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APPARATUS FOR SPRAYING OR SQUIRTING METAL

Filed Jan. 20, 1934

2 Sheets-Sheet 1

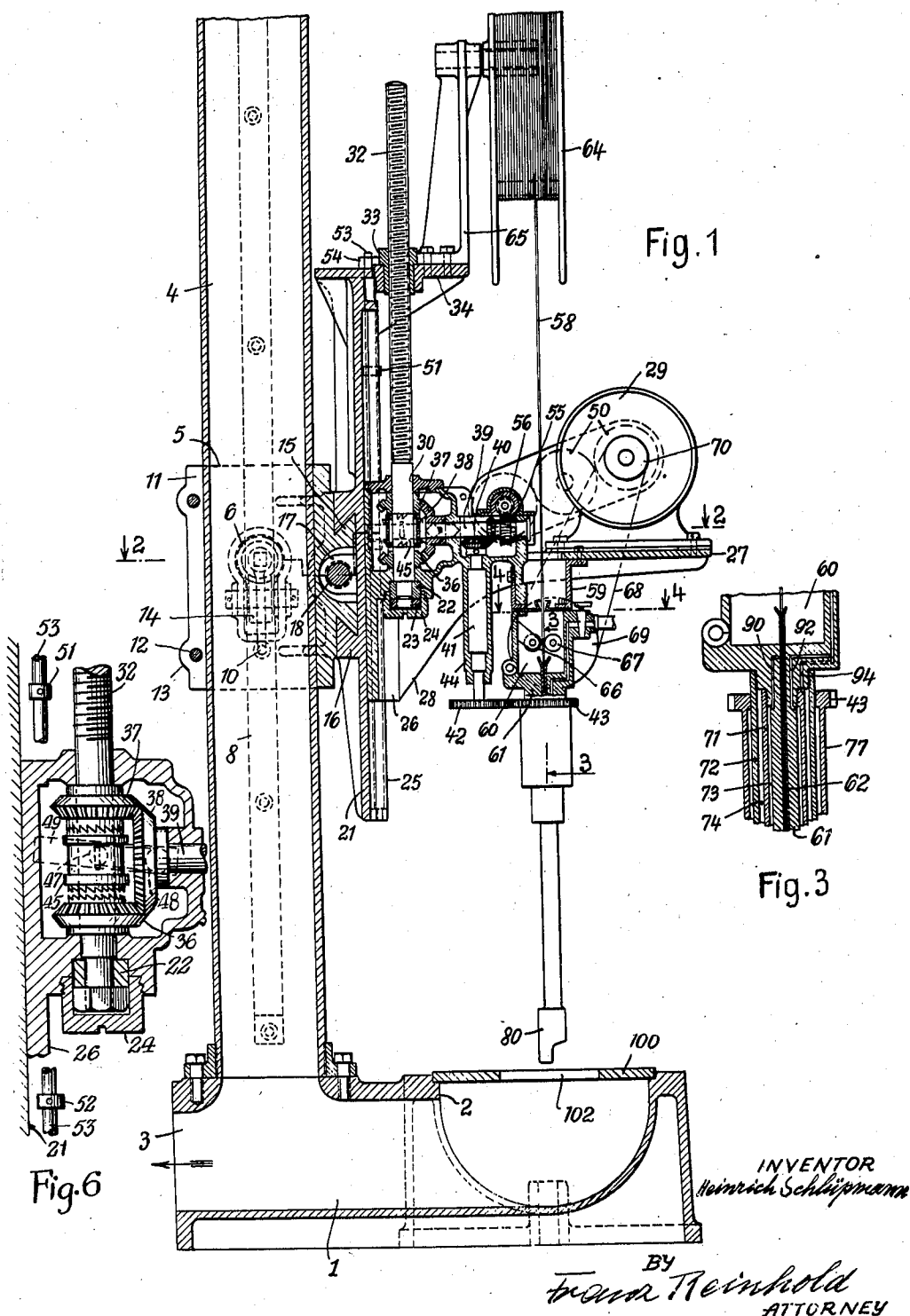


Fig. 1

Fig. 3

Fig. 6

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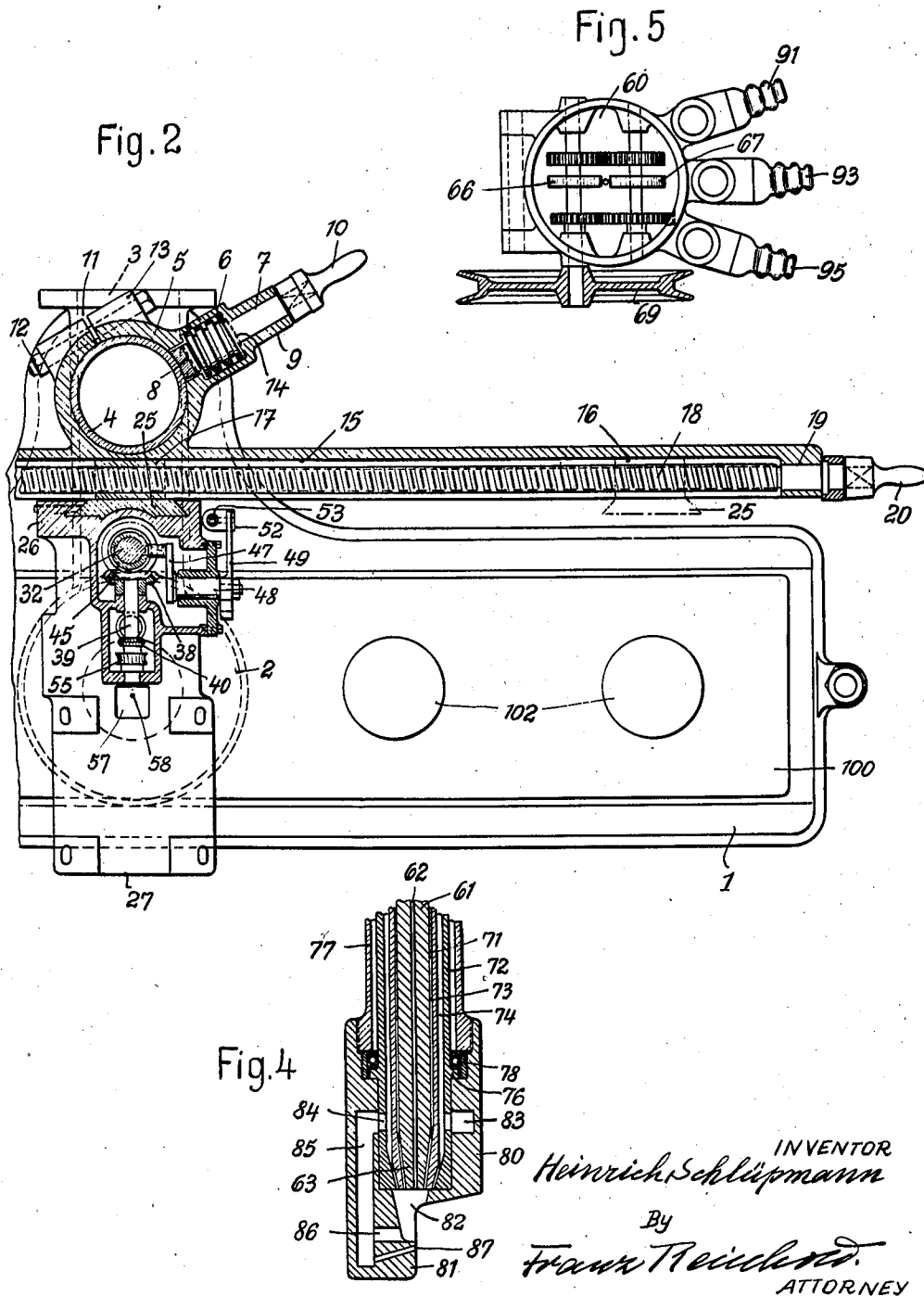
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UNITED STATES PATENT OFFICE

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APPARATUS FOR SPRAYING OR SQUIRTING METAL

Heinrich Schlüpmann, Berlin-Niederschön-
weide, GermanyApplication January 20, 1934, Serial No. 707,521
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5 Claims. (Cl. 91—12.2)

My invention relates to improvements in apparatus for spraying or squirting metal, and more particularly in apparatus for applying a thin coating of metal to objects for preventing corrosion. In recent years it has been suggested to apply a thin coating of steel to elements made from light metal such for example as the sliding surfaces of cylinders and pistons, and for such work hand operating spraying or squirting apparatus have been found to be unsatisfactory. The object of the improvements is to provide a spraying or squirting apparatus in which the squirting device is automatically moved relatively to the object to be coated with metal.

Other objects of the improvements will appear from the following description.

For the purpose of explaining the invention an example embodying the same has been shown in the accompanying drawings in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings,

Fig. 1 is a sectional elevation of the apparatus,
Fig. 2 is a sectional plan view taken on the line 2—2 of Fig. 1,

Fig. 3 is a sectional elevation on an enlarged scale taken on the line 3—3 of Fig. 1 and showing the top part of the squirting device,

Fig. 4 is a fragmentary sectional elevation on an enlarged scale and on the same plane of section, showing the delivery end of the squirting device, and

Fig. 5 is a sectional plan view on an enlarged scale taken on the line 4—4 of Fig. 1.

Fig. 6 is a fragmentary view in vertical section, showing to larger scale a portion of the apparatus as seen in Fig. 1.

In the examples shown in the drawings the machine comprises a base 1 which preferably is made hollow, and which is formed with a horizontally disposed work-supporting plate penetrated by one or more holes 2 and adapted to have the objects to be coated placed thereon. Ordinarily the said objects, for example cylinders, are hollow, and they are placed with their axis or axes vertically on the base 1 and surrounding the holes 2 thereof. The base 1 is formed at one side with an opening 3 which may be connected with an exhauster for drawing air through the object or objects placed on the hole or holes 2. Thus the gas and metal dust developed within the object or objects is withdrawn, so that it may not injure the health of the workmen.

On the base 1 a pillar 4 is mounted on which the spraying or squirting mechanism is verti-

cally movable. As shown the said spraying or squirting mechanism is supported on a tubular slide 5 which is adapted to be raised or lowered on the pillar 4 and to be held in position thereon by suitable mechanism. The said mechanism 5 comprises a worm gearing consisting of a worm 6 secured to a worm shaft 7 and a gear wheel 14 engaged by said worm and engaging a rack 8 fixed to or made integral with the pillar 4. The said worm shaft 7 is mounted in a bearing 9 provided on the slide 5, and it has a crank 10 secured thereto. The slide 5 is slitted longitudinally as is shown at 11 and it is adapted to be clamped in adjusted position on the pillar 4 by means of screws 12 passed through eyes formed on the slide 5.

At its front side the slide 5 is formed with a dove-tailed horizontal guideway 15, on which a slide 16 is movable in horizontal direction. The said slide is connected or made integral with a nut 17 which is engaged by a screw-threaded spindle 18 rotatably mounted in bores 19 made at the ends of the guideway 15, the said spindle 18 carrying a crank 20. The slide 16 is made integral with a plate 21 which is formed with a vertical guideway 25.

On the said guideway a slide 26 is vertically movable and the said slide is formed with a forwardly directed arm or table 27 braced by ribs 28 and having a motor 29 mounted thereon. In bores 30 made in the slide 26 a vertical spindle 32 is mounted, which is screw-threaded at its upper part and which is in engagement with an internally screw-threaded nut 33 secured to a bracket 34 made integral with the plate 21 of the slide 16. Vertical displacement of the spindle relatively to the slide 26 is prevented by means of a ring 22 mounted on the bottom part of the spindle and held in position thereon by means of a nut 23 and a cap screw 24. Thus the slide 26 is moved upwardly or downwardly on the guideway 25 when the spindle 32 is turned to the right or left.

For thus imparting rotary movement to the spindle in either direction the following mechanism is provided: On the bottom part of the spindle 32 two bevel gearings 36 and 37 are rotatable which are engaged by a bevel gearing 38 secured to a shaft 39 mounted in suitable bearings provided on the table 27. At its front end the said shaft 39 carries a worm gearing 55 meshing with a worm 56, and the said worm is connected through the intermediary of gear wheels 58 with the shaft of the motor 29. Between the gear wheels 36 and 37 a coupling sleeve 55

45 is mounted on the spindle 32, which is axially slidable and nonrotatable on the said spindle. The sleeve 45 is formed at either end with coupling teeth adapted for engagement with corresponding teeth formed on the hubs of the bevel gearings 36 and 37. Thus either one of the said gear wheels may be coupled by means of the sleeve 45 with the spindle 32 for turning the same either clockwise or anticlockwise and raising or lowering the slide 26. The said sleeve 45 is adapted to be automatically thrown into engagement with the bevel gearing 36 or 37 when the slide 26 arrives in its upper or lower end position. For this purpose the sleeve 45 is formed with a circumferential groove engaged by a crank arm 47 secured to a shaft 48 mounted on the slide 26. To the shaft 48 and arm 49 is secured which is directed from the shaft 48 rearwardly and into position for engagement with an upper lug 51 and a lower lug 52 vertically adjustable on a rod 53 secured to the bracket 34 at 54.

The table 27 carries the spraying or squirting device. As shown the said squirting device comprises a hollow head 60 which is suspended from the table 27 by means of arms 59. The said head is made integral with a rod 61 which is formed with a longitudinal bore 62, and which has a tapering bottom end 63. Through the said bore a wire 58 of the metal to be squirted is passed downwardly and to the bottom end of the rod 61, the said wire being supplied from a spool 64 mounted on a bracket 65 carried by the bracket 34 and passed through a hole 57 made in the table 27. Within the head 60 a pair of feed rollers 66 and 67 are mounted which are in clamping engagement with the wire 58, and the roller 66 is connected by a rope 68 and pulleys 69 and 70 with the shaft of the motor 29. Thus the wire is positively fed to the squirting device.

To the rod 61 two concentric pipes 71 and 72 are secured which extend downwardly therefrom, the rod 61 and the pipe 71 providing an annular passage 73 ending at the bottom end of the rod 61, and the pipes 71 and 72 providing an annular passage 74 which likewise ends at the bottom end of the rod 61. At their bottom ends the passages 73 and 74 taper inwardly. Near its bottom end the pipe 72 is formed with a flange 76, and on the said flange a pipe 77 is supported through the intermediary of an anti-friction bearing 78, the said pipe 77 being guided at its top end on the pipe 72. To the bottom end of the pipe 77 a sleeve or spraying head 80 is secured which is formed at its bottom with an extension 81 having a cavity 82 in front of the delivery ends of the bore 62 and the passages 73 and 74, the said cavity opening laterally so as to direct the gases and the molten metal laterally. The inner walls of the cavity 82 converge in the direction of the advance of a jet of flame from the passages 73 and 74.

Internally of the head 80 there is an annular passage 83 which is connected with the passage 74 through holes 84, and which is connected through a downwardly directed passage 85 with a passage 86 opening through the converging walls of the cavity 82 and into the bottom end of the cavity 82, and with a series of small bores 87 disposed around the said cavity and directed upwardly and towards the axis of the passage 86.

The annular passage 73 is connected at its top by a bore 90 made in the wall of the hollow head 60 with a tubular stud 91 adapted to be connected with a supply of a suitable fuel such as acetylene, and it is also connected through a similar bore

92 with a tubular stud 93 adapted to be connected with a supply of oxygen, and the passage 74 is connected through a bore 94 with a similar tubular stud 95 adapted to be connected with a supply of a compressed incombustible gas such as air. Thus mixture of acetylene and oxygen is delivered through the inner annular passage 73 and around the wire 58 passed through the bore 62, the said mixture being ignited for melting the said wire. Simultaneously compressed air is forced through the passage 74 and delivered around the annular jet of fuel delivered through the bore 73 and the wire. Further, a part of the said compressed air is forced through the annular passage 83 and the passage 85 and it is delivered through the passage 86 into the bottom part of the cavity 82 and through the bores 87 around the said cavity. The jet of burnt fuel and molten metal and compressed air is deflected laterally by the cavity 82 and it is further deflected by the jets of air delivered through the passage 86 and the bores 87. Thus the molten metal is atomized by the air and thrown from the head 80 at an angle of about 90° relatively to the axis thereof. Further, the annular jet of air delivered through the annular passage 74 has a sucking action on the mixture of acetylene and oxygen, which suction prevents backfiring.

The pipe 77 is adapted to be rotated from the motor 29, and for this purpose it carries a spur gear 43 at its top end which is in mesh with a spur gear 42 secured to a vertical shaft 41. The said shaft is guided in a tubular extension 44 extending downwardly from the table 27, and it is operatively connected with the shaft 39 by a bevel gearing 40.

In the operation of the apparatus a plate 100 is placed on the hole 2 of the base 1, which plate is formed with one or more circular holes 102, and the object to be coated such for example as the cylinder of an internal combustion engine is placed on one of the said holes 102. The spraying nozzle is placed concentrically into the said cylinder by shifting the same together with the table 27 and the slide 26 laterally on the guideway 15 by means of the spindle 18 and the crank 20, and further shifting the same in vertical direction by displacing the slide 5 on the pillar 4 by means of the gearing 6, 7, 8, 10. The lugs 51 and 52 are set in position on the rod 53, so that the vertical movement of the slide 26 is reversed in the desired end position corresponding to the height of the cylinder. The wire 58 is passed downwardly through the hole 57 made in the table 27, the head 60 and the bore 62, so that it projects downwardly from the said bore. Air and oxygen are supplied to the spraying nozzle through the tubular studs 91 and 93 and the annular passage 73, and compressed air is supplied through the tubular stud 95 and the annular passage 74, the said compressed air being delivered through the tapering bottom part of the passage 74, the passage 86 and the bores 87. The exhaustor connected with the base 1 is started, so that air is drawn from the said base and through the cylinder placed thereon, so many of the holes 102 as are not in instant use being preferably closed by lids placed thereon. Now the mixture of oxygen and acetylene delivered through the squirting head is ignited so as to melt the bottom end of the wire 58, and the motor 29 is started. Thereby the slide 26, the table 27 and the parts carried thereby are moved in vertical direction, the coupling sleeve 45 being in coupling engagement with one of the bevel gearings 36 or 37. Further, the pipe 77 is rotated

from the motor 29 and the shaft 39 through the intermediary of the bevel gearing 40, the shaft 41 and the spur gears 42 and 43. The wire 58 is gradually advanced by means of the feed rollers 56 and 57 which are driven from the motor 29 through the intermediary of the rope 68. Thus the molten metal which is delivered from the spraying head 80 in lateral direction is atomized and thrown on the cylindrical surface to be coated, while the said head rotates and is gradually shifted upwardly and downwardly, the movement of the slide 26, the table 27 and the squirting device being automatically reversed in the desired end positions by the lugs 51 and 52, the cranks 47, 48, 49 and the coupling sleeve 45.

From the foregoing description it will be understood that the squirting nozzle has exactly regulated rotary and vertical movements imparted thereto by the positive driving mechanisms acting thereon, and that also exact lengths of wire are gradually fed through the bore 62. Therefore exactly regulated amounts of molten metal are thrown on the surface to be coated per unit of surface area, and a coating of the desired thickness is obtained.

As is shown in Fig. 2 the guideway 15 carried by the tubular slide 5 extends laterally to both sides, and the base 1 is likewise extended laterally. The plate 100 is formed with a plurality of holes 102 which are located so that all the cylinders of a multi-cylinder engine may be placed thereon. After one of the cylinders has been coated the squirting device is removed therefrom and shifted laterally on the guideway 15 and brought into position for acting on the next cylinder. But I wish it to be understood that a plurality of squirting devices may be provided on the guideway 15 which may be simultaneously brought into positions for acting on the cylinders. In Fig. 2 I have diagrammatically indicated a second slide 16 and its guideway 25.

Instead of connecting the sucking device with the opening 3 of the base 1, the said sucking device may also be connected with the hollow pillar 4.

It will be understood that the rate of the wire feeding operation may be varied, for example, by providing pulleys 69 and 70 of a different gear ratio. In a similar way the number of revolutions of the squirting device may be varied by providing gear wheels 42, 43 of a different gear ratio.

I claim:

1. An apparatus for coating objects with metal, comprising a base adapted to have a plurality of objects to be coated placed in succession thereon, a pillar rising from said base, a slide shiftable on said pillar and formed with a guideway extending in the direction of a succession of objects placed on said base, a plurality of members shiftable on said guideway into positions near the objects placed on said base, arms borne by and shiftable on said members towards and away from said base, squirting devices mounted on said arms, mechanism on said arms for moving the same on said members towards and away from the base and operating said squirting devices, and means

for shifting said slide on said pillar towards and away from said base.

2. An apparatus for coating objects with metal, comprising a support adapted to have an object to be coated placed thereon, a device for squirting metal mounted on said support and having means for supplying molten metal, positive means for imparting progressive movement and positive means for imparting rotary movement to said squirting device across the surface to be coated, and operating means positively connected both with said metal-supplying means and with the means for imparting progressive movement and the means for imparting rotary movement to the squirting device, for simultaneously moving the same.

3. An apparatus for coating objects with metal comprising a base adapted to have an object to be coated placed thereon, an upright member mounted on said base, a slide mounted on said upright member, a metal-squirting device mounted on said slide in position for squirting metal on the surface of the object placed on said base, a motor, a screw-threaded spindle and its nut adapted when rotated to move said slide on said member, gear wheels intermediate said motor and said screw-threaded spindle for imparting rotary movement thereto, mechanism intermediate said motor and said squirting device for imparting rotary movement thereto, and mechanism for feeding wire to said squirting device.

4. An apparatus for coating objects with metal comprising a base adapted to have an object to be coated placed thereon, an upright member mounted on said base, a slide mounted on said upright member, a metal-squirting device mounted on said slide in position for squirting metal on the surface of the object placed on said base, a screw-threaded spindle and its nut for moving said slide, a beveled driving gear wheel connected with said motor, a pair of driven beveled gear wheels in mesh with said driving gear wheel and adapted to be rotated thereby in opposite directions and mounted on said screw-threaded spindle, and a clutch adapted selectively to connect said driven gear wheels with said spindle.

5. An apparatus for coating objects with metal comprising a base adapted to have an object to be coated placed thereon, an upright member mounted on said base, a slide mounted on said upright member, a metal-squirting device mounted on said slide in position for squirting metal on the surface of the object placed on said base, a screw-threaded spindle and its nut for moving said slide, a beveled driving gear wheel connected with said motor, a pair of beveled driven gear wheels in mesh with said driving gear wheel and adapted to be rotated thereby in opposite directions and mounted on said screw-threaded spindle, a clutch adapted selectively to connect said driven gear wheels with said spindle, mechanism for shifting said clutch into engagement with either one of said driven gear wheels, and stops mounted on said member in positions for engaging said mechanism and shifting said clutch.

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