

[54] **AIR SCRUBBER APPARATUS WITH GREASE REMOVAL MEANS**

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[63] Continuation-in-part of Ser. No. 195,170, Nov. 3, 1971, Pat. No. 3,770,061.

[52] U.S. Cl. **169/65, 55/260, 55/462, 55/DIG. 36**

[51] Int. Cl. **A62c 3/00**

[58] Field of Search **169/1 R, 2 R, 65; 98/115 R, 115 K; 55/DIG. 36, 228, 229, 220, 257, 260, 462, 241**

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[57] **ABSTRACT**

An air scrubber apparatus for cleaning gases emanating from a heating surface comprising a housing having a plurality of vertical walls which define an inlet at the bottom and an outlet at the top of said housing. A grease extractor is connected to the housing across the housing inlet to remove a portion of the grease which arises from the heating surface, and a hood is mounted to the housing and extends over the heating surface to direct gas towards the grease extractor. The housing construction defines a passageway through which the partially degreased gases can travel and in which a spray nozzle is mounted to discharge fluid in spray form to clean and cool gas traveling through the housing passage. A plurality of downwardly projecting baffle members are secured to the housing below the spray nozzle to direct the gas along a serpentine flow path and to carry off fluid discharged from the spray nozzle to a drain connected to the housing with at least one of the baffle members being positioned above the spray nozzle and a fire extinguisher apparatus connected to the housing.

12 Claims, 3 Drawing Figures

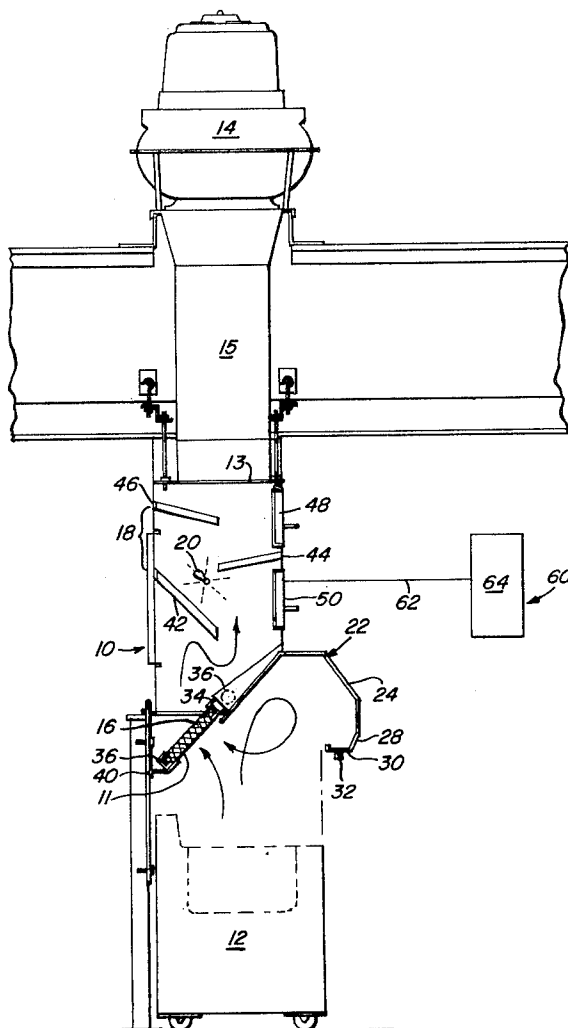


Fig. 1

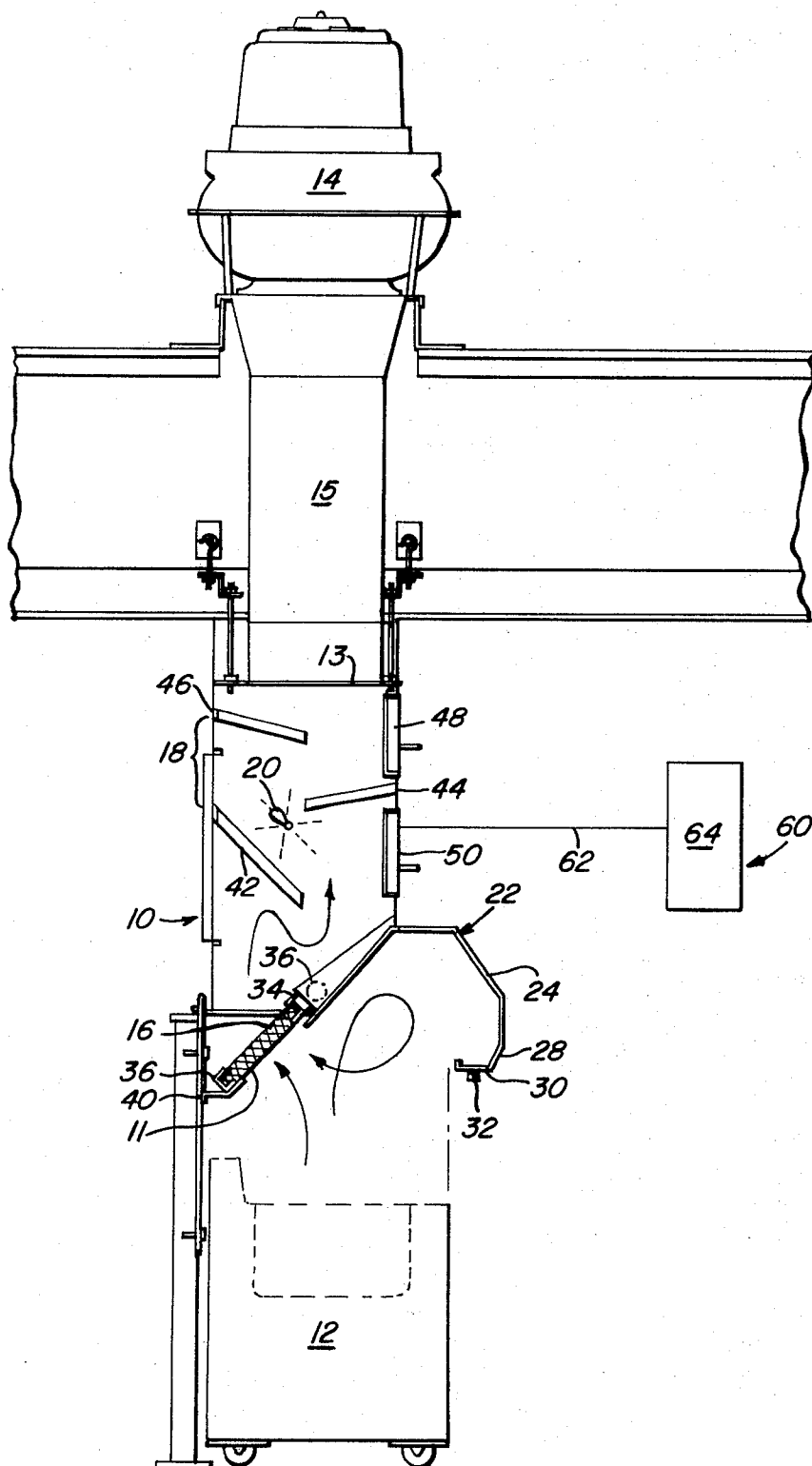


Fig. 2

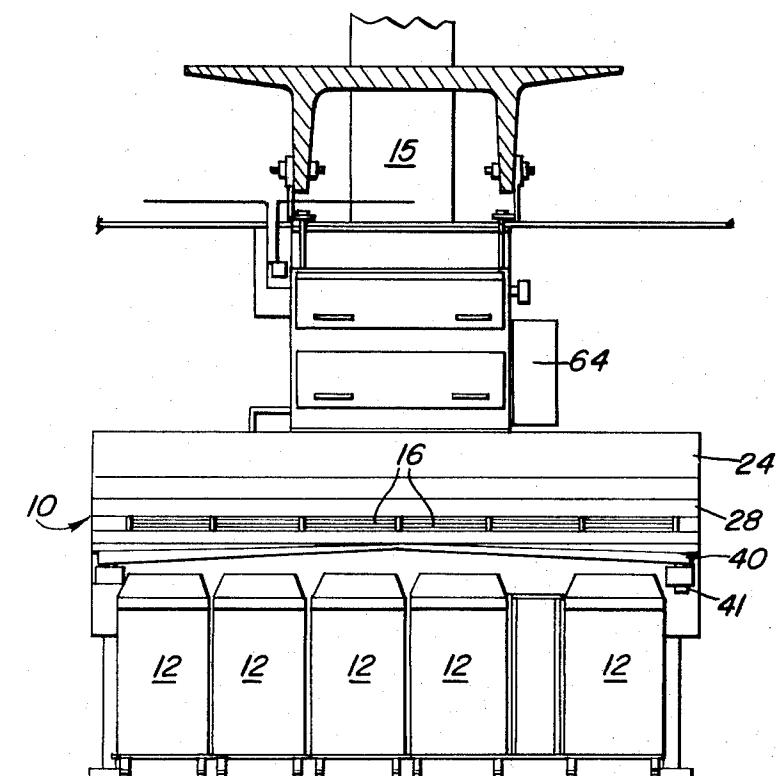
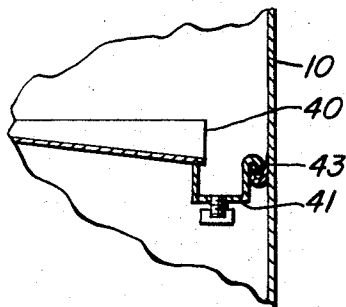


Fig. 3



AIR SCRUBBER APPARATUS WITH GREASE REMOVAL MEANS

This application is a continuation-in-part of application Ser. No. 195,170, filed Nov. 3, 1971, now U.S. Pat. No. 3,770,061.

The present invention generally relates to a fluid-cleaning apparatus and more specifically to a gas cleaning apparatus which cleans gases arising from a cooking apparatus or surface. The gases are cleaned by passing the contaminated gases through a grease extractor, baffle means and a fog blanket of fluid spray, which scrubs the gases so that solid matter and pollutants are removed.

In the invention, smoke, grease, cooking odors and other condensable contaminants emanating from a cooking surface pass through a grease extractor and a fog blanket discharged by the spray means of the apparatus within a baffle means of the apparatus. The grease extractor initially extracts a portion of the grease from the gas so that when the gas passes through the baffles and fog blanket the remainder of the contaminated particles are entrained in the spray droplets of the fog blanket. The fog droplets fall downward to the baffle means where they condense and are directed to a suitable depository, which carries the contaminant-carrying fluid away. When the heated grease, condensable contaminants and/or other particles contact the fog blanket, the fog droplets are turned to steam, thus further atomizing the grease and condensable contaminants.

The construction of the invention effects a quick and highly efficient elimination of the impurities contained in the gases, thus preventing the impurities from being deposited into the atmosphere outside of the building in which the air scrubber is located. The present invention thus significantly contributes in cutting down air pollution.

The present invention provides an improved air scrubber which can be manufactured efficiently and economically with an adequate fire-extinguishing system, while at the same time being continuously self-draining. The invention reduces the danger of the likelihood of fire by disposing of grease which is the major cause of fires in this type of apparatus and provides a simple means for extinguishing fires if they should arise.

Other advantages and embodiments of the invention will become apparent from the following detailed description and upon reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 discloses a cross sectional view of the air scrubber apparatus with schematic diagram of the fire extinguisher mechanism.

FIG. 2 shows a front elevational view of the air scrubber.

FIG. 3 discloses a partial enlarged view of a drainage modification in the invention.

DETAILED DESCRIPTION OF THE DRAWINGS:

The air scrubber as disclosed in FIGS. 1 through 3 comprises a hooded housing 10, having a gas inlet 11 and a gas outlet 13, which is adapted to be mounted over a cooking appliance or appliances such as a broiler, frying plate, or a french fryer 12. The housing

is preferably constructed of stainless steel, but any other suitable material can be used.

The air scrubber apparatus is constructed to purify or clean gases which arise from a cooking surface carrying contaminants such as grease, smoke, fumes, or other added materials. The air scrubber apparatus cleans the gases passing through it with the gases passing from the top of the housing up into an exhaust mechanism 14 such as a centrifugal upblast exhaustor or fan which discharges the purified gases into the atmosphere.

The housing 10 is preferably of rectangular construction, having a front wall, rear wall and connecting side walls. However, housing of a circular or angular configuration could be used within the scope of the invention. The inlet end 11 of the housing takes in gases emanating from the cooking appliances or food-stuffs being cooked, while the outlet or discharge end 13 is adapted to be connected to a discharge duct 15 which can extend into the atmosphere outside the building in which the apparatus is located or to an air exhaust mechanism 14.

In the preferred embodiment, a centrifugal upblaster is attached to the outlet or duct 15 leading from the outlet 13 to draw the gas into and through the housing. A fan or blower could be adapted to be used in place of the centrifugal upblaster, if desired.

The housing 10 preferably has a grease extractor 16 mounted thereto and baffle means 18 comprising baffle plates or members secured to the inner surface of the walls of the housing with a spray means 20 positioned therebetween. The baffle members project inward to define a substantially serpentine path for the flow of gases and entrained particles rising from the broiler or cooking area, with a lower baffle member serving as a fluid catchpan to carry the fluid condensed from the spray means into a contained drain system.

As the heated contaminated gas rises from a cooking surface it directly passes through the grease extractor 16 or is directed by the hood 22 toward the grease extractor. The hood 22 is preferably secured to the housing 10 and comprises a forward section 24 which extends past the cooking surface and a rear section 26 which forms part of the base of housing. In the preferred embodiment the forward section 24 does not extend from the body at an angle greater than 45°. The hood sections direct the rising gas back into the flow stream passing through the grease extractor and serve to separate some of the grease from the gases. The forward section 24 curves back toward the rear section forming a forward edge 28. The forward edge 28 terminates in a channel or grease catch 30 which is substantially U-shaped with the end of the grease catch being offset from the fryer 12. This channel catches grease droplets which have been deposited on the inner surface of the forward section and run downward toward the cooking surface. The catch 30 has a drain 32 connected thereto so that the grease is continually drained away from the catch into a suitable depository (not shown). Prior apparatus have had hoods in which the grease droplets have collected on the hood and dripped down falling upon the hands or body of the operator causing severe burns. The rear section 26 of the hood preferably extends into the cooking area at an angle greater than 45° from the plane of the cooking surface preferably in the range of 50° to 60°. It has been found that a good working angle for the hood is approximately 53°.

The rear section 26 is secured to the housing 10 and acts as baffle member. Secured to the baffle member 26 is a grease extractor bracket 34 and drain means 36 which carries away the water deposited from the spray means 20. The drain conduit 36 is preferably constructed of copper or some other heat transfer material so that it will not have grease forming on its interior surface, because the heat of the rising gases will keep the grease and particles entrained in the fluid until the fluid is drained off. If desired the spray fluid can drain from the baffle means.

The grease extractor 16 is removably mounted in bracket 34 and a second bracket means 36 secured to the housing or a secondary construction. The second bracket means 36 preferably has a sloping trough or drain 40 secured or connected thereto so that the grease collected by the grease extractors is drained into the drain 40 and from the drain into a suitable reservoir such as containers 41 shown in FIGS. 2 and 3.

A typical type of grease extractor 16 which can be used in the invention is disclosed in U.S. Pat. No. 3,566,585. Preferably, the grease extractor acts to force the grease laden air to make an abrupt change in direction by means of two opposite offset baffle plates. In resisting this directional change the grease drops strike the surface of the plates which are covered with "Teflon" or other suitable covering and run off to the drain 40. The drain 40 which slopes to the sides of the housing 10 preferably terminates at the walls of the housing 10 as shown in FIG. 2 or can terminate short of the housing walls as shown in FIG. 3, allowing the grease to be deposited in container 41. The containers 41 can be made of a disposable material so that they can be removed from the drain 40 and thrown away or they can be of a more permanent nature with a plug in the bottom so that they can be drained at the end of a day's collection. When disposable containers are used a cap can be placed in the top of the container and the closed containers slide out along tracks 42 and thrown away. In any event, the capacity of the containers 41 is approximately one quart.

After the particle-carrying gas stream passes through the grease extractor 16 which removes a significant portion of the grease, it comes into contact with the bottom surface of baffle member 42, which effects an approximate 180° reversal in the direction of flow of the gas. Another gas flow direction reversal occurs when the gas flow passes from the bottom surface of baffle member 42 toward baffle member 26 causing the gas flow to be directed toward the bottom surface of baffle member 44 so that the gas flow passes through the fog blanket generated by the impingement nozzle of the spray means 20. The centrifugal action resulting from this flow reversal causes some of the condensable grease and oil entrained in the gas stream to be deposited on baffle member 42 thereby providing a secondary extraction stage.

The baffle member 42 is preferably secured to the inner sides of the housing 10 at an approximate 45° angle with respect to the sides of the housing.

The fluid spray means 20 is utilized in connection with the baffle members 42, 44, and 46 to provide a liquid fog which forms a blanket or filter through which the gases from the heated surface must pass on their way to the atmosphere. The spray means 20 causes the water to be mixed in the gas in the form of a fog so that the spray droplets serve as vehicles for collecting and

carrying impurities remaining in the gases and cooling the heated gases. The spray then collects on the baffle member surfaces, where it condenses and is eventually carried to discharge conduit 36. Any hot water source, preferably between 140° - 180° can be used to provide water for the spray means 20. In the apparatus the water passes from a water source (not shown) which is connected with a solenoid means such as that shown in the application Ser. No. 195,170.

The solenoid means (not shown) is preferably connected with a blower on the broiler or with a fuel feed to the cooking appliance so that when the cooking appliance is activated, the solenoid means is likewise activated. The solenoid means is preferably constructed with a valve which serves to close or open, thus determining the flow of water to the spray means. If desired, the water flow passing through the solenoid means and conduit can enter a pressure regulator (not shown) which is adapted to regulate the water pressure at any designated psi pressure so that the spray means 20 will be under a constant pressure. Furthermore, the solenoid means can be connected to a detergent source so that detergent can be added to the water for periodic cleaning. After being regulated by pressure regulator if such is being used, the water travels along a conduit to an impingement type nozzle of the spray means where it is discharged or expelled into the inner surface of the housing. The spray discharged by the nozzle causes a blanket or curtain of water to be set up in the center area of the housing so that grease and soot laden gases having been subjected to the primary degreasing come into contact with the water spray blanket to remove the remaining particles of grease, carbon and other matter while the temperature of the heated gases is simultaneously cooled. The action of gravity and force of the discharge of the nozzle cause the water droplets bearing contaminants to fall on the baffle members which directs the flow of condensate over their upper surface to the drain means 36.

The baffle members actually form a combination air direction baffle and fluid baffle with the fluid carrying being accomplished by the upper surface of the baffles and the air direction being accomplished by positioning the baffle members to force the particle-laden gas to follow a serpentine path so that the heavier particles are partially separated from the gas at the angular turns due to the directional flow change and change in velocity. As fluid flows down the baffle members into drain 36 it is diverted into proper sewerage or other adequate disposal units.

Baffle member 46 is placed near the top of the air scrubber housing 10 and is secured to the sides of the housing to form a gas passage, causing the spray scrubbed air to flow in a serpentine path up through the housing. The baffle member 46 prevents the water from the spray means from passing out through discharge outlet 13.

Two access doors 48 and 50 are provided in the front wall of the housing 10 for cleaning the interior of the scrubber. The access doors are positioned substantially opposite the baffle members 42 and 46 to allow easy access to the baffle members along with baffle members 26 and 44 so that the same can be readily cleaned and maintained.

If desired a thermometer means can be optionally mounted in the upper portion of the housing so that a thermometer bulb, which can be positioned in several

ways, projects into the gas stream or path close to the spray nozzle means 20 as is shown in U.S. Pat. No. 3,770,061. The thermometer means is utilized to determine if the spray nozzle has been blocked by dirt or other foreign particles carried into it by the incoming fluid. If there is blockage in the nozzle, a rise in temperature will occur. Thus, the thermometer means is used as an indicator that something is wrong with the nozzle.

Tests have shown that the temperature at the bottom of the scrubber apparatus around inlet 11 can run around 900°F, while the temperature above the fog blanket produced by the spray means 30 is approximately 225°–250°F. It is apparent that any decrease in the fog blanket will result in an immediate temperature rise. If desired, an acoustic or light signal can be attached to the thermometer means for automatic activation when the temperature reaches a predetermined degree. A 50°–500° F. thermometer is preferably used in connection with the apparatus.

An extinguishing safety system 60 such as that disclosed in U.S. Pat. No. 3,770,061 is also preferably used with the air scrubber body in this system. However, the fire extinguisher is not mounted to the body of the scrubber as disclosed in the prior application but is mounted separately to a wall, ceiling or other suitable structure. A conduit 62 leads from the chemical container 64 to the housing 10 where it is mounted inside the housing 10.

While the preferred embodiment of the invention has been disclosed, it is understood that the invention is not limited to such an embodiment, since it may be otherwise embodied in the scope of the appended claims.

What is claimed is:

1. An air scrubber apparatus for cleaning gas arising from a heated surface comprising a housing having a plurality of walls forming a gas inlet and outlet, a grease extractor means mounted to said housing across said inlet said grease extractor means being adapted to collect grease, a hood mounted to said housing and extending across said heated surface, said hood comprising a front section and a rear section, said front section defining an edge curved back towards said rear section to form a drain lip, said rear section forming a baffle member for said housing, drain means connected to said rear section and first grease extractor holding means secured to said rear section, a second grease extractor holding means secured to said housing, said second grease extractor holding means being adapted to hold said grease extractor means, drain means connected to said second grease extractor holding means, said drain means being adapted to drain grease collected by said grease extractor means to disposal means connected to said drain means, a spray means mounted in said housing, said spray means being connected to a source of fluid so that it can spray fluid into said housing, a plurality of baffle members secured to said housing below said spray means and at least one baffle member secured to said housing above said spray means, said plurality of baffle members defining a serpentine passageway for an incoming gaseous flow and directing fluid discharged from said spray means to said drain means, and fire extinguishing means connected to

said housing.

2. Apparatus as claimed in claim 1 wherein said rear section of said hood is inclined at least 45° from an imaginary plane formed by said heated surface.

3. Apparatus as claimed in claim 1 wherein said rear section of said hood is inclined from an imaginary plane formed by said heated surface at an angle in the range of 50°–60°.

4. Apparatus as claimed in claim 1 wherein said disposal means comprises disposable containers connected to said drain means.

5. Apparatus as claimed in claim 1 wherein said disposal means comprises removable containers connected to said drain means.

6. Apparatus as claimed in claim 5 wherein said removable containers have plug means provided therein to allow drainage from said removable containers.

7. Apparatus as claimed in claim 1 wherein said front section of said hood extends from said housing at an angle not greater than 45°.

8. Apparatus as claimed in claim 1 wherein said grease extractor comprises a plurality of opposing offset baffle plates coated with Teflon.

9. Apparatus as claimed in claim 1 wherein said second grease extractor holding means is a bracket.

10. Apparatus as claimed in claim 9 wherein said bracket has a sloping trough secured thereto to drain off grease collected by the grease extractor means.

11. Apparatus as claimed in claim 1 including a second disposal means connected to said hood drain lip and second drain means connected to said disposal means.

12. An air scrubber apparatus for cleaning gas arising from a heated surface comprising a housing having a plurality of walls forming a gas inlet, a grease extractor means mounted to said housing across said inlet, said grease extractor means comprising at least one frame having opposing offset baffle plates secured thereto, a hood mounted to said housing and extending across said heated surface, said hood comprising a front section and a rear section, said front section having an edge curved back towards said rear section to form a drain lip, said rear section forming a baffle member with extractor holding means secured thereto, drain means mounted to said rear section baffle member, a second grease extractor holding means mounted to said housing, said second grease extractor holding means being provided with a second drain means, said second drain means comprising an inclined trough connected to said second grease extractor holding means, spray means mounted to said housing and comprising at least one impingement nozzle, said spray means being connected to a source of fluid so that it can spray fluid into said housing, at least one baffle member secured to said housing below said spray means and at least one baffle member secured to said housing above said spray means, said plurality of baffle members defining a serpentine passageway for an incoming gaseous flow and directing fluid discharged from said spray means to said drain means, and fire extinguishing means connected to said housing.

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