Sept. 18, 1923. 1,468,507

N. T. McKEE

SWAGING MACHINE

Filed Feb. 8, 1922 5 Sheets-Sheet 1

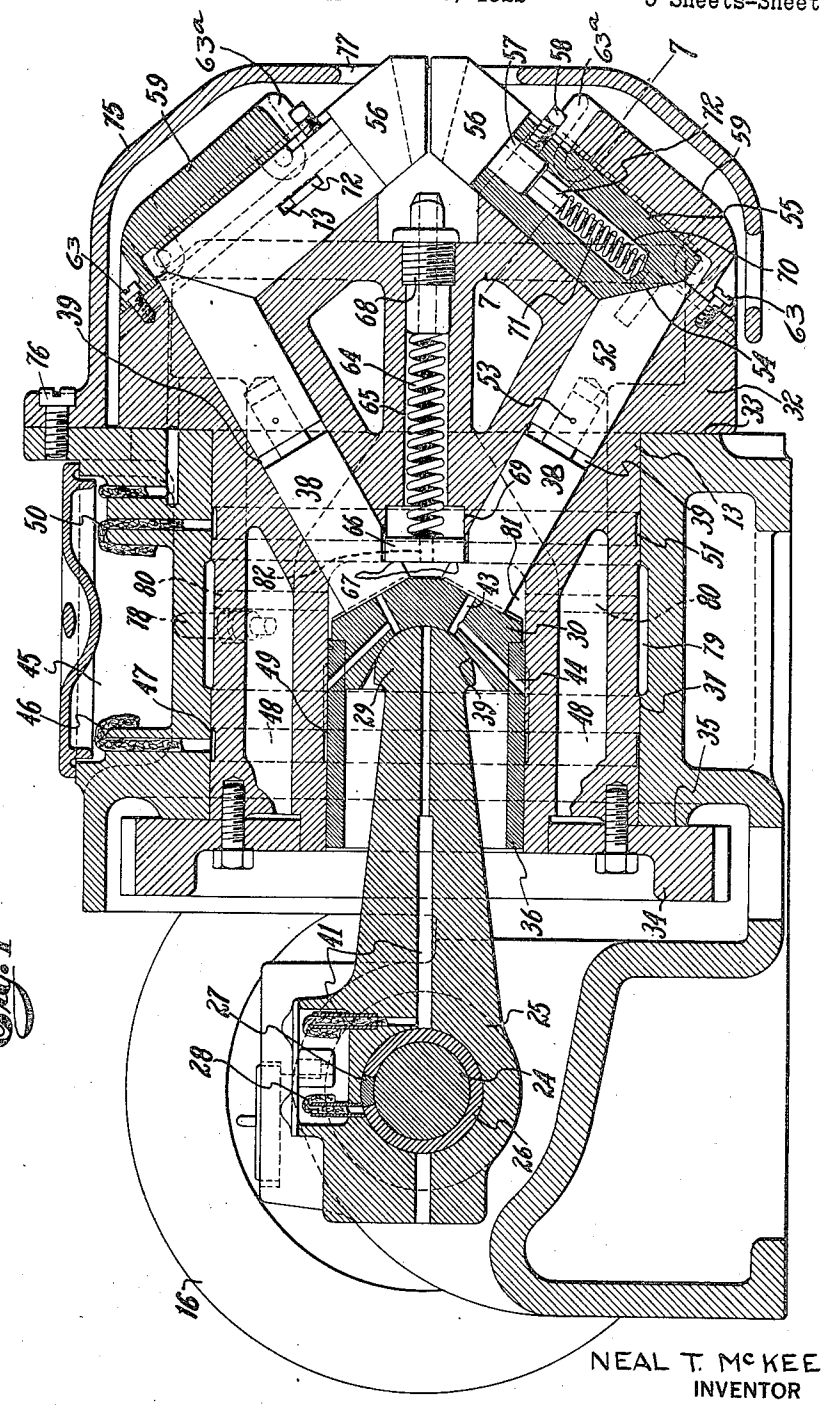


Fig. 1

NEAL T. McKEE
INVENTOR

BY O. V. Thiele

his ATTORNEY

Sept. 18, 1923. 1,468,507

N. T. McKEE

SWAGING MACHINE

Filed Feb. 8. 1922 5 Sheets-Sheet 2

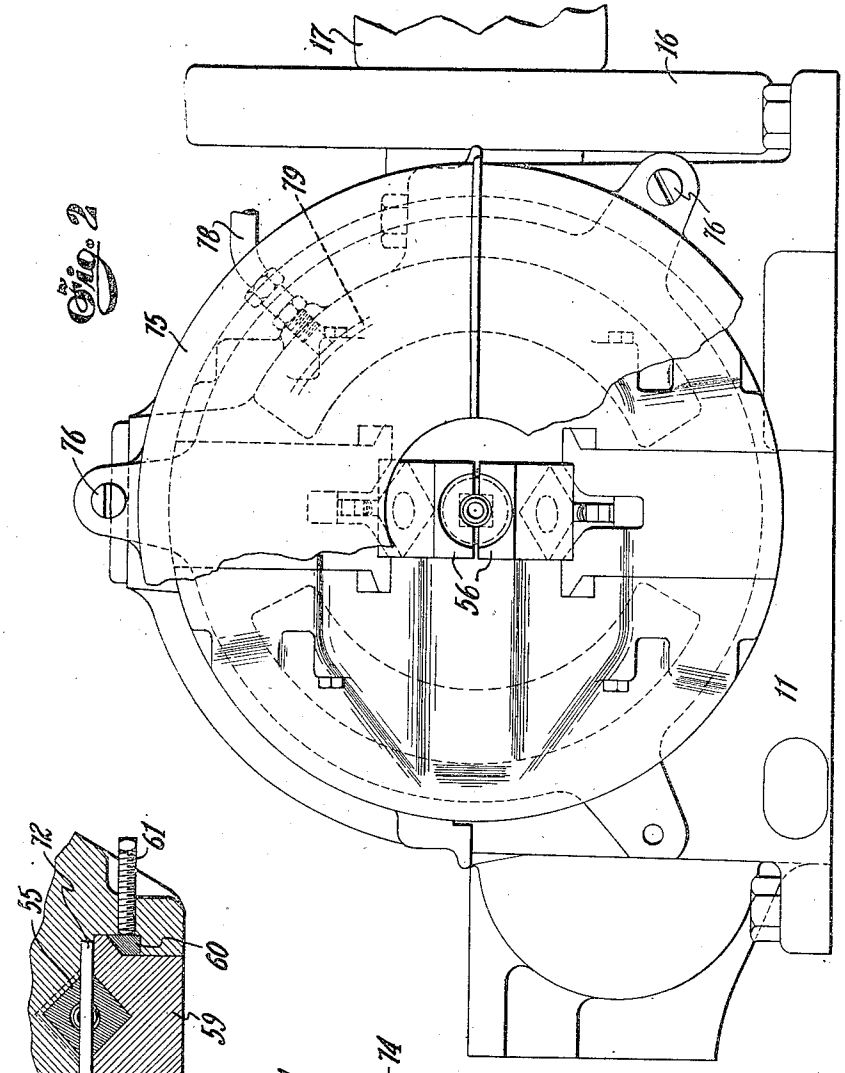


Fig. 2

Fig. 7

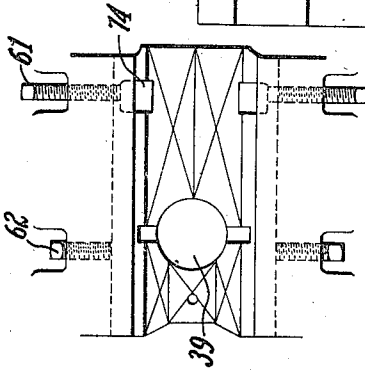


Fig. 8

NEAL T. McKEE
INVENTOR

BY O. V. Thiele
his ATTORNEY

Sept. 18, 1923. 1,468,507

N. T. McKEE

SWAGING MACHINE

Filed Feb. 8, 1922 5 Sheets-Sheet 3

Fig. 3

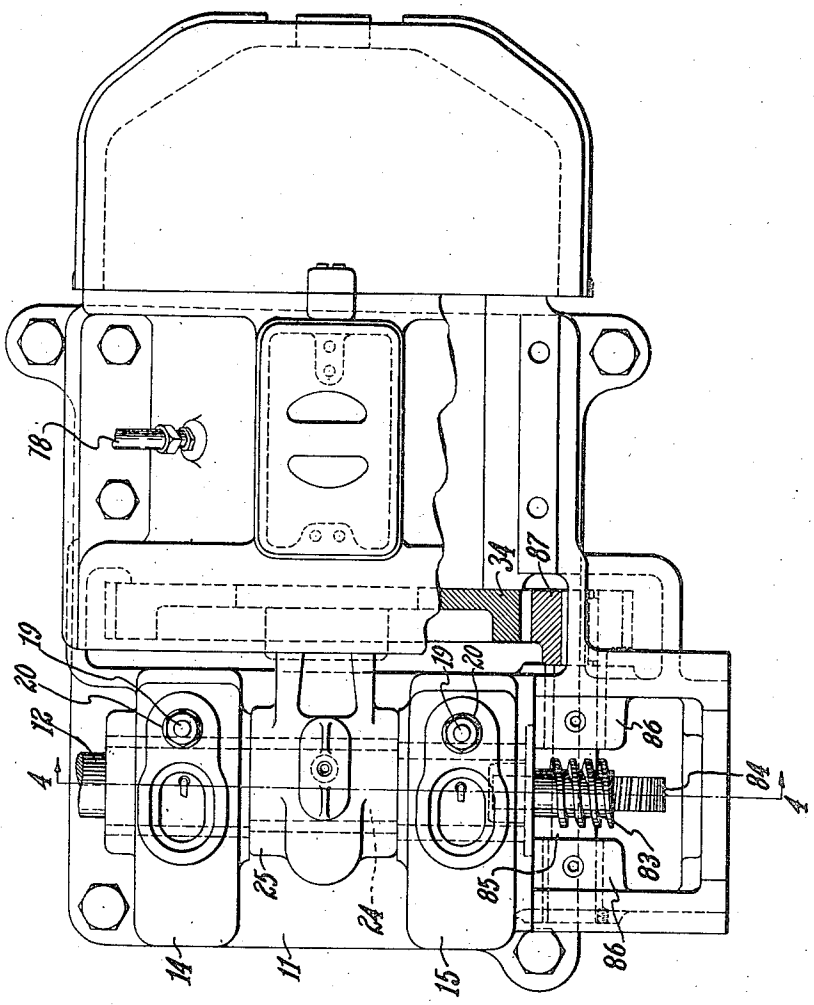
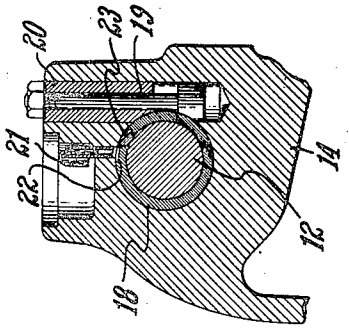


Fig. 9



NEAL T. McKEE
INVENTOR

BY O. V. Thiele

his ATTORNEY

Sept. 18, 1923. 1,468,507

N. T. McKEE

SWAGING MACHINE

Filed Feb. 8, 1922 5 Sheets-Sheet 4

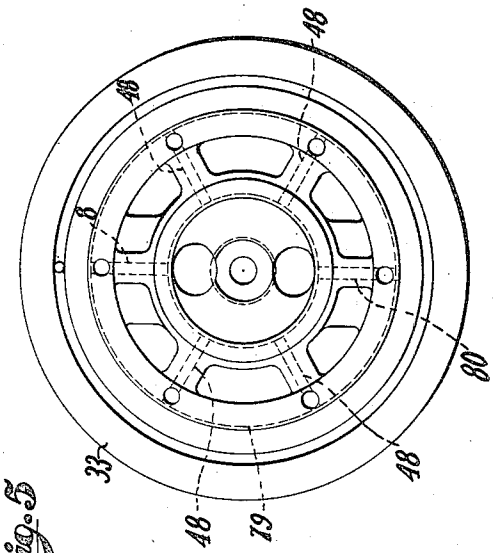


Fig. 5

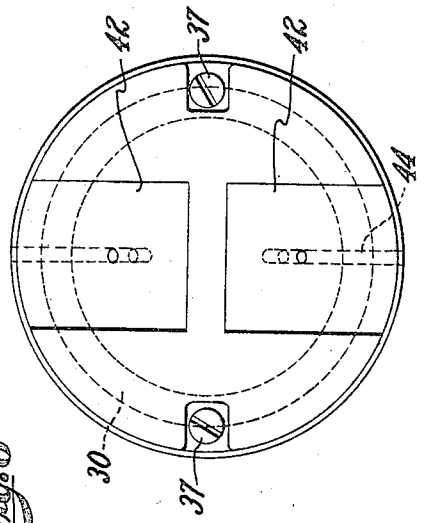


Fig. 6

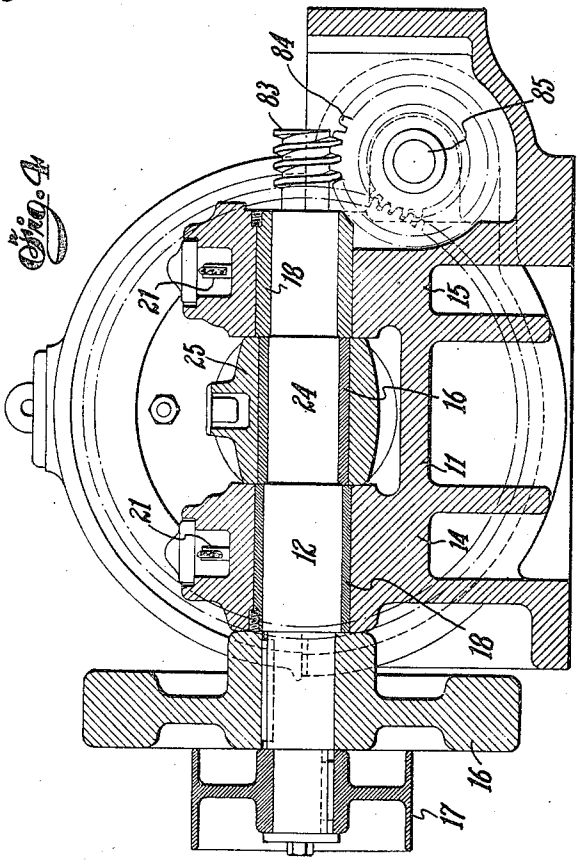


Fig. 4

NEAL T. McKEE
INVENTOR

BY O. V. Thiele
his ATTORNEY

Sept. 18, 1923.

1,468,507

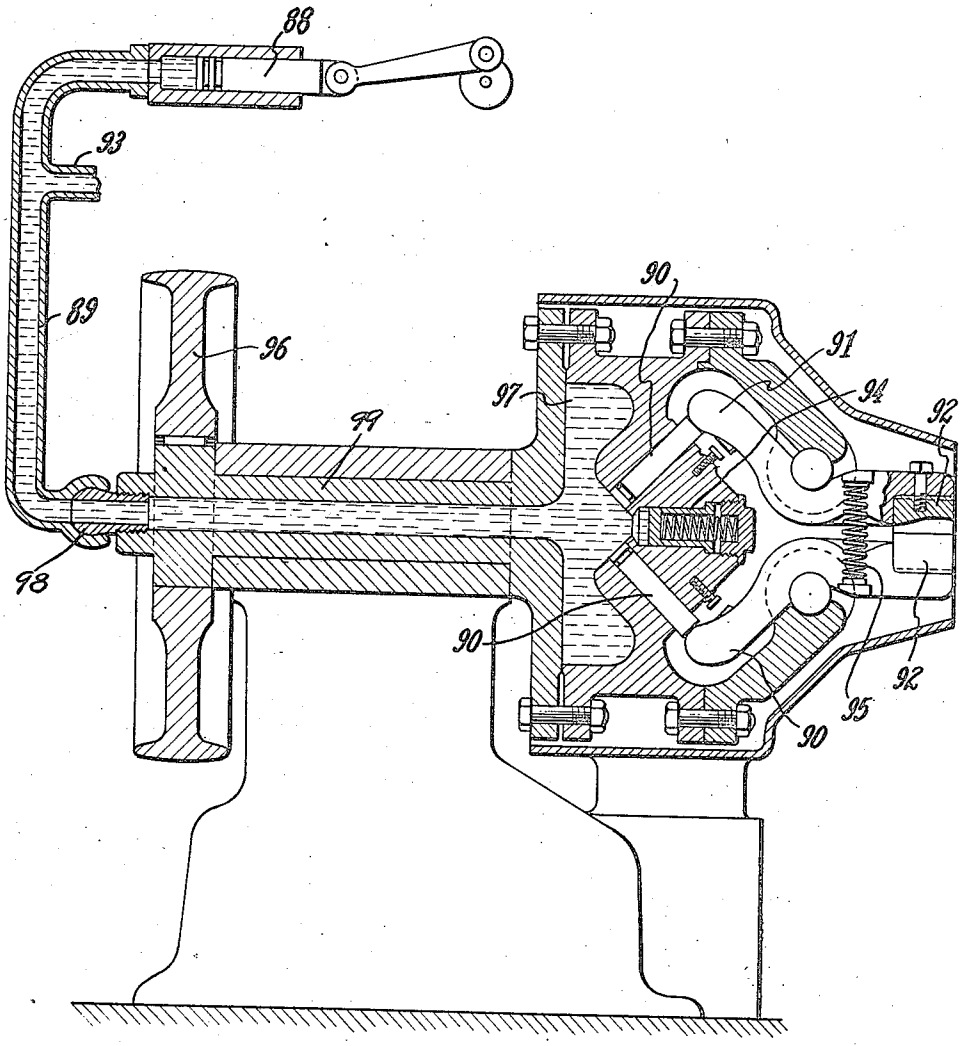
N. T. McKEE

SWAGING MACHINE

Filed Feb. 8. 1922

5 Sheets-Sheet 5

Fig. 10



NEAL T. McKEE
INVENTOR

BY O. V. Riele

his ATTORNEY

Patented Sept. 18, 1923. 1,468,507

UNITED STATES PATENT OFFICE.

NEAL TRIMBLE McKEE, OF LONDON, ENGLAND, ASSIGNOR TO SUPERHEATER COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

SWAGING MACHINE.

Application filed February 8, 1922. Serial No. 535,019.

To all whom it may concern:

Be it known that I, NEAL TRIMBLE McKEE, a citizen of the United States, residing at 195 Strand, London, W. C. 1, England, have invented certain new and useful Improvements in Swaging Machines, of which the following is a specification.

This invention relates to improvements in methods of and means for working metals. More particularly, the invention relates to the forging of metals.

The invention comprises a method of forging or working metals which consists in operating upon the work-piece by transversely reciprocating dies and rotating or reciprocating said dies about the work-piece.

The invention also comprises a method for forging or working metals which consists in operating upon the work-piece by reciprocating dies acting obliquely to the axis of the work-piece.

According to the invention the work-piece is fed between transversely reciprocating dies, means being provided whereby said dies may be completely rotated or reciprocated about the longitudinal axis of the work-piece.

The dies may operate at right angles to the longitudinal axis of the work-piece or at some other angle thereto.

The dies may be carried in a die head which is mounted so as to be capable of rotary or reciprocatory motion.

The dies may be mounted on levers or members, longitudinal or pivotal movements of which cause a transverse reciprocation of the dies.

The working or inward stroke of the dies may be caused by a pull on the die carrying members or such stroke may be effected by a thrust on said members.

Means may be provided for adjusting the die opening.

When forging articles such as steam superheater elements in which there are provided double flow and return passages or legs, means may be provided for preventing the dies coming into contact with the parts not being worked.

Further features of invention will be hereinafter described.

In the accompanying drawings which illustrate the carrying of the invention into effect according to one form which is more particularly suitable for forging the torpedo or like ends of superheater elements:—

Fig. 1 shows one form of apparatus in sectional elevation;

Fig. 2 an end view looking in the die members;

Fig. 3 is a plan;

Fig. 4 is a sectional elevation on the line 4—4 of Fig. 3 and showing the driving arrangements;

Fig. 5 is an end view of the rotating head with the transmission wheel removed;

Fig. 6 is an end view of a detail;

Fig. 7 is a section taken on the line 7—7 of Fig. 1;

Fig. 8 is a partial view of the seating for the die carrying member;

Fig. 9 is a sectional detail of the arrangement of the shaft bearing;

Fig. 10 shows diagrammatically and in section a modification in which the power is conveyed by means of a fluid.

Referring now to Figs. 1 to 9, 11 is the main casting or base plate of the machine and is provided with bearings for the power shaft 12 and the die head 13. The bearing for the power shaft is formed in two parts, 14 and 15, arranged on either side of the longitudinal axis of the machine, i. e., the axis of rotation of the die head 13. The power shaft is provided with a flywheel 16 and a belt pulley 17 whereby it may be driven. Bushes 18 are provided for the power shaft which are locked in position by the bolts 19 and sleeves 20. Lubricant is fed to the bearings by a wick 21, groove 22 and felt pad 23.

The central part 24 of the power shaft is formed eccentric and mounted upon such eccentric part is the pitman or reciprocating member 25. A bush 26 having an oiling pad 27 fed by a wick 28 is provided, the bush being prevented from rotating by means of a suitable set screw holding it fast in the pitman.

The pitman 25 is provided with a spherical end 29 contacting with a pad member 30 for a purpose hereinafter referred to.

The die head 13 is adapted to rotate in the bearing 31 and is provided with an enlarged part 32 outside the bearing so that a bearing surface 33 is formed which contacts with a seating on the bed plate 11. A gear wheel 34 is attached to the die head 13 and such

wheel is adapted to seat against the surface 35 of the bed plate 11 whereby longitudinal movement of the die head is prevented. Concentric with the bearing surface the die head is bored out to accommodate the sleeve 36 which is adapted to slide longitudinally within such boring. The sleeve is mounted on the pad number 30 and is connected thereto by screws 37 (Fig. 6).

The pad member is adapted to contact with and transmit the reciprocations of the pitman 25 to the rear or intermediate reciprocating members 38 which are mounted to slide in bores 39 in the die head 11, such bores being inclined to the longitudinal axis of the machine.

The pad is provided with a seating surface or cavity 39 with which the spherical end 29 of the pitman 25 contacts. This surface is lubricated by means of the passage 40 in the pitman and the wick 41.

On its other surface, which is of conical form, the pad member 30 is provided with diametrically opposite bearing surfaces 42 with which the rear reciprocating members 38 contact. Lubrication of these bearing surfaces is provided by means of the passages 43 in the pad to which are connected passages 44 passing through the pad and sleeve 36. The lubricant is brought to the passages 44 from the reservoir 45 by means of the wick 46, the groove 47 in the die head, radial passages 48 and groove 49 in the bore in the die head. The passages 43 also supply lubricant to the bearing surface 39. From the reservoir 45 oil is also led by means of a wick 50 to a groove 51 which provides further lubricant for the bearing surfaces 31.

The rear reciprocating members 38 are circular in cross-section and are connected to wedge blocks 52 by means of pins 53, spaces being provided between each part 38 and the part 52 so that for safety purposes it will be understood that the pins 53 may break if necessary and the parts 38 and 52 be forced nearer to one another.

Each wedge block 52 is provided with a bearing surface 54 which contacts with a bearing surface on a reciprocating block 55 which is mounted in the die head. The reciprocating blocks 55 are square in cross-section and are mounted in similar shaped cavities in the die head which cavities are inclined to the longitudinal axis so that the angle between each reciprocating block 55 and its co-operating wedge block 52 is substantially a right angle, as indicated in Figure 1.

The reciprocating blocks 55 carry the die pieces 56 each of which is provided with a stem 57 engaging in a cavity in the bearing block and held therein by means of a set screw 58.

Referring to Fig. 7, the bearing block 55 is arranged so that two of its faces enclosing an angle are guided by guiding surfaces in the die head while the other two faces are guided by guiding surfaces in a cap member 59. The cap member is held in position in an undercut groove in the die head by wedge strips 60 and adjusting set screws 61 and 62. The caps are held in place by screws, one of which shows at 63 for each cap. The caps are cut away at 63^a to allow for the set screws 58.

In order to return the rear reciprocating block and wedge blocks after a forward thrust of the pitman a spring 64 is provided and is located in an axial cavity 65 in the die head. The spring presses a collar or disc 66 into contact with surface 67 on the reciprocating blocks 38. The other end of the spring abuts against a nozzle 68 screwed into the die head. On a forward movement of the pitman the collar 66 is pressed into the recess 69 in the die head.

For the purpose of returning the reciprocating blocks 55 carrying the die pieces each block is provided with a recess 70 accommodating a spring 71 which bears against a bar 72 passing through a slot 73 in the reciprocating block 55 and held rigidly in recesses 74 in the die head (see Figs. 1, 7, and 8).

A guard member 75 is provided and is mounted upon the bed plate 11 by means of screws 76. The guard member is provided with an orifice through which the device to be forged may be presented to the dies 56. The guard member is for the purpose of preventing parts of the work not to be operated upon from coming into contact with the dies or die head.

The nozzle 68 is provided with a central bore 77 through which compressed air may be directed on to the work if desired. Such compressed air is led in through a flexible pipe 78 to the circular cavity 79 between the die head and the base plate 11 and thence through passages 80 to the inner space 81 from whence it is able to pass through an aperture 80 in the collar 66 to the bore 65 in the die head into which the nozzle projects.

Referring now to Figs. 3 and 4, the power shaft 15 is provided with a worm 83 engaging a worm wheel 84 mounted upon a countershaft 85 carried in the bearings 86 formed in the bed plate 11. Carried upon the shaft 85 is a pinion 87 which gears with the spurwheel 34 whereby rotational movement is imparted to the die head.

In operation, rotation of the power shaft 15 will cause the pitman to reciprocate by reason of the eccentric 24. Such reciprocations will cause longitudinal movements of the pad 30 and sleeve 36 in the die head which movements are transmitted to the members 38 and 52 which in turn, by means

of their wedge-shaped ends, will cause a longitudinal movement of the die carrying members 55.

At the same time, the rotation of the shaft 15 by means of the worm and worm wheel 83 and 84 will rotate the countershaft at a reduced speed and thus cause a slow revolution of the die head by the spur gearing 87 and 34.

The return or non-working stroke of the reciprocating elements will be caused by the springs 64 and 71 which keep the elements in contact and thus avoid a jarring action.

Should adjustment of the dies 56 be necessary this may be effected in any convenient way as, for instance, by inserting packing between the die and the member 55.

In some cases it may be desirable to reciprocate the die head instead of rotating it. Such reciprocation may be effected in any convenient way.

Further, although a pair of dies arranged at diametrically opposite points has been described, it is obvious that three dies or any other suitable number may be provided.

If desired, means may be provided for feeding the workpiece up to the dies.

In the form of apparatus illustrated it is to be observed that the dies operate upon the workpiece at an angle to the longitudinal axis thereof. This is of importance when forging articles such as superheater elements having return bends in which case the blow of the dies is effective both on the longitudinal part of the workpiece and also on the end thereof.

In the form of apparatus indicated diagrammatically in Fig. 10 the working effort is transmitted to the reciprocating member by means of a fluid such as oil. As indicated in the figure, a piston device 88 is provided and pulsations are transmitted by means of the oil in the conduit 89 and in the chamber 97 in the die head to the reciprocating members 90 which in turn transmit the effort to the pivoted levers 91 carrying the die pieces 92. The conduit 89 is provided with a branch 93 leading to a reservoir or make-up device. A safety member 94 is provided in the die head. Springs 95 are provided to return the dies to the old position after the working stroke. Rotation of the die head is effected by the wheel 96, a coupling 98 being provided between the conduit 89 and the shaft 99 carrying the wheel 96 and die head.

What I claim is:—

1. In apparatus of the class described, the combination of a die head having a longitudinal axis, the head having two bores diverging from one point in the axis and two other bores intersecting them and converging from the intersections toward another point in the axis and a reciprocable member in each bore; each pair of members meeting at the said two intersections engaging along a plane forming an acute angle with each of the two bores.

2. In apparatus of the class described, the combination of a die head having a longitudinal axis, the head having two bores diverging from one point in the axis and two other bores intersecting them and converging from the intersections toward another point in the axis, a reciprocable member in each bore; each pair of members meeting at the said two intersections engaging along a plane forming an acute angle with each of the two bores; means to reciprocate one pair of diverging members; and means tending to keep the other pair of members in a position away from the axis.

3. In apparatus of the class described, the combination of a die head having a longitudinal axis, the head having two bores diverging from one point in the axis and two other bores intersecting them and converging from the intersections toward another point in the axis, a reciprocable member in each bore; each pair of members meeting at the said two intersections engaging along a plane forming an acute angle with each of the two bores; means to reciprocate one pair of diverging members; and yielding means keeping the members in contact at the intersections.

4. In apparatus of the class described, the combination of a die head having a longitudinal axis, the head having two bores diverging from one point in the axis and two other bores intersecting them and converging from the intersections toward another point in the axis, a reciprocable member in each bore; each pair of members meeting at the said two intersections engaging along a plane forming an acute angle with each of the two bores; dies secured to one pair of members at the end adjacent to the axis; means to reciprocate the other pair of members in unison, whereby the die-carrying pair is forced periodically toward the axis; and resilient means tending to keep the die carrying pair in a position away from the axis.

5. In apparatus of the class described, the combination of a die head having a longitudinal axis, the head having two bores diverging from one point in the axis and two other bores intersecting them and converging from the intersections toward another point in the axis, a reciprocable member in each bore; each pair of members meeting at the said two intersections engaging along a plane forming an acute angle with each of the two bores; dies secured to one pair of members at the end adjacent to the axis; means periodically to force the second pair of members in unison in a direction away from the axis; resilient means tending to return said second pair toward the axis;

whereby the die-carrying pair is forced periodically toward the axis; and resilient means tending to keep the die-carrying pair away from the axis.

6. In apparatus of the class described, the combination of a die head having a longitudinal axis, the head having two bores diverging from one point in the axis and two other bores intersecting them and converging from the intersections toward another point in the axis, a reciprocable member in each bore; each pair of members meeting at the said two intersections engaging along a plane forming an acute angle with each of the two bores; a pad reciprocating along the axis adjacent to the ends of one pair of members; resilient means keeping the members in engagement with the pad; and other resilient means to keep the second pair of members in engagement with the first.

7. In apparatus of the class described, the combination of a die head having a longitudinal axis, the head having two bores diverging from one point in the axis and two other bores intersecting them and converging from the intersections toward another point in the axis; a reciprocable member in each bore; each of the members meeting at the said two intersections engaging along a plane forming an acute angle with each of the two bores; and means to rotate the head about its axis.

NEAL TRIMBLE McKEE.