Oct. 13, 1959 W. ST. JOHN ET AL 2,908,490

FINE WIRE DRAWING FURNACE

Filed Nov. 23, 1954 2 Sheets-Sheet 1

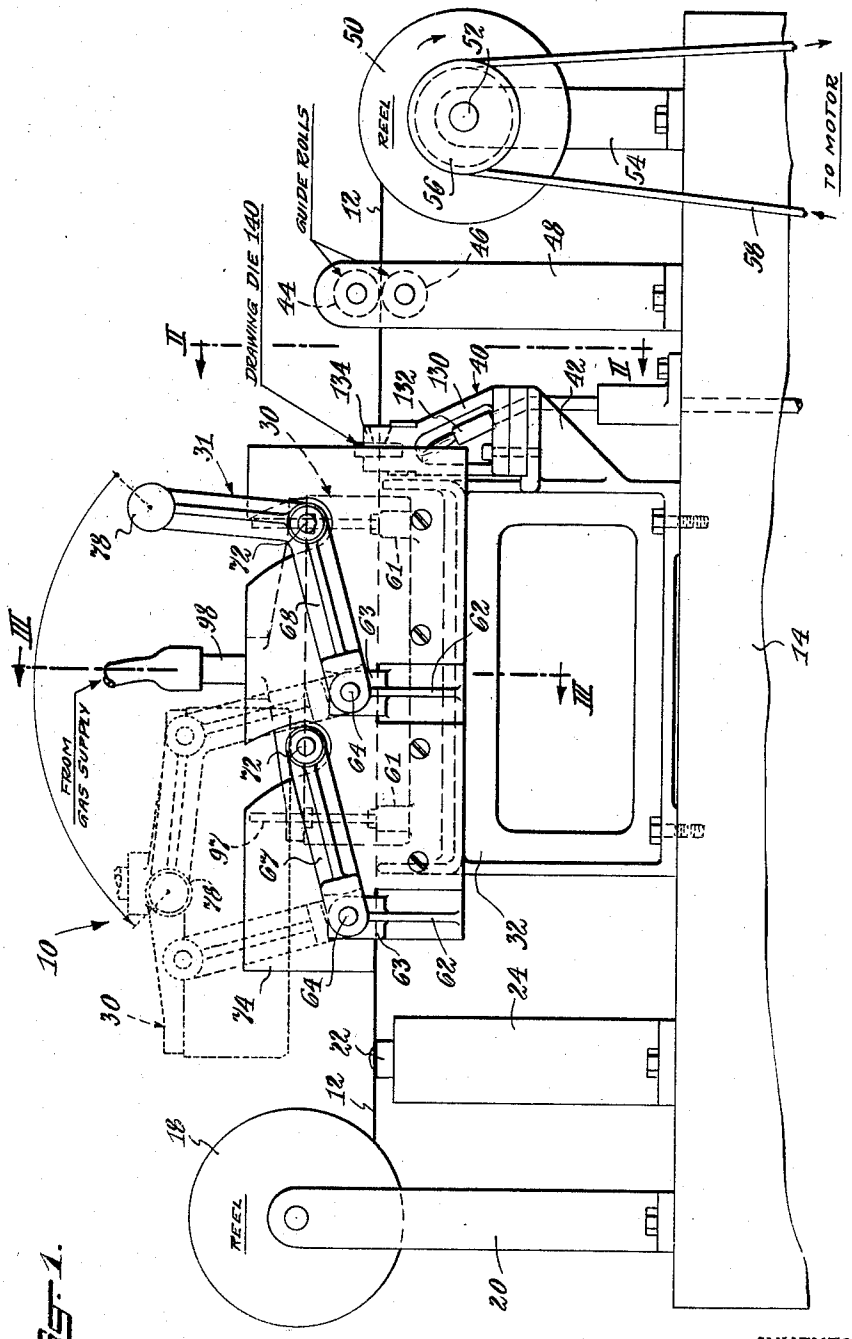


Fig. 1.

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Fig. 3.

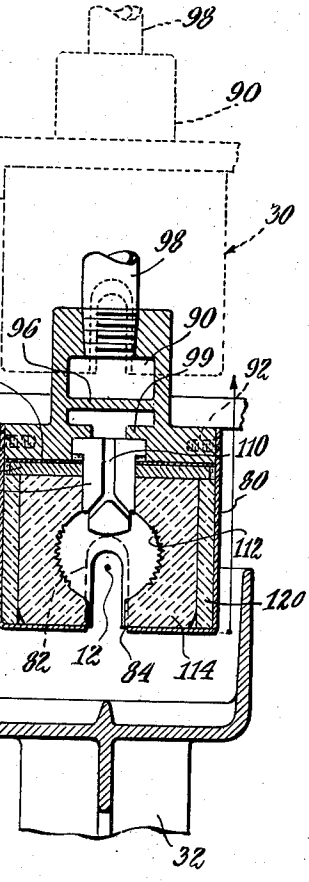


Fig. 2.

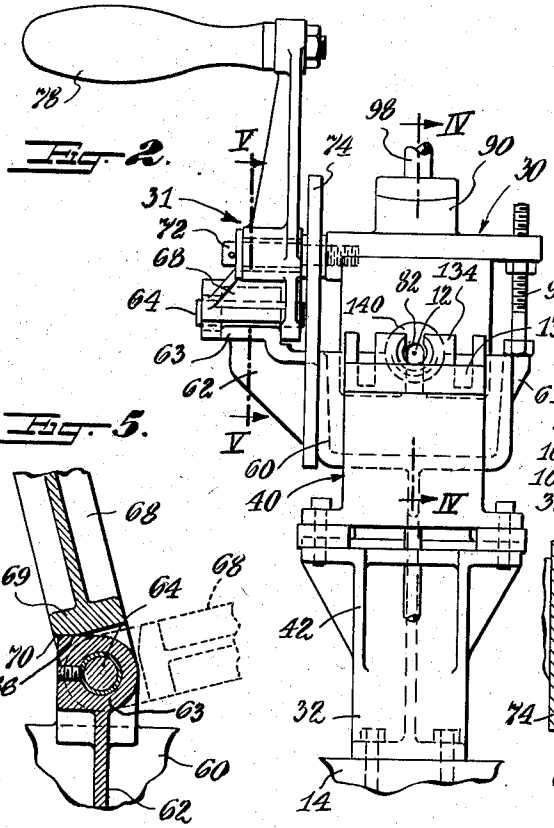
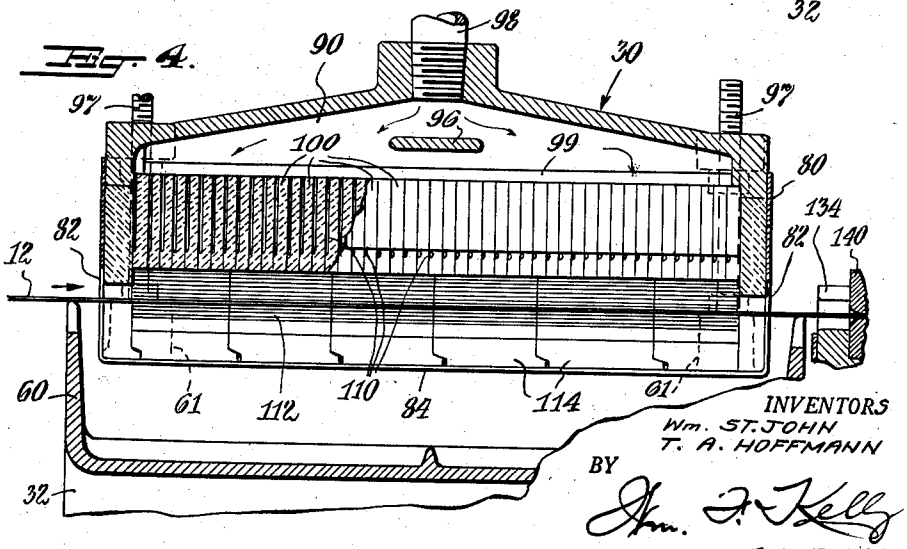


Fig. 5.

Fig. 4.



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FINE WIRE DRAWING FURNACE

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3 Claims. (Cl. 263—3)

The present invention relates to the manufacture of incandescent and fluorescent lamps and, more particularly, to a tungsten or molybdenum wire drawing machine.

The present tungsten or molybdenum wire drawing machines reduce the size and weight of wire by passing the wire over a pulley, through a furnace to heat it, and then through a preheated die having a smaller diameter hole therein. The furnace employed may consist of a flat manifold having approximately 200 burner tips formed in said manifold and from which the gas is emitted and burned. The manifold is located underneath the wire and from time to time the burner tips become clogged with aquadag, the wire drawing lubricant, falling thereon. In addition, another of the defects of the prior art furnace is non-uniform heating of the wire as the wire passes over the individual burner tips and in and out of the soft flame envelope thereof. Minor gas fluctuations and drafts affect the flame locations and tend to produce non-uniform heating of the wire from the time it enters the furnace until it leaves the die.

In the past various types of U-shaped grids have been installed in the furnace around the wire to indirectly heat the wire. Water jackets on either side of the furnace manifold have also been applied to protect or baffle the manifold from drafts and to conduct heat away from the working parts of the wire drawing machine. These water jackets require considerable maintenance due to leaks. In addition when water flow ceases, due to clogging of the jacket, high pressure steam may develop within the jacket during operation of the furnace.

If the wire undergoing drawing is not uniformly heated, excessive wear on the die itself reduces the die life and produces varying wire weight or diameter from one end of a piece of wire to the other. Obviously poorer machine efficiency and low production results from wire breakage, respooling and die replacement. Other methods of heating the wire, such as surrounding the wire with a tube and heating the tube from the side by burners was found unsatisfactory. Again, direct use of high frequency coils around the wire was found impractical and uneconomical.

Hence, it has been found advantageous according to the present invention to provide a wire drawing furnace for a wire drawing machine which will eliminate the above mentioned defects, increase production and improve quality of the drawn wire while at the same time reducing the cost of production. The furnace consists of a tunnel-like body open at the bottom and at the ends through which the wire passes. The tunnel walls are gas heated from a ribbon extending along the length thereof so that the flames therefrom sweep down the furnace walls but do not impinge directly on the wire undergoing drawing. The furnace of the present invention permits the wire to be completely enclosed, indirectly heated, and contained within a protective atmosphere created by the products of combustion, which escape at the furnace ends, until the wire reaches to the die.

In order that the furnace of the present invention may

be easily removed from its operating position while still hot to thread a wire over the pulley at the entrance to the furnace tunnel and through the wire drawing die, a furnace elevating mechanism is provided that shifts the furnace backward and upward on two sets of pivots without jarring and thus damaging the furnace refractory.

The wire drawing furnace of the present invention uniformly heats the wire. Minor gas pressure fluctuations do not effect wire temperature. Drafts are eliminated. The wire is protected until it enters the die. Water jackets and grids are not necessary. The burner does not clog. In addition, die life is increased, wire breakage and attendant respooling is reduced and gas savings are effected. Quality in the form of a uniform weight of wire is improved and production in the form of total length of wire drawn is increased.

In its general aspect the present invention has as its objective elimination of the defects of the prior art design of wire drawing furnaces.

A specific object of the present invention is a wire drawing furnace and in which the wire is completely enclosed, indirectly heated thereby, and enveloped in a protective atmosphere until the wire enters the die.

An additional object is a wire drawing furnace which is easily removed from its operating position without jarring and damaging the burner refractory.

Other objects of the present invention will become apparent to those skilled in the art to which it appertains as the description thereof proceeds.

Referring now to the drawings in which like numerals of reference indicate similar parts through the several views:

Fig. 1 is a side elevational view of a wire drawing machine incorporating the wire drawing furnace of the invention and showing the nonoperating or wire loading position of the wire drawing furnace in dotted lines.

Fig. 2 is a vertical end view of the drawing die head and the exit end of the wire drawing furnace along the line II—II of Fig. 1 in the direction of the arrows and showing the wire drawing furnace in its operating position.

Fig. 3 is an enlarged fragmentary vertical sectional view of the wire drawing furnace along the line III—III of Fig. 1 in the direction of the arrows, and showing the inoperative position of the furnace in dotted lines.

Fig. 4 is a vertical longitudinal sectional view of the wire drawing furnace along the line IV—IV of Fig. 2 in the direction of the arrows.

Fig. 5 is an enlarged fragmentary vertical sectional view of one of the pivot points of a furnace elevating mechanism along the line V—V of Fig. 2 in the direction of the arrows and showing the operating lever thereof in its raised position.

Referring now to the drawings, particulraly to Fig. 1 the reference numeral **10** designates a wire drawing machine, particularly adapted for the drawing of fine tungsten or molybdenum wire **12** and which is mounted, as hereinafter described in detail, on a table or platform **14**.

The wire drawing machine **10** has a reel **18** mounted on a suitable shaft projecting laterally from a bracket **20** upstanding from the table **14**. This reel **18** carries the wire **12** which is to be drawn to a reduced weight and diameter by the machine **10**. Adjacent to the reel **18** the wire passes through a lubricant cup **22** mounted on a suitable holder **24** upstanding from the table or platform and into a wire drawing furnace **30** of the present invention. The wire drawing furnace **30** is mounted by means of a furnace elevating mechanism **31** on a bracket **32**. The bracket **32**, in turn, is secured as by bolts, to the platform **14**. Near the exit end of the furnace **30** the wire **12** passes through a drawing die head

40 mounted on a shelf-like projection 42 of the bracket 32.

A pair of guide rolls 44 and 46, carried by an upstanding roller mounting bracket 48 may guide the now reduced drawn wire 12 from the drawing die head 40 to a reel or spooling head 50 where the drawn wire is wound thereon in the usual manner. This reel 50 is carried on a horizontal shaft 52 projecting from an upstanding bearing 54 and is reciprocably traversed on said shaft 52 by a reel traversing mechanism (not shown). In addition to the reel 50 the shaft 52 carries a driven pulley 56, rotatable by suitable means, such as a belt 58 driven by a motor (not shown).

The elevating mechanism bracket 32 carries a channel-like heat baffle 60 (Fig. 2), of generally shallow U-shaped vertical section, which extends substantially the length of the wire drawing furnace 30 and is juxtaposed therebeneath when said furnace 30 is in its normally down or operating position, shown in Figs. 1 and 2. The baffle 60 has lugs 61 (Fig. 2) on one of its longitudinal side walls for limiting the downward pivotal motion of the wire drawing furnace 30 from the upper non-operating position (shown in dotted lines in Fig. 1) to the lower operating position.

Furnace lifting mechanism

A pair of upstanding pivot posts 62 of the wire drawing furnace elevating mechanism (Figs. 1, 2 and 5) project upwardly from the bracket 32. Each post 62 is provided with a shaft supporting hub portion 63 which has a generally horizontal upper surface 66, as viewed in Fig. 5. A headed shaft or pin 64 extends through and is rotatable in the hub portion 63 of each of the pivot posts 62. The shafts 64, as viewed from left to right in Fig. 1, carry operating or furnace lifting levers 67 and 68 respectively. The lever 68 has a hub encircling mounting flange 69, as shown in Fig. 5, and is provided with a shoulder 70 of generally tapered contour. This shoulder 70 becomes engageable with upper surface 66 of the hub portion 63 to limit the upward pivotable movement of the operating levers 67 and 68 and hence the wire drawing furnace 30 to the dotted line position shown in Fig. 1 which position is beyond the "dead center" position, as hereinafter explained.

Each of the operating levers 67 and 68 has an upper shaft hub which carries a headed shaft or pin 72 (Figs. 1 and 2) projecting through suitable arcuate slots in a stationary side baffle 74. The baffle 74 is affixed to the heat baffle 60, as by bolts which extend into a gas manifold 90 of the wire drawing furnace 30. It will be understood that the lever 68 is of the bell crank type and carries (Figs. 1 and 2) an operating handle 78 (Fig. 2) projecting laterally therefrom.

It will be understood from a consideration of Fig. 1 that the levers 67 and 68 (pivoted on the upper ends of the pivot posts 62) and a body 80 of the wire drawing furnace 30 (pivotable on the shafts 72 carried on the upper hubs of the levers 67 and 68) form a pivotable parallelogram and constitute the wire drawing furnace lifting mechanism 31. By means of the handle 78, the wire drawing furnace 30 can be swung counterclockwise (Fig. 1) from its operating position within the baffle 60 to its non-operating or wire loading position shown in the dotted lines of Fig. 1.

Wire drawing furnace 30

The metallic casting or body 80 (Figs. 3 and 4) comprises essentially an open topped box provided with wire entrance and exit clearance slots 82 in the end portions thereof and a longitudinal wire clearance slot 84 in the bottom face thereof which connects the end slots 82.

As shown in Figs. 3 and 4 particularly, a gas manifold 90 is secured by the flanged portions thereof and suitable bolts 92 (Fig. 3) to the body 80. A gas flow baffle 96 is juxtaposed below a gas inlet connection 98 of the manifold 90 to circulate the gas to all parts of the manifold 90. The bottom mounting flange of the gas manifold 90 carries adjustable stops 97 (Figs. 2 and 4) which engage lugs 61 on the baffle 60 to limit downward motion of the furnace 30. This flange of the manifold 90 is suitably machined to provide a shoulder 99 (Fig. 3) for the positioning therein of a plurality of longitudinally stacked generally T-shaped burner tips 100 of suitable refractory material, such as a high grade fire clay, for example Kaolin, a trademark for a clay containing such high alumina minerals as kynite or andalusite. A suitable retaining plate gasket 102 fits about the shanks of the burner tips 100 between the flanged portions of the gas manifold 90 and a refractory retaining plate 104 secured to the flanged portion of the gas manifold 90, as by suitable bolts, not shown.

Each of the burner tips 100 shown in Fig. 4 has an inverted Y-shaped gas slot or port 110 (Fig. 3) cut in one face thereof. It will be understood that the gas burner groove 110 in a given burner tip 100 rests against the flat face of the next burner tip 100 thus providing a gas port for the passage of the gas therethrough. The upper end of each gas port 110, as viewed in Fig. 3, leads into the gas manifold 90. The bottom aperture in each gas port 110 diverges the gas against a corrugated arcuate surface 112 of refractory reflectors 114, suitably of the same refractory material as the burner tips 100.

As shown in Fig. 4 the arcuate corrugated refractory reflectors 114 on either side of the wire 12 comprise a series of sections fitted together in overlapping engagement. The corrugations 112 tend to slow the flow of gas from the gas outlet portions of the gas ports 110. It will be understood that when the washboard surface of the reflector on either side of the wire 12 may have been heated, for example, to a white heat in the neighborhood of 1500–2000° C. the gas tends to burn not only at the open gas port 110, but in an encircling arc which covers the entire corrugated surface of the reflectors. This provides uniform heat to the wire 12 passing through the wire drawing furnace 30.

Between the longitudinal side walls of the casting or body 80 of the furnace 30 and the refractory reflectors 114, suitable insulating or packing material 120 (Fig. 3) of a refractory nature, such as a high temperature bonding cement or refractory mortar containing kaolin precalcined at a temperature over 3000° F., is provided to insulate the refractory reflectors 114 from the side walls of the casting 80.

Die holder head

The die holder head 40 (Figs. 1 and 2) has a generally hollow flanged die holder casting 130 secured, as by bolts, through the flanged portions thereof (Fig. 1) to the mounting projection 42 of the bracket 32. Insulating plates or spacers may be juxtaposed between the projection 42 and the casting 130. A die heater 132 (Fig. 1) suitably a burner having a curved upper end, is secured to the table 14, as by bolts, and projects upwardly through the generally hollow triangular vertical cross section of the casting 130. The flame of the burner 132 is directed against a die holder block or a block-like portion 134 of the casting 130.

As shown particularly in Fig. 2 the block 134, a portion of the casting 130, is siutably slotted on either side of the die holder retaining portion thereof to provide adequate insulation and protection to a heated die 140 from drafts. The wire drawing die 140, maintained desirably at a temperature between 300–400° C., is secured in the die holder retaining portions of the block 134. The right hand end of the block 134 when viewed in Fig. 1, is suitably formed or machined to provide a generally frustoconical guide and clearance hole for the drawn wire 12 as it leaves the die 140 and enters the guide rollers 44 and 46.

Thus, it will be seen from the foregoing description

that the wire drawing furnace **30** of the invention has a hollow body **80**, slotted at the bottom and at the ends to permit passage therethrough of the wire **12**. Refractory arcuate corrugated reflectors **114**, secured in the side walls of the furnace **30**, are gas heated by a plurality of burner tips **100**. The tips **100** are arranged and stacked one behind the other along the longitudinal axis of the furnace, so that the flames therefrom sweep down the side walls of the reflectors **114** and the corrugations **112** thereon to first heat the side walls of the reflectors **114** to a white incandescence whereupon the gas burns along the entire periphery thereof.

The wire drawing furnace **30** of the invention permits the wire **12** to be completely enclosed within the body **80** and the baffle **60** and contained within a protective atmosphere within the furnace **30**. The protective atmosphere is created by the products of combustion which circulate about the wire **12** within the wire heating chamber between the refractory reflectors **114**. These protective products of combustion exit at the furnace end slots **82** and protects the wire **12** being heated within the wire drawing furnace **30** from oxidation etc. right up to the entrance of the wire **12** into the heated die **140**.

To facilitate the threading of the wire **12** over the guide pulley (not shown) at the entrance to the wire drawing furnace **30** and through the wire drawing die **140** at the exit end thereof, the furnace **30** is provided with a furnace elevating mechanism **31**. This mechanism **31** swings the wire drawing furnace **30** backwards and upwards on two pivot posts **62** without jarring and thus avoids damaging the refractory reflectors **114** or the refractory retaining plate **104**.

The wire drawing furnace **30** of the invention uniformly heats the wire **12**. Minor gas pressure fluctuations within gas manifold **90** do not affect the temperature of the wire **12**. The heat baffle **60** below the wire drawing furnace **30** retains the heat within the refractory reflectors **114** thus reducing appreciably the amount of heat formerly required. This baffle **60** also contains the protective atmosphere created by the products of combustion and prevents fluctuations in the heat within the wire drawing furnace **30** due to drafts. In addition, it is impossible for the burner tips **100** to become clogged due to aquadag falling thereon. Uniform temperature of the wire **12** which is assured by the wire drawing furnace **30** of the invention, provides longer life for the dies **140**, appreciably reduces breakage of the wire **12** thus eliminating the necessity for periodic wire respooling. The furnace **30** also provides substantial gas savings in the operation thereof. As a result the quality of wire **12** in the form of uniform weight of wire is improved and production in the form of total length of drawn wire **12** is increased.

Although a preferred embodiment of the invention has been disclosed it will be understood that modifications may be made within the spirit and scope of the invention.

We claim:

1. A furnace for heating wire which is to be drawn through an adjacent die, comprising a heat baffle adapted to retain heat within the furnace, contain the products of combustion within the furnace as a protective atmosphere for the wire passing therethrough and prevent fluctuations of heat within the furnace due to drafts, a body normally partially contained within said heat baffle and provided with a corrugated surface adapted to be disposed about said wire and adapted to slow the flow of gas thereabout, and means associated with said body for introducing gas to said corrugated surface and heating the latter to incandescence to cause the gas to burn along the entire corrugated surface thereby uniformly heating the wire.

2. A furnace for heating wire which is to be drawn through an adjacent die, comprising a heat baffle adapted to retain heat within the furnace, contain the products of combustion within the furnace as a protective atmosphere for the wire passing therethrough and prevent fluctuations of heat within the furnace due to drafts, a body normally partially contained within said heat baffle and provided with a corrugated surface adapted to be disposed about said wire and adapted to slow the flow of gas thereabout, means associated with said body for introducing gas to said corrugated surface and heating the latter to incandescence to cause the gas to burn along the entire corrugated surface thereby uniformly heating the wire, and means connected to said body and operable to move said body away from said heat baffle to permit the threading of the wire through the heat baffle and into the adjacent die.

3. A furnace for heating wire which is to be drawn through an adjacent die, comprising mounting means, a heat baffle on said mounting means and adapted to retain heat within the furnace, contain the products of combustion within the furnace as a protective atmosphere for the wire passing therethrough and prevent fluctuations of heat within the furnace due to drafts, a body normally partially contained within said heat baffle and provided with a corrugated surface adapted to be disposed about said wire and adapted to slow the flow of gas thereabout, means associated with said body for introducing gas to said corrugated surface and heating the latter to incandescence to cause the gas to burn along the entire corrugated surface thereby uniformly heating the wire, and means connected to said body and said mounting means and operable to move said body away from said heat baffle to permit the threading of the wire through the heat baffle and into the adjacent die.

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