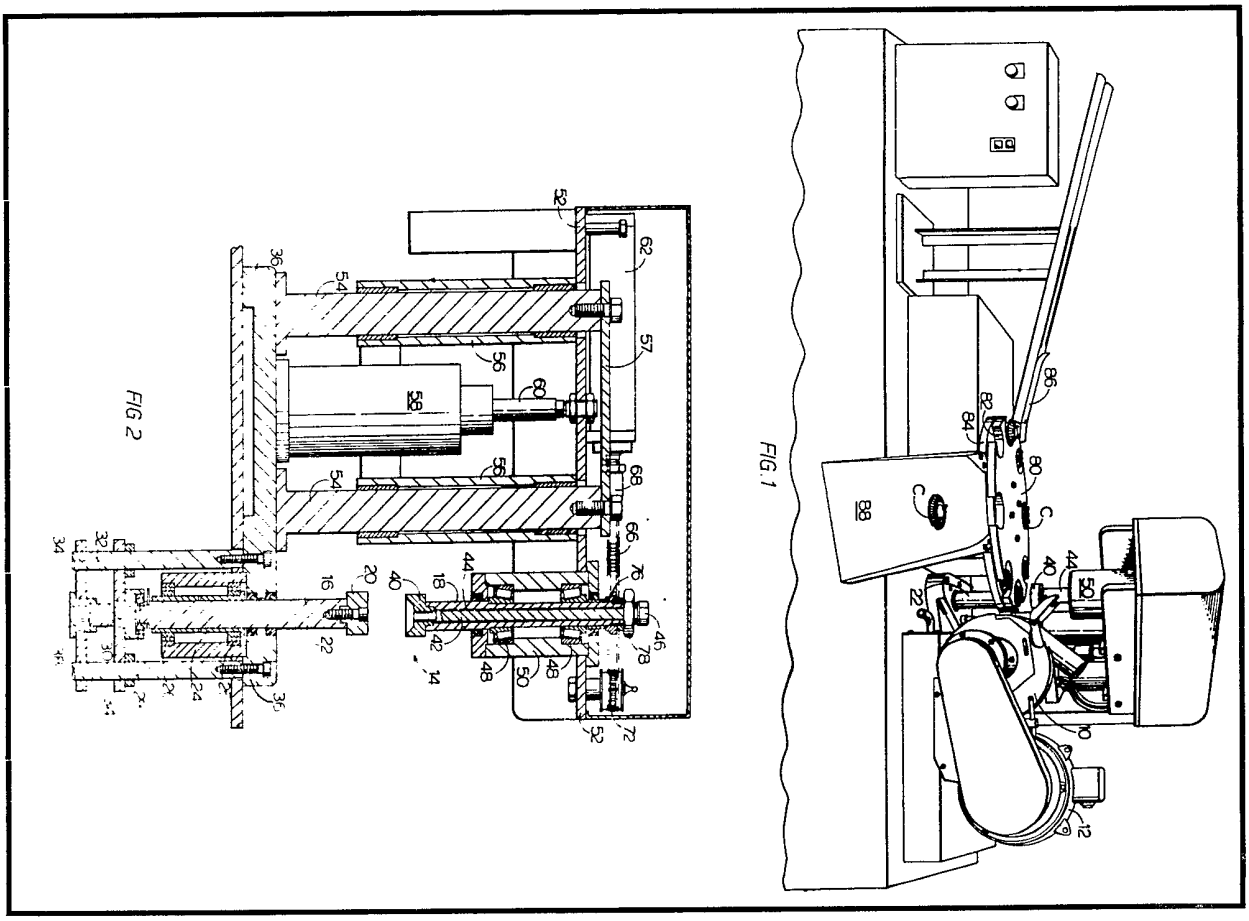
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(71) Applicant
BCIRA
Alvechurch
Birmingham
B48 7QB
(72) Inventor
Ronald George Godding
(74) Agents
Barker Brettell & Duncan

(54) Fettling machine

(57) An automatic machine for fettling circular forgings and castings comprises a carrier 14 arranged to receive a casting from a conveyor 80 and to present it to a guarded grinding wheel 10, with the carrier rotating the casting so that the circular flash line is moved across the periphery of the rotation wheel. The carrier comprises a resiliently supported, rotatable, support member 16, and a vertically reciprocable, rotatable, clamp head 18. The clamp head is lowered to clamp a casting against the support member, and further lowered to depress the support member to present the casting to the wheel. The conveyor is in the form of a rotatable disk 80 with peripheral pockets 82, a feed chute 86 supplying castings to the pockets and a delivery chute 88 removing fettled castings.



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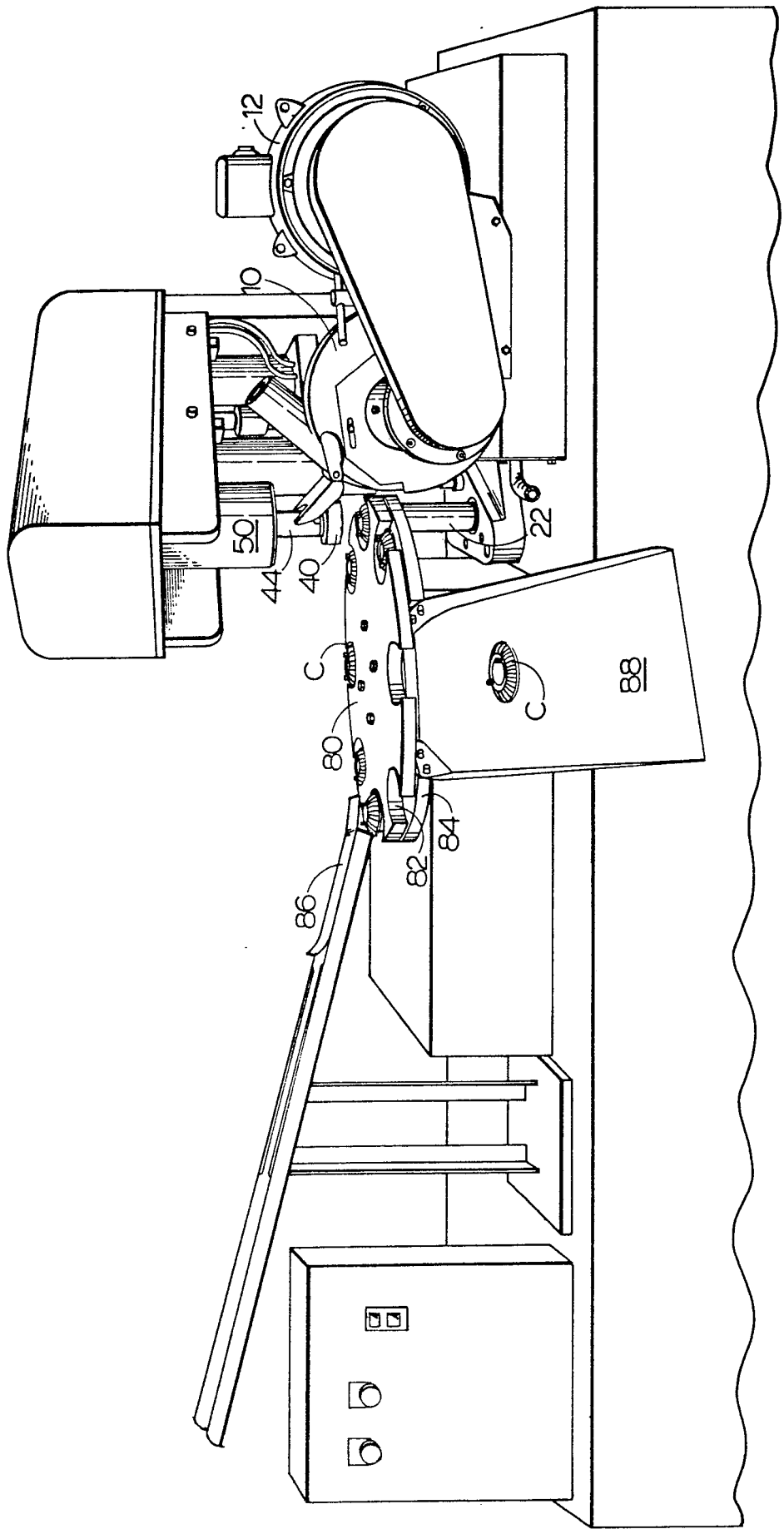


FIG.1.

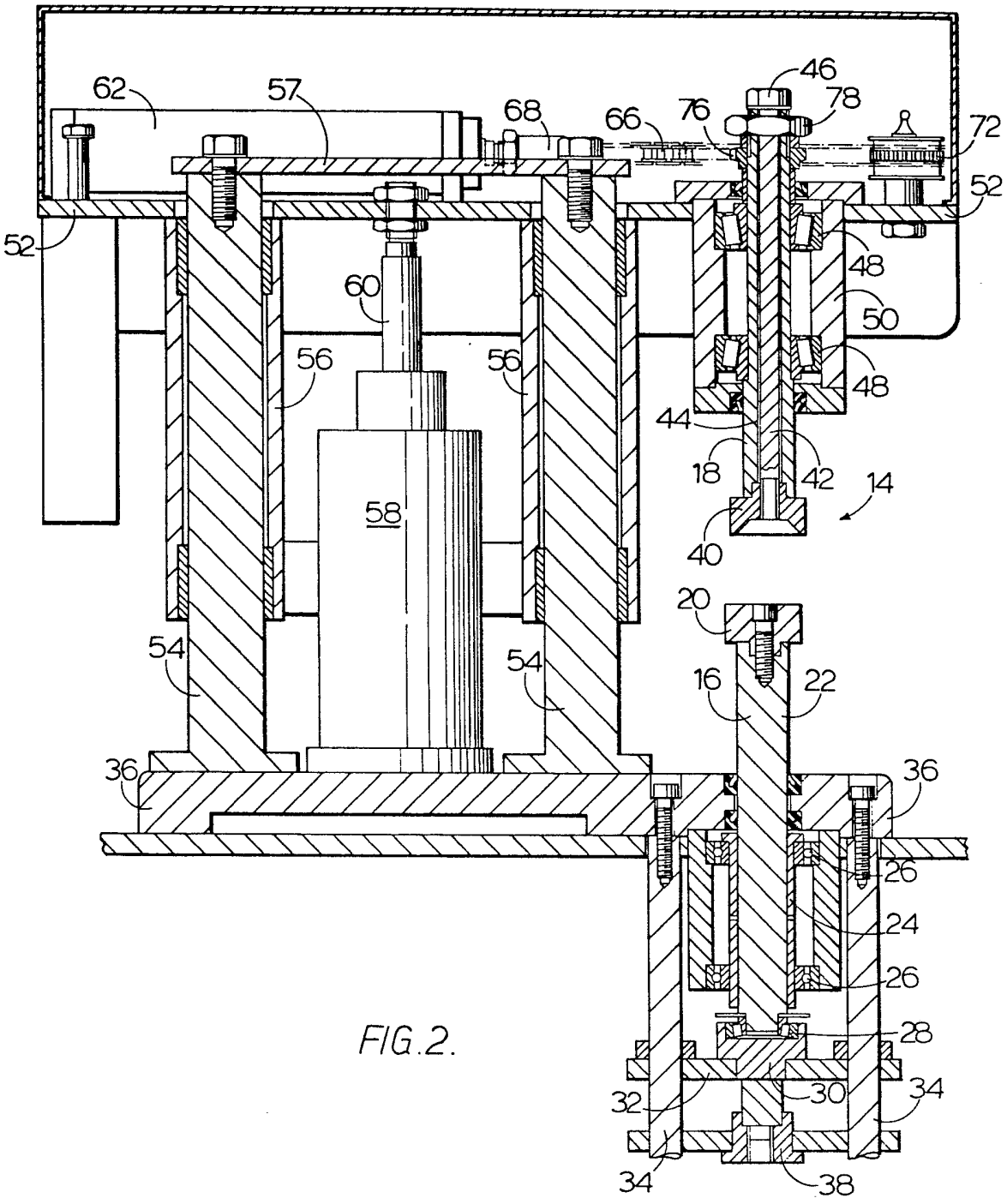

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FIG.2.

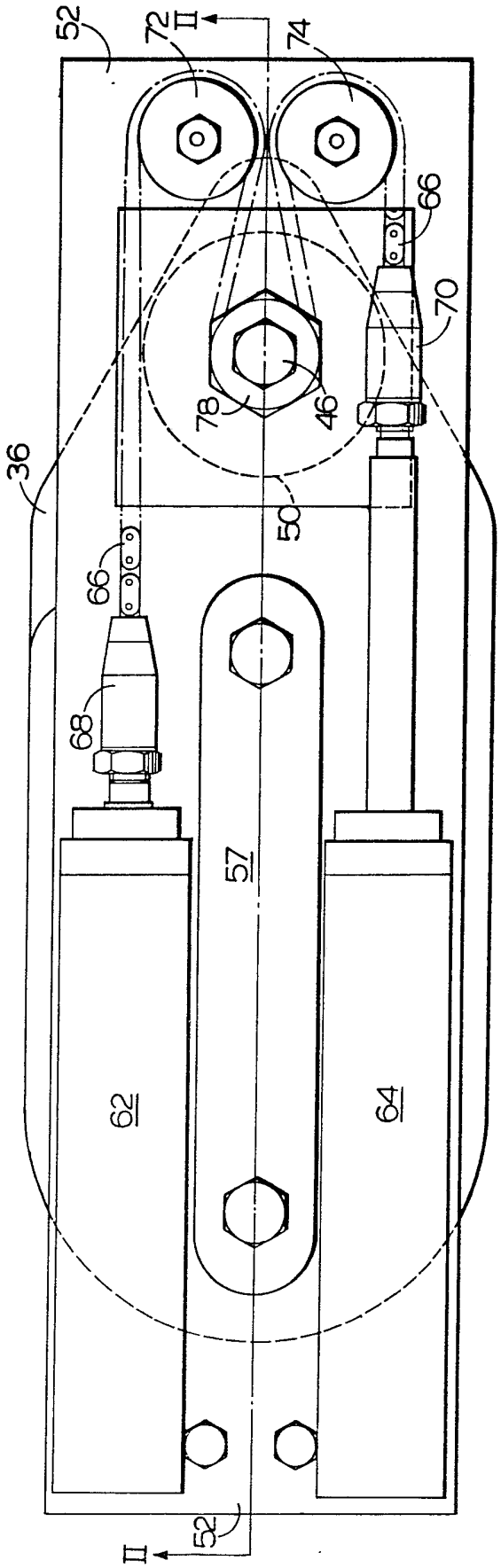


FIG. 3.

SPECIFICATION

Fettling machine

This invention relates to the fettling of manufactured bodies, for example metal forgings and castings.

A very large number of round castings such as gas burner tops, valve seats, water impellers and similar castings are produced and a large proportion of these are fettled by hand grinding. The hand grinding of small bodies is an extremely difficult operation and quite often the fingers of the fettlers have to be individually taped with sticking plaster in order that the work can be carried out. If this precaution is not taken, severe damage can occur to the hands and fingers when such an operation is carried out over a number of years. Gloves are not favoured because of the lack of 'feel' that these introduce.

Producers of castings of this type have endeavoured to use machines which would automatically fettle these types of castings but have generally not adopted those available. Their criticisms include a lack of speed of operation, extremely high fixture costs, a lengthy machine changeover time from one casting to another and inevitably the overall cost of the machine.

A skilled fettler, when obtainable, can handle for example, 800 50 mm burner caps per hour and this is often used as a criterion for judging a fettling machine. This judgement, however, should be tempered by considering the price which is paid for scrap caused through over-grinding, and for the inevitably uneven appearance of the finished casting. This can be extremely important because many of these small castings do not undergo a further machining operation. The 800 pieces per hour is also quite often not a mean throughput but a peak output.

Fixture costs, with the present shortage of skilled tool makers, can be extremely high and fixtures may require renewing at regular intervals. The high speed machines available for use often have a requirement for multiple fixtures, some requiring up to twenty per casting handled.

The invention provides a fettling machine for use in trimming a circular peripheral surface of a body, the machine comprising a rotatable grinding wheel and a carrier arranged to carry a body from a loading position and to present it for trimming to the periphery of the grinding wheel, with the peripheral surface of the body extending transversely of the periphery of the wheel where the wheel and the body make contact, the carrier being arranged for rotation of the body about the axis of the peripheral surface of the body whilst the wheel is rotated about the wheel axis to trim the body. The carrier is preferably arranged to present the body with the axis of rotation of the body extending in a direction perpendicular to the wheel axis, and may be arranged to move the body to a position in which the wheel axis and the peripheral surface of the body lie in a common plane. In a preferred arrangement the carrier is arranged to move the body from the loading position to the wheel along a linear path, being the axis of rotation of the body.

In a preferred machine according to the invention, the carrier comprises a support member and a clamp head arranged to clamp a body in the form of a casting therebetween, the support member and the clamp head being rotatable to rotate the casting about the axis of its peripheral surface. The support member is resiliently supported, and the clamp head is arranged to move towards the support member to clamp the casting against the support member at the loading position, continued movement of the clamp head causing depression of the support member to present the clamped casting to the wheel. The machine comprises means operative to rotate the clamp head to rotate the casting through 375° whilst presented to the grinding wheel. The means operative to rotate the clamp head conveniently comprises two fluid pressure operated cylinders arranged to operate alternately to drive a band along its length alternately in opposite directions, the band passing around a pulley portion of the clamp head. In the preferred machine, the band is in the form of a chain, but could alternatively be in the form of a toothed belt or in other suitable form. The carrier is thus arranged to rotate alternate castings in opposite directions, in presenting a succession of castings to the wheel.

A machine according to the invention may comprise conveyor means arranged to deliver castings successively to the carrier at the loading position. The conveyor means may comprise a turntable and means for rotating the turntable in steps to bring castings successively to the loading position. In one preferred form, there are cut-outs in the turntable which form a plurality of pockets in which castings are retained by a support surface beneath the turntable, the castings sliding over the support surface as the turntable is rotated. A gap in the support surface enables a casting to be moved by the turntable on to the carrier at the loading position. The machine may also comprise means arranged to feed castings into the pockets of the turntable.

There now follows a description, to be read with reference to the accompanying drawings, of a machine which illustrates the invention by way of example.

In the accompanying drawings:

Figure 1 is a view in perspective of the machine;

Figure 2 is a sectional view in elevation, on the line II–II of Fig. 3, of a carrier assembly of

the machine;

Figure 3 is a plan view of the carrier assembly, with a protective cover removed.

The machine is for use in trimming flash from a circular peripheral surface of a casting, and comprises a guarded grinding wheel 10, the wheel being mounted to rotate about a horizontal axis. A motor 12 is arranged to rotate the wheel at a steady speed in a conventional manner. The wheel has an overall diameter, when new, of 200 mm. In Fig. 1, the guarded wheel 10 is shown in a slightly withdrawn, non-operational, position for clarity.

A carrier 14 (Figs. 1 and 2) of the machine is arranged to carry a casting from a loading position and to present it for trimming to the periphery of the grinding wheel. The carrier is arranged to present the casting with the perhipheral surface of the casting extending transversely of the periphery of the wheel, where the wheel and the casting make contact, and to rotate the casting about the axis of the peripheral surface of the casting whilst the wheel is rotated about the wheel axis by the motor 12.

The carrier 14 (Fig. 2) comprises a support member 16 and a clamp head 18 arranged to clamp a casting therebetween, the support member and the clamp head both being vertically reciprocable and rotatable about a common vertical axis.

The support member 16 comprises a table portion 20 which is bolted to the upper end of a vertical shaft 22. The shaft 22 is supported for rotation about its vertical axis, and reciprocation along the axis, in a sleeve 24 which itself is mounted for rotation in ball bearings 26. The shaft 22 can slide vertically through the sleeve 24. The lower end of the shaft 22 is supported for rotation in a roller bearing 28 of a support cup assembly 30. The assembly 30 is mounted on a guide plate 32 which is free to slide along vertical guide bars 34 depending from a base plate 36 of the carrier assembly of the machine. The guide plate 32 and support cup assembly 30 are together secured to an upper end of a piston rod assembly 38 projecting vertically upwardly from an air cylinder (not shown) arranged to act as an air-spring unit. Thus the support member 16 is resiliently supported by the air-spring unit.

The clamp head 18 of the carrier 14 comprises a clamping member 40 which is threadedly mounted on a bottom end portion of a supporting rod 42. The rod 42 extends vertically along the bore of a tubular member 44. A nut 46, threadedly mounted on a top end portion of the rod 42, clamps the assembly of the clamping member 40, the rod 42 and the tubular member 44 together, with the clamping member 40 bearing against a bottom end face of the tubular member 44. The clamping member 40 can thus readily be released, for example for substitution of a different clamping member.

The tubular member 44, and thus the clamp head 18 as a whole, is mounted for rotation about a vertical axis, coaxial with the axis of rotation of the support member 16, in roller bearings 48 mounted in a tubular housing 50. The housing 50 depends vertically downwards from a cantilevered portion of a carrier plate 52 which is mounted to slide vertically along two guide pillars 54 mounted on the base plate 36; bearing sleeves 56 depend vertically downwards from the plate 52 to slide over the pillars 54 for support of the plate 52. A bracing plate 57 connects the upper ends of the pillars 54. A double-acting pneumatic cylinder 58 is mounted on the base plate 36 with its piston rod 60 projecting vertically upwards. The rod 60 is secured to the carrier plate 52, so that the cylinder 58 is arranged to reciprocate the clamp head 18 vertically towards and away from the support member 16.

The carrier assembly comprises means operative to rotate the clamp head 18 alternatively in opposite directions. The means for rotating the clamp head comprises two fluid pressure operated cylinders, in the form of single-acting pneumatic cylinders 62 and 64, arranged to operate alternately to drive a band, in the form of a chain 66, along its length alternately in opposite directions. As shown in Figs. 2 and 3, the cylinders 62 and 64 are arranged horizontally in parallel, mounted on an upper surface of the carrier plate 52. The two ends of the chain 66 are secured to piston rods 68 and 70 of the cylinders. Between the two piston rods, the chain extends around two sprockets 72 and 74, mounted on the carrier plate 52 to be freely rotatable about vertical axes, and around a pulley portion of the clamp head 18. The pulley portion of the clamp headn comprises a sprocket wheel 76 secured by means of a nut 78 on an upper end portion of the tubular member 44. The arrangement is such that, in operation, the clamp head 18 is rotated through 375°, alternately in opposite directions.

The machine comprises also conveyer means arranged to deliver castings successively to the carrier at the loading position. The conveyor means (Fig. 1) comprises a turntable in the form of a horizontal disk 80, and means (not shown, but of a conventional kind) for rotating the disk about its axis in steps. The disc 80 provides a plurality of pockets in the form of peripheral cut-outs 82, and is mounted over a backing plate 84 which provides a support surface for retention of castings within the cut-outs 82. At the loading position a first gap in the backing plate is arranged to allow a casting to be moved by an indexing movement of the disk 80 on to the support member 16 of the carrier 14.

The machine comprises also means, in the form of a feed chute 86, arranged to feed castings into the cut-outs 82 of the disk 80, and a delivery chute 88 by which castings escape from the turntable, through a second gap in the back plate, after being fettled.

Operation of the machine will now be described. With the grinding wheel rotated continuously by the motor 12, castings C are fed down the feed chute 86 to enter the cut-outs 82 in the disk 80, one casting to each cut-out. The disk 80 is rotated clockwise (as viewed from above), in steps, to bring the castings successivley to the loading position, where the support member 16 waits to receive a casting with the clamp head 18 in a raised position as shown in Figs. 1 and 2. After a casting has been thus positioned on the support member 16, the pneumatic cylinder 58 is actuated to lower the carrier plate 52, to bring the clamping member 40 of the clamp head down towards the support member and on to the casting, to clamp the casting against the support member. Then clamping member 40 serves also to centre the casting, so that the axis of the circular peripheral surface to be fettled of the casting is coaxial with the axis of rotation of the carrier. Continued operation of the cylinder 58 causes continued movement of the clamp head and depression of the support member 16, against the resilient action of the air -spring, to present the clamped casting to the rotating grinding wheel.

The axis of rotation of the carrier 14 lies in the vertical plane of the grinding wheel, and the carrier is arranged to move a casting from the loading position to the wheel along a linear path, being the axis of rotation of the carrier and the casting. The carrier thus presents the casting to the wheel with the axis of rotation of the casting extending in a direction perpendicular to the wheel axis, and when the casting is fully presented to the wheel the wheel axis and the peripheral surface of the casting lie in a common, horizontal, plane. When the casting is at the loading position, its flash line (around its peripheral surface) is approximately 25 mm above said horizontal plane, and around 3 mm from the grinding wheel when the wheel is new; this latter distance is due to the curvature of the grinding wheel, and of course increases as the wheel gets smaller due to normal wheel wear.

The support member 16 is depressed until a positive stop is engaged, in which position the casting will be fully presented to the grinding wheel. Upon engagement of the stop, one of the pneumatic cylinders 62 and 64 is actuated to rotate the carrier 14, and so the casting, through 375° so that all flash is removed by the wheel from the peripheral surface of the casting. The pneumatic cylinder 58 is then reversed, to raise the clamp head 18 so that the fettled casting is returned to the loading position by the air-spring under support member. A next indexing movement of the disk 80 serves to remove the fettled casting from the support member and to place a further casting on to the support member. This further casting is then fettled in the same manner as the previous one, except that by actuation of the other of the pneumatic cylinders 62 and 64 it is rotated in the opposite direction during fettling.

Each indexing movement of the disk 80 results in a casting being received into a cut-out 82 from the feed chute 86, a casting being moved on to the carrier and a fettled casting being moved from the carrier, and a fettled casting being delivered to the delivery chute 88, and the machine can thus operate continuously.

Since the unground parts of the castings approach the wheel alternately from opposite directions, wear of the sides of the wheel is evened out, which prevents feather edges developing with the possibility of relatively large pieces of abrasive breaking from the wheel.

There can be automatic or manual feed arrangements for a movable table carrying the grinding wheel, and appropriate dust extraction arrangements of a conventional kind are provided. Rotation of the grinding wheel is vertically upwards at its point of contact with the castings and dust extraction is, therefore, taken from the top of the wheel. Manual adjustment is provided to allow for wheel wear.

The indexing disk 80, with cut-outs 82 for the castings, can handle a limited range of casting sizes. A wide range of castings can be handled if a range of rapidly changeable disks is provided, in conjunction with a range of clamping members to adapt the clamp head to different sizes and shapes of casting.

For certain shapes of castings, for example rather thin and flat castings, centring of a casting by means of the clamp head alone can be unreliable. Accordingly an air jet may be arranged to ensure that a casting moved on to the support member is positioned against stops on the support member, so that the casting is centred on the support member.

CLAIMS

1. A fettling machine for use in trimming a circular peripheral surface of a body, the machine comprising a rotatable grinding wheel and a carrier arranged to carry a body from a loading position and to present it for trimming to the periphery of the grinding wheel, with the peripheral surface of the body extending transversely of the periphery of the wheel where the wheel and the body make contact, the carrier being arranged for rotation of the body about the axis of the peripheral surface of the body whilst the wheel is rotated about the wheel axis to trim the body.

2. A machine according to Claim 1 in which the carrier is arranged to present the body with the axis of rotation of the body extending in a direction perpendicular to the wheel axis.

3. A machine according to Claim 2 in which the carrier is arranged to move the body to a position in which the wheel axis and said peripheral surface lie in a common plane.

4. A machine according to any one of Claims 1 to 3 in which the carrier is arranged to move the body from the loading position to the wheel along a linear path.

5. A machine according to Claim 4 in which the carrier is arranged to move the body along its axis of rotation.

6. A machine according to any one of the preceding Claims in which the carrier is arranged to rotate the body, whilst presented to the wheel, through 375°.

7. A machine according to any one of the preceding Claims in which, in presenting a succession of bodies to the wheel, the carrier is arranged to rotate alternate bodies in opposite directions.

8. A machine according to any one of the preceding Claims in which said carrier comprises a support member and a clamp head arranged to clamp a body therebetween, the support member and the clamp head being rotatable to rotate the body about the axis of its peripheral surface.

9. A machine according to Claim 8 in which the support member is resiliently supported, and the clamp head is arranged to move towards the support member to clamp the body against the support member at the loading position, continued movement of the clamp head causing depression of the support member to present the clamped body to the wheel.

10. A machine according to either one of Claims 8 and 9 comprising means operative to rotate the clamp head to rotate the body.

11. A machine according to Claim 10 in which said means operative to rotate the clamp head comprises two fluid pressure operated cylinders arranged to operate alternately to drive a band along its length alternately in opposite directions, said band passing around a pulley portion of the clamp head.

12. A machine according to any one of the preceding Claims comprising conveyor means arranged to deliver bodies successively to the carrier at the loading position.

13. A machine according to Claim 12 in which said conveyor means comprises a turntable and means for rotating the turntable in steps to bring bodies successively to the loading position.

14. A machine according to Claim 13 in which said turntable provides a plurality of pockets in which bodies are retained by a support surface beneath the turntable, the bodies sliding over the support surface as the turntable is rotated.

15. A machine according to Claim 14 in which a gap in the support surface enables a body to be moved by the turntable on to the carrier at the loading position.

16. A machine according to Claim 15 comprising means arranged to feed bodies into the pockets of the turn-table.

17. A fettling machine, for use in trimming a circular peripheral surface of a body, substantially as hereinbefore described with reference to the accompanying drawings.

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