 82. The upper portion of the spindle 80 has loosely disposed thereon the cone race 83 the interior sides of which register with a ball bearing 84.

The piston 85 having longitudinally disposed and centrally secured therewithin the piston stem 86, is supported upon the ball bearing 84, the lower portion of said piston being undercut at angles such as 45 degrees for receiving said ball bearing.

As the tracer tip 79 receives lateral pressure, there is a very slight lateral motion of the lower portion of the spindle within the self aligning bearing 81 with an immediate vertical motion imparted to the piston 85 by means of the angularly disposed cone race 83. In other words, any lateral pressure is immediately translated through the self aligning bearing 81, spindle 80, the cone race 83, and the ball bearing 84 to cause a vertical displacement of the tracer piston 85 thereby controlling the flow of pressure fluid such as oil into either the upper or lower portion of cylinder 74.

An obstruction causing the piston to rise slightly allows a flow of oil or other fluid through intake conduit 87 into the valve chamber 88 which now communicates with the fluid line 89, conducting fluid into the top of cylinder 74. This action immediately causes said cylinder to rise carrying therewith the attached cutter and also the tracer itself until the spindle again assumes a normal position shutting off the fluid supply to the top of said cylinder.

In a similar manner, when the spindle drops below normal position the fluid supply in conduit 87 enters valve chamber 88 which now communicates with conduit 91, conducting fluid into the lower portion of cylinder 74, causing same to descend, carrying with it the attached cutter and tracer until the spindle assumes a normal position.

As the cylinder descends, the oil above the piston is forced back out through conduit 89 where the piston 85 is in such lowered position as to allow this fluid to escape through valve chamber 92' which now communicates with exhaust conduit 92, where it joins the main exhaust line 93.

In a similar manner when cylinder 74 rises, fluid is forced back out through conduit 91 and is free to enter valve chamber 91' which now communicates with exhaust line 93 in raised position, and the hydraulic unit as before mentioned.

Similarly as in Figure 5, the umbrella 95 and trough 95' provide for disposal of oil seepage which then escapes through the vacuum line 96, communicating with the hydraulic unit in the same manner as heretofore described.

Referring to Figure 2, it is obvious that arm 2 may be made of any convenient length. For the purposes of particular jobs said arm may be

lengthened by inserting and suitably securing an additional arm segment or spacer of similar cross section with openings therein corresponding to conduits 51, 49, 41 and 54, with suitable gaskets interposed.

Referring to the high speed 5 of Figure 1, it will be seen that the collar 97 adjustably disposed upon the rod 98 provides means for manually regulating vertical movement of the quill 20, spindle 21 and cutter 22.

The micrometer adjusting nut 18 heretofore described as forming a part of the hydraulic duplicating attachment, provides an accurate adjustment means through bracket 4, to act in combination with the adjusting means 97 which forms a part of the high speed head 5.

In the above description the cylinder 3 is designed for reciprocating the cutting tool. It is contemplated that cylinders could be provided, in a similar arrangement whereby the work table and pattern support could be reciprocated with respect to a nonreciprocable cutter to accomplish similar results.

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

We claim:

1. A hydraulic duplicating attachment comprised of a tracer mechanism, a cylinder reciprocally movable in unison therewith, a stationary piston in the cylinder relatively to which the cylinder is movable, a stationary housing for enclosing and supporting the cylinder, and pivotal means supported by the cylinder for rigid attachment to the reciprocable cutter quill of a movable cutting means.

2. A hydraulic duplicating attachment comprised of a tracer mechanism, a cylinder reciprocally movable in unison therewith, a stationary piston in the cylinder relatively to which the cylinder is movable, a stationary housing for enclosing and supporting the cylinder, and a pivotally mounted bracket supported by the cylinder for rigid attachment to the reciprocable cutter quill of a milling head.

3. A hydraulic duplicating attachment comprised of a tracer mechanism, a cylinder reciprocally movable in unison therewith, a stationary piston in the cylinder relatively to which the cylinder is movable, a stationary housing for enclosing and supporting the cylinder, a bracket supported by the cylinder for rigid attachment to the reciprocable cutter quill of a milling head, and an adjustable means interposed between said cylinder and bracket for varying the position of the cylinder longitudinally of its housing with respect to said cutter quill.

4. The duplicating attachment of claim 3, in combination with an adjusting means on said milling head designed to regulate vertical movement of the cutter with respect to its stationary part.

5. A hydraulic duplicating attachment adapted for use on a machine having a stationary part, comprised of a tracer mechanism, a cylinder reciprocally movable therewith, a stationary cylinder enclosing housing, means for connecting the housing with the stationary part, a piston in the cylinder retained in fixed relation to said housing, and means supported by the cylinder for attachment to the reciprocable cutter of said machine.

6. A hydraulic duplicating attachment comprised of a tracer mechanism, a passage bearing arm for supporting said mechanism, a cylinder

enclosing housing, a cylinder axially movable in said housing, means for mounting the passage bearing arm to the cylinder for movement in unison therewith and for cooperation therewith, and means for connecting said cylinder to a movable work tool.

7. A hydraulic duplicating attachment of this class comprised of a fluid controlling tracer mechanism, a fluid passage bearing arm for supporting said mechanism, a cylinder reciprocally movable therewith, a stationary cylinder enclosing housing attachable to the stationary part of a work tool having a longitudinally disposed slot within said housing for guiding said arm upon axial movement of said cylinder within and relatively to said housing, and means for connecting the cylinder to the movable part of said work tool.

8. A duplicating attachment comprised of a tracer mechanism, a passage bearing arm for supporting said tracer having a plurality of non-communicating fluid passages therein, a cylinder joined to said arm and reciprocally movable therewith, a stationary housing attachable to the stationary part of a work tool, a piston within said cylinder rigidly supported by said housing, a constant low fluid pressure producing means for causing movement of the cylinder in one direction, and a high fluid pressure producing means, operated and regulated by said tracer mechanism for causing movement of the cylinder in the opposite direction.

9. The duplicating attachment of claim 2, in combination with means for adjusting the cutter with respect to said cylinder.

10. The combination, with a fluid controlling tracer mechanism, a conduit bearing arm mounted on said tracer mechanism, having a plurality of non-communicating fluid passages communicating with the interior of said tracer mechanism, a cylinder carried by said arm communicating at one end thereof with one of said fluid passages, and means for delivering fluid under pressure to the opposite end of said cylinder.

11. The combination, a fluid controlling tracer mechanism, a conduit bearing arm mounted on said tracer mechanism, having a plurality of non-communicating fluid passages communicating with the interior of said tracer mechanism, a cylinder carried by said arm communicating at one end thereof with one of said fluid passages, a drain pipe communicating with a passage in said arm, a fluid delivery pipe communicating with another passage therein, and a fluid exhaust pipe communicating with another passage therein.

12. A duplicating attachment comprised of a tracer mechanism, a passage bearing arm secured thereto, having therein a plurality of non-communicating fluid passages, a reciprocable cylinder joined to said arm and movable therewith, a stationary housing journaling said cylinder and having a piston secured therein, said arm being provided with a passage for receiving and conducting high pressure fluid to the tracer, a passage for conducting said fluid back to said cylinder, and a passage communicating with said tracer through which oil seepage may be withdrawn.

13. A hydraulic duplicating attachment comprised of a tracer mechanism, a cylinder reciprocally movable in unison therewith, a stationary piston in the cylinder relatively to which the cylinder is movable, a stationary housing for enclosing and supporting the cylinder and a bracket

supported by said cylinder adapted for attachment to the reciprocable quill of a cutting means.

14. A hydraulic duplicating attachment comprised of a tracer mechanism, a cylinder reciprocally movable in unison therewith, a stationary piston in the cylinder relatively to which the cylinder is movable, a stationary housing for enclosing and supporting the cylinder and a bracket supported by said cylinder adjustable with respect thereto adapted for changing and regulating the distance between a relatively movable cutting means and work support.

15. A hydraulic duplicating attachment comprised of a tracer mechanism, a passage bearing arm for supporting the same, an axially reciprocable cylinder joined to said arm, a piston relatively to which said cylinder is movable and means for connecting said cylinder to a reciprocable work tool.

16. A hydraulic duplicating attachment comprised of a tracer mechanism, a passage bearing arm secured to said tracer for supporting the same, a cylinder joined to said arm reciprocally movable with said arm and tracer mechanism, a stationary housing for enclosing and journaling the cylinder, a bracket supported by the cylinder for rigid attachment to the reciprocable cutter quill of a milling head, and an adjustable means interposed between said cylinder and bracket for varying the position of the cylinder longitudinally of this housing with respect to said cutter quill.

17. A hydraulic duplicating attachment comprised of a tracer mechanism, a passage bearing arm for supporting the mechanism, a cylinder supporting housing, a cylinder axially movable in said housing, means for mounting the passage bearing arm to the cylinder for movement in unison therewith and for cooperation therewith, a stationary piston within said cylinder, said arm having a tracer controlled passage for conducting fluid into said cylinder on one side of said piston, governing movement of said cylinder in one direction, means for supplying fluid into said cylinder on the other side of said piston for governing movement of said cylinder in the opposite direction, and means for connecting said cylinder to a movable work tool.

18. A hydraulic duplicating attachment comprised of a tracer mechanism, a passage bearing arm for supporting the same, a cylinder supporting housing, a cylinder axially movable in

said housing, means for mounting the passage bearing arm to the cylinder for movement in unison therewith and for cooperation therewith, a hollow stationary piston within said cylinder having a hollow piston rod, said arm having a tracer controlled passage for conducting fluid into said cylinder on one side of said piston, governing movement of said cylinder in one direction, means for supplying fluid through said piston rod into said cylinder on the other side of said piston for governing movement of said cylinder in the opposite direction, and means for connecting said cylinder to a movable work tool.

19. A hydraulic duplicating attachment comprised of a tracer mechanism, a cylinder reciprocally movable therewith, a piston in the cylinder relatively to which the cylinder is movable, a stationary housing for enclosing the cylinder and supporting said piston, and a bracket supported by the cylinder for rigid attachment to the reciprocable cutter quill of a movable cutting means.

20. In a hydraulic duplicating mechanism, a fluid pressure source, a tracer head; a cylinder for moving said head axially, a piston within said cylinder; means for delivering liquid from said source to said tracer and to said cylinder for moving said cylinder axially in one direction; tracer actuated means for controlling the delivery of said liquid to one side of said piston, and means for delivering liquid directly from said source to the other side of said piston for moving said cylinder in the opposite direction, said second mentioned delivery means being constant in its delivery.

21. A hydraulic duplicating attachment comprised of a tracer mechanism, a passage bearing arm for supporting said mechanism, a cylinder enclosing housing, a cylinder axially movable in said housing, means for mounting the passage bearing arm to the cylinder for movement in unison therewith and for cooperation therewith, and means for connecting said cylinder to a movable work tool, the passages in said arm being adapted to conduct fluid under pressure from said tracer to one side or the other of a stationary piston in said cylinder for controlling movement thereof in either direction.

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