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DRAWING APPARATUS

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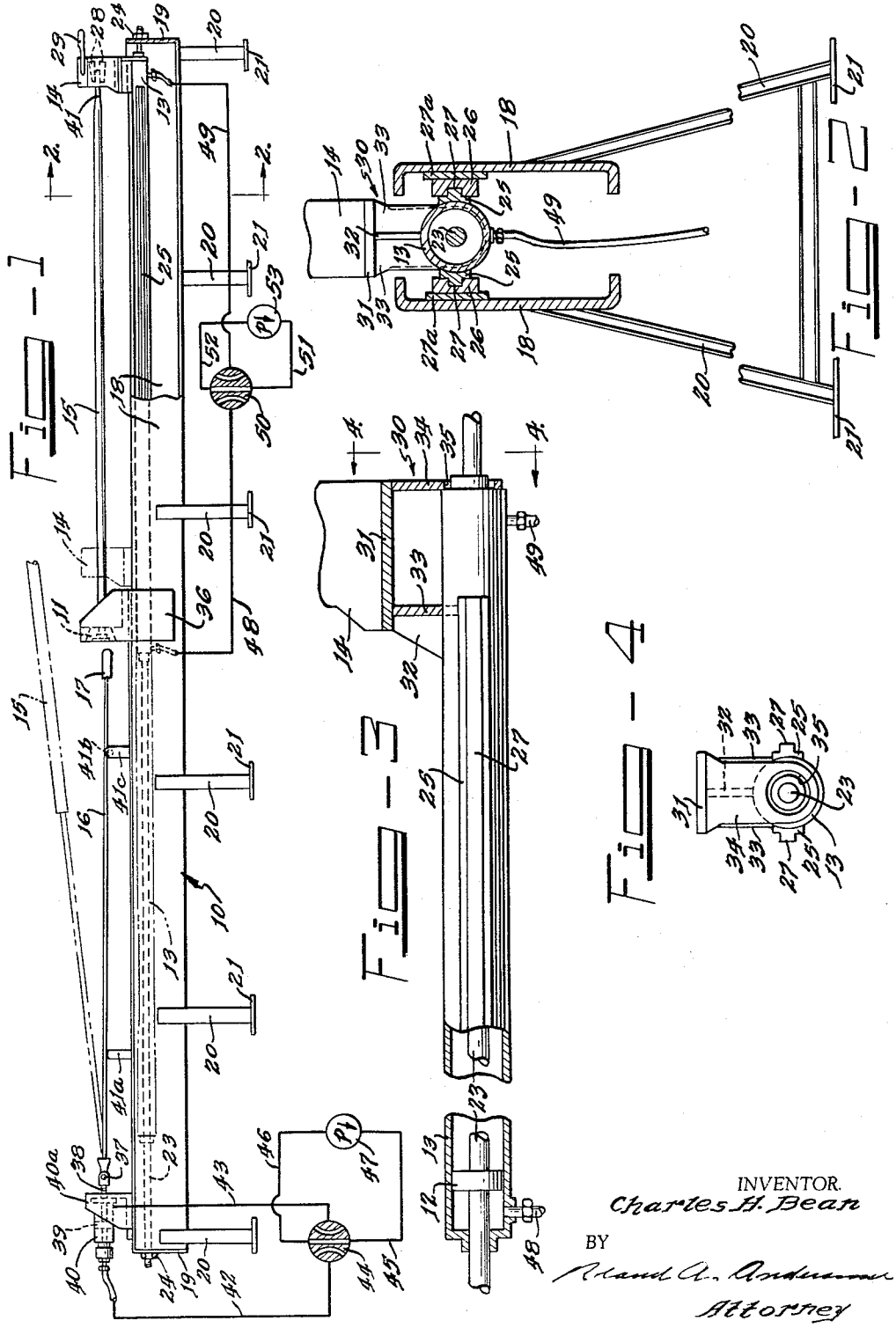


Fig - 1

Fig - 2

Fig - 3

Fig - 4

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DRAWING APPARATUS

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1 Claim. (Cl. 72—283)

This invention relates to an apparatus for drawing long metallic rods or tubes, and more particularly, to an arrangement of such a drawing apparatus enabling the over-all length thereof to be held down.

Drawing apparatuses are well known in which the movement of a workpiece through a drawing die is produced by relative movement between a piston and a pressure-fluid cylinder. With such an apparatus the over-all length is about three times the length of the workpiece being drawn. Thus, if a long tube or rod is being drawn, a large space in a shop must be provided to accommodate the apparatus.

An object of the present invention is to provide an improved drawing apparatus in which the over-all length is held down.

A further object is the provision of an improved drawing apparatus in which a workpiece is pulled by a pressure-fluid cylinder and piston.

Other objects will appear from the following description and the attached drawing, in which:

FIG. 1 is an elevation, partly in section and a schematic showing, of the novel drawing apparatus of the present invention;

FIG. 2 is a sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a fragmentary view, partly in section, showing the mounting for a workpiece gripper on an hydraulic cylinder; and

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 3.

The novel drawing apparatus of the present invention comprises an elongated frame **10**, a drawing die **11** mounted at about the midpoint of the length of the frame **10**, a fixed piston **12** also mounted at about the midpoint of the length of the frame **10**, a movable cylinder **13** axially shiftable lengthwise of the frame **10**, and a gripper **14** for pulling a workpiece **15** through the die **11**, the gripper being attached to one end of the cylinder **13** so that the workpiece extends in parallel side-by-side relationship to the cylinder **13**. Thus, the frame **10** need be only about twice as long as the workpiece **15**.

In the example shown, the workpiece being reduced by the drawing die **11** is a tube and is carried on a mandrel **16** having at its free end an enlarged plug **17** for internally supporting the workpiece at the region passing through the drawing die **11**.

The frame **10** essentially comprises a pair of side members **18** in the form of long shallow channels and a pair of end pieces **19** secured by welding or the like to the side members **18** to hold them in spaced parallel relationship. The frame **10** is horizontally supported above and in spaced relation to the floor by means of a plurality of pairs of legs **20**, which are secured as by welding or the like at their upper ends to the side members **18** and have at their lower ends support shoes **21**, which may be bolted to the floor. The legs **20** of each pair are braced by horizontal cross pieces **22** secured by welding or the like to the legs just above the support shoes **21**.

The piston **12** is fixed with respect to the frame **10** by being secured at about the midpoint of a rod **23** which is secured to the end pieces **19** of the frame. The rod

23 extends through the piston **12** and between the side members **18** of the frame and has threaded ends passing through the end pieces **19**. Nuts **24** on the ends of the rod **23** bear against the end pieces **19** and place the rod under tension.

The cylinder **13**, which tightly embraces the piston **12**, is mounted for axial movement with respect to the frame **10** by means of a pair of opposed longitudinal shoes **25** secured to the cylinder and a pair of opposed longitudinal ways or gibs **26** engaging the shoes **25** and secured to the inner faces of the side members **18**. The shoes **25** are secured by welding or the like to the cylinder **13**, extend substantially the entire length thereof, and have tongues **27** fitting grooves on the ways **26** so as to support the cylinder **13** vertically. The ways **26** extend substantially the entire length of the side members **18** and are secured thereto by welding or the like with spacing elements **27***a* therebetween.

The gripper **14**, which essentially comprises relatively movable jaws **28** and an actuator **29** for regulating the jaws, is attached to one end of the cylinder **13** by a structure **30**. This structure comprises a horizontal top piece **31** to which the gripper **14** is directly fastened, as by bolting or welding, a vertical longitudinal piece **32**; a pair of vertical cross pieces **33** secured to opposite sides of the piece **32**, the top piece **31** and the cylinder **13**; and a vertical end piece **34** secured to the top piece **31**, longitudinal piece **32**, and the cylinder **13**. The securement just described is by welding or the like. The end piece **34** lies against the transverse end surface of the cylinder **13** and has an opening **35** through which the rod **23** passes.

The die **11** is mounted at a midregion of the frame **10** by being detachably connected to a head **36** secured to the frame **10** by welding or the like.

The end of the mandrel **16** remote from the plug **17** is joined in a pivotal connection **37** to a short rod **38** secured to a piston **39** slidably mounted in a double-acting fluid-pressure cylinder **40**. The pivotal connection **37** permits the mandrel **16** to be swung upwards to the broken-line position of FIG. 1 for clearing the die **11** so that the workpiece **15** may be slipped on the mandrel. The cylinder **40**, which is relatively short, is secured to one end of the frame by a bracket **40***a*.

The piston **39** and cylinder **40** move the mandrel **16** axially so that the mandrel plug **17** fitting within a reduced end **41** on the workpiece **15** moves the workpiece to bring the reduced end partially through the die **11** so that it can be engaged by the gripper **14**. When the gripper first engages the reduced end **41** of the workpiece **15**, the gripper will be somewhat to the left of its broken-line position of FIG. 1. When there is no workpiece **15** on the mandrel **16**, it rests, as shown in FIG. 1, on a support **41***a* and a roller **41***b* of a support **41***c*, the supports being attached to the upper edges of the member **18**. When the mandrel **16** has received the workpiece **15**, the latter engages the support **41***a* and roller **41***b*.

The piston **39** is moved in one direction or the other in the cylinder **40** by pressure fluid such as oil supplied thereto by lines **42** and **43** connected by a 4-way 3-position valve **44** with pressure and exhaust lines **45** and **46** of a pump **47**. In the position of the valve **44** shown in FIG. 1, the pressure and exhaust lines **45** and **46** of the pump **47** are connected with one another so as to bypass the cylinder **40**, and the piston **39** is held against movement because pressure fluid is neither supplied to nor exhausted from the lines **42** and **43**. When the valve **44** is rotated counterclockwise, from the position of FIG. 1, it connects the left end of the cylinder **40** with the pressure line **45** through the line **42** and the right end of the cylinder with the exhaust line **46** through the line

43, and so the piston 39 moves to the right. When the valve 44 is rotated clockwise from the position of FIG. 1, the right end of the cylinder 40 is connected with the pressure line 45 through the line 43, and the left end of the cylinder is connected with the exhaust line 46 through the line 42; consequently, the piston 39 moves to the left. At the start of a drawing operation, the piston 39 is moved to the right to insert the mandrel plug 17 in the die 11. At the end of a drawing operation, the piston 39 is moved to the left so that the plug 17 clears the die 11 and the mandrel can be swung upwards to the broken-line position of FIG. 1 for the application of a new workpiece to the mandrel or the reapplication of the workpiece just drawn thereto for another drawing operation.

The cylinder 13 is relatively long, being somewhat longer than the portion of the workpiece 15 being subjected to a drawing operation. The cylinder 13, as previously described, is movable along the rod 23 over the stationary piston 12. The cylinder is of the double-acting fluid-pressure type, being supplied at both ends at opposite sides of the piston 12 with pressure fluid such as oil, through lines 48 and 49 connected through a 4-way 3-position valve 50 with pressure and exhaust lines 51 and 52 of a pump 53. The lines 48 and 49 are connected to the lower side of the cylinder 13 near its ends and extend downwardly therefrom through the space formed between the lower edges of the side members 18. In the position of the valve 50 of FIG. 1, the pressure and exhaust lines 51 and 52 are connected with one another so that the pump 53 by-passes the cylinder 13, and the cylinder is held against movement because pressure fluid can neither escape from nor enter the lines 48 and 49. When the valve 50 is rotated counterclockwise from the position of FIG. 1, line 48 is connected with pressure line 51, and line 49 with exhaust line 52, so that the cylinder 13 moves to the left. When the valve 50 is turned clockwise from the position of FIG. 1, line 49 is connected with pressure line 51, and line 48 with exhaust line 52, so that the cylinder 13 moves to the right.

The over-all length of the drawing apparatus, i.e., of the frame 10, is only a little more than twice that of the workpiece 15. This saving in length is made possible, because the movable cylinder 13 carries at one end the workpiece gripper 14 and is in side-by-side coextensive relationship with the workpiece 15. Stated in another way, the gripper 14 is attached to that end of the cylinder 13 which is displaced from the other end in the same direction the gripper moves in going away from the die 11. Thus, as seen in FIG. 1, the gripper 14 moves to the right away from the die 11, and the gripper is attached at the right end of the cylinder 13.

The apparatus of the present invention may be used to draw tubes or rods of steel, zirconium alloys, copper alloys, and aluminum alloys to reduce the diameter of the rods or tubes in one or a number of passes.

It is also understood that the invention is not to be limited by the details given herein but that it may be modified within the scope of the appended claim.

What is claimed is:

Apparatus for drawing a tube of a given length, comprising a frame approximately twice as long as the tube, a die mounted on the frame approximately at its center, a rod extending the length of the frame and having its ends fixed thereto, a single piston fixed to the rod approximately at its center, a single fluid-pressure cylinder embracing the piston and extending lengthwise of the rod, the cylinder being long enough to contain about half the length of the rod, a pair of opposed longitudinal ways secured to the frame and extending substantially the entire length thereof, a pair of opposed shoes secured to the cylinder and extending substantially the entire length thereof, the shoes slidably engaging the ways for supporting the cylinder on the frame, a gripper for the tube shiftable in a certain direction lengthwise of the rod and cylinder from a position of adjacency to the die to a position of remoteness from the die, for pulling the tube through the die, the gripper also being shiftable in the opposite direction from the position of remoteness to the position of adjacency, means fixing the gripper only to that end of the cylinder which is spaced from the other end of the cylinder in the said certain direction, means for supplying pressure fluid to the cylinder to shift the same and the gripper in the said certain direction and the opposite direction, and a mandrel having a free end adjacent the die and the opposite end connected to an end of the frame, the mandrel extending in the said opposite direction from the said free end to the said opposite end, the mandrel being about half as long as the frame and supporting the tube during its passage through the die.

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