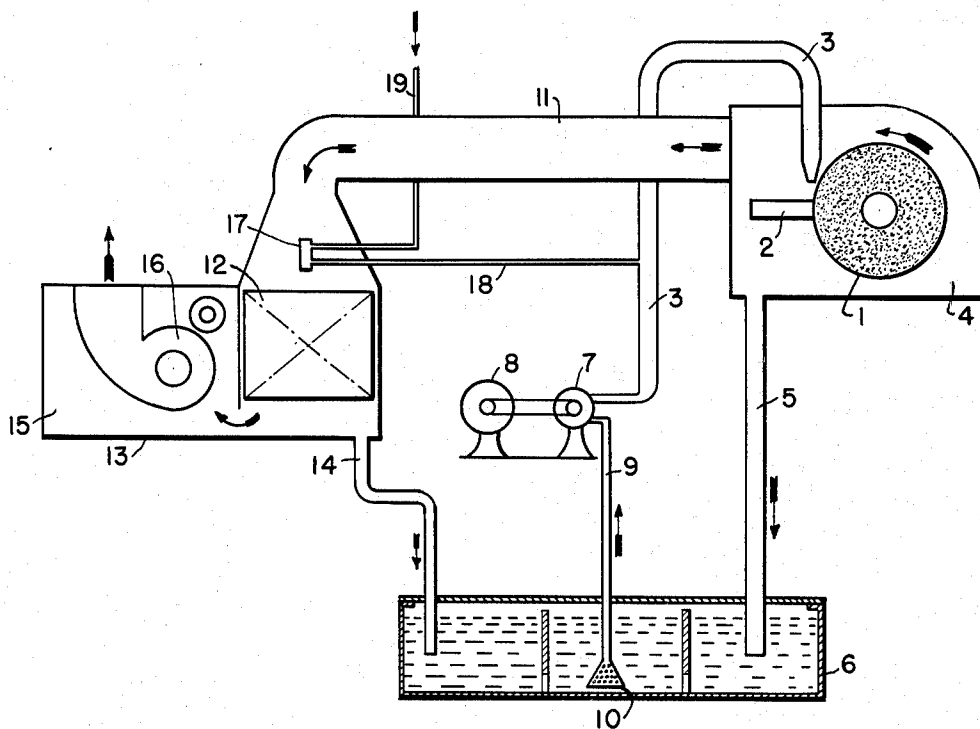


April 24, 1956

G. F. LANDGRAF
METHOD AND APPARATUS FOR CLEANING
AIR OR GAS LADEN WITH OIL MISTS
Filed March 23, 1953

2,742,974



INVENTOR.
George F. Landgraf

BY
W. H. Mackey & Burden
HIS ATTORNEYS

1

2,742,974

METHOD AND APPARATUS FOR CLEANING AIR OR GAS LADEN WITH OIL MISTS

George F. Landgraf, Pittsburgh, Pa., assignor to Trion, Inc., McKees Rocks, Pa., a corporation of Pennsylvania

Application March 23, 1953, Serial No. 343,869

6 Claims. (Cl. 183—7)

This application relates to method and apparatus for cleaning air or gas laden with oil mist. They are particularly useful for disposing of oil mist generated by high speed machine tools and they will be described with reference thereto. However, my method and apparatus are useful for removing oil mist from a gas as well as from air. Whenever air is mentioned throughout this application, it will be understood that gases are intended as well.

In operating high speed machine tools, such as lathes, planers, shapers, grinders, etc., it has long been customary to flow a cooling oil over the work piece and the part of the tool in contact with the work piece in order to cool the work piece and the tool and thus to obtain longer life for the tool, to accomplish higher speeds, and to prevent any deleterious effect of high temperature on the work piece.

When oil is thus poured over the work piece and a part of the high speed machine tool, a large amount of mist develops, particularly in the case of a high speed grinding machine. This mist is very objectionable to the machine operators and creates a fire hazard in the plant and, therefore, it has been the practice to surround the grinding wheel or cutter with a hood and to exhaust the hood out through an electrostatic filter which removes the oil particles forming the mist from the air. The air has then passed out through a stack. Where possible, the oil mist has not been allowed to pass out through the stack because of contamination of the air around the plant and because the mist condenses in the stack and creates a fire hazard.

A very serious difficulty in the control of the oil mist as just described arises from the fact that the temperature of the work piece may be so high that some of the coolant becomes partially oxidized and passes in this form into the electrostatic precipitator, together with the unoxidized oil mist. The partially oxidized coolant forms a thin film on the collecting plates of the precipitator. This film is more viscous than the unoxidized oils collected on the plates and will not flow off the plates as readily as the unoxidized oils. The film of partially oxidized oils further oxidizes while on the plates to form a varnish-like coating on the collecting plates which is a dielectric material and which, therefore, seriously interferes with the operation of the precipitator. As operations continue, the varnish-like coating covers more and more of the surface of the collecting plates until finally the precipitator becomes wholly inoperative and the oil mist passes freely out through the stack to contaminate the atmosphere around the plant, and creates a fire hazard in the stack. In actual operation of an electrostatic precipitator on air laden with oil mist from a grinding wheel, I found that the operation of the precipitator began to become affected after two hours of operation and that after 24 hours it was inoperative.

Heretofore, it has been the practice to shut down the machine and remove the varnish-like coating from the collecting plates of the precipitator before the precipitator

2

has become wholly inoperative. This, obviously, is not satisfactory since the machine tool must be shut down while the precipitator is removed from the duct work and cleaned or two precipitators must be used, one working while the other is being cleaned. To aggravate the problem, the varnish-like coating is extremely difficult to remove from the collecting plates. It has been found necessary to use a "steam jenny" and with it clean the plates with a mixture of live steam, water and detergent. The plates have also been cleaned by sand blasting.

My inventions solve these problems by preventing the formation of the varnish on the collecting plates of the precipitator. I add to the air flowing from the machine tool and laden with coolant oil mist and partially oxidized coolant oil, an additional amount of the same coolant oil in the form of a fine spray. The oil thus added is carried by the air along with the mist developed at the machine tool to the precipitator where both are removed simultaneously from the air and collected by the precipitator and returned to the coolant oil reservoir of the machine. I add so much oil to the air flowing to the precipitator that the portions of the coolant which have been partially oxidized by the heat of the machine tool operations are diluted to such an extent that the viscosity of the partially oxidized coolant is decreased and it flows off the collecting plates with the oil in the mist created by the machine and with the oil in the mist which I have added to the air in advance of the precipitator. From the precipitator the partially oxidized coolant flows with the other components into a reservoir for cooling oil where it settles in the reservoir as sludge. The coolant oil is filtered before it is pumped back to the machine so that the partially oxidized material does not return to the machine.

Cooling oils used in machine tools have a variety of compositions. Some are entirely oil, some are mixtures of oils and other chemicals, and others are emulsions of oil and water. In this application, the words "cooling oil" or "oil" refer to all types of oils, oil mixtures, or oil emulsions which are used in machine tools to cool the work piece and/or the tool in contact with the work piece.

I have illustrated my inventions in the accompanying schematic drawing. The drawing shows a grinding wheel 1 and a work piece 2 on which the grinding wheel is operating. A pipe 3 supplies cooling oil to the machine at the point of contact of the work piece and the grinding wheel. As shown in the drawing, the wheel and the work piece are wholly enclosed in a hood 4. A second pipe 5 drains the liquid oil from the bottom of the hood to an oil reservoir 6. A pump 7, driven by a motor 8, pumps cooling oil from the reservoir into a pipe 9, having a filter 10 at its lower end, to the pipe 3.

As stated earlier, a considerable amount of oil mist is generated when the oil is poured over the grinding wheel and the work piece. This mist is drawn off from the hood 4 through a conduit 11 to an electrostatic precipitator 12 which collects the small oil particles forming the mist on its collecting plates. The oil thus collected drips off the plates on to the bottom 13 of a casing for the precipitator and flows through a pipe 14 to the oil reservoir 6. The air which carried the oil mist to the precipitator passes into a plenum 15 and is blown by a centrifugal fan 16 out through an exhaust stack, or it may be returned to the room.

As explained above, I add cooling oil in the form of a fine mist to the mist laden air flowing from the machine tool to the precipitator. To accomplish this, I provide a conventional spray nozzle 17 in the duct 11 upstream from the precipitator 12. A pipe 18 connected to the pipe 3 and leading from the pipe 3 to the spray nozzle supplies oil to the nozzle. A pipe 19 leading from a

3

source of compressed air supplies the necessary air pressure for the nozzle.

I have found that by adding cooling oil in the form of a fine mist to the air flowing from the machine tool to the precipitator, I dilute the partially oxidized oil sufficiently to increase its fluidity permitting it to flow from the collecting plates. There is nothing critical about the quantity of oil which is added, so long as sufficient is added to dilute the partially oxidized oil to a state of relatively high fluidity. It is obvious that the more oil that is added, the less likelihood there is of any of the partially oxidized oil remaining on the collecting plates. There are, however, practical limits as to the quantity of oil which can be sprayed into the duct leading to the precipitator. Oil should not be added in such amounts that it cannot be removed from the air by the precipitator which is determined by the capacity of the precipitator. In actual operation, I have found that a good rate is one pint per minute for a precipitator having a filtering capacity of 1,200 cubic feet a minute.

From the foregoing, it is apparent that I have solved efficiently and simply a problem which has seriously affected the machine tool industry, namely, the efficient elimination of oil mist generated during the operation of high speed machine tools in which some of the coolant oil is partially oxidized. While electric precipitators have been used prior to my inventions to collect this oil mist, any partially oxidized oil in the mist has seriously impaired the operation of the precipitator. It has been necessary to either stop the machine tool to clean the precipitator or to use two precipitators so that one could be collecting the oil mist while the other was shut down for cleaning. Moreover, the varnish formed by the partially oxidized oil is extremely difficult to remove from the plates. My inventions solve all of these difficulties.

While I have described certain present preferred embodiments of my inventions, it is to be understood that they may be otherwise embodied within the scope of the appended claims.

I claim:

1. Apparatus for cleaning air laden with a mist of oil and partially oxidized oil comprising an electrostatic precipitator, a conduit leading the air to the precipitator, means in the precipitator for collecting the mist, means for gathering the collected materials, a reservoir for oil, a pipe connecting said gathering means and the reservoir, means for creating a mist of oil of the same type as the unoxidized oil in the air being cleaned in said conduit in advance of the precipitator and means for supplying oil from said reservoir to said mist creating means.

2. Apparatus for disposing of a mist of oil and partially oxidized oil generated by a machine tool comprising an electrostatic precipitator, a conduit leading air laden with mist generated by the machine tool from the machine tool to the precipitator, means in the precipitator for collecting the mist, means for gathering the collected materials, a reservoir for oil used by the machine tool, a pipe con-

4

necting said gathering means and the reservoir, means for creating an oil mist in said conduit in advance of the precipitator, and means for supplying oil of the same type as the unoxidized oil in the air being cleaned from the reservoir to the machine tool and to said mist creating means.

3. A method of disposing of a mist of oil and partially oxidized oil generated by a machine tool comprising leading air carrying the mist to a precipitator, adding to the air in advance of the precipitator and in the form of a mist oil of the same kind as in the mist generated by the machine tool, removing the mist from the air by the precipitator, collecting the mist removed by the precipitator, separating the partially oxidized oil from the unoxidized oil, and returning the unoxidized oil to the machine tool and in the form of mist to the air moving from the machine tool to the precipitator.

4. A method of disposing of a mist of oil and partially oxidized oil generated by a machine tool comprising leading air carrying the mist to a precipitator, adding to the air in advance of the precipitator and in the form of a mist unoxidized oil of the same kind as in the mist generated by the machine tool, removing the mist from the air by the precipitator, collecting the mist removed by the precipitator, separating the partially oxidized oil from the unoxidized oil and returning the unoxidized oil to the machine tool.

5. A method of disposing of a mist of oil and partially oxidized oil generated by a machine tool comprising leading air carrying the mist to a precipitator, adding to the air in advance of the precipitator and in the form of a mist oil of the same kind as in the mist generated by the machine tool, removing the mist from the air by the precipitator, collecting the mist removed by the precipitator, separating the partially oxidized oil from the unoxidized oil and returning the unoxidized oil in the form of mist to the air moving from the machine tool to the precipitator.

6. A method of disposing of partially oxidized oil generated by a machine tool comprising leading air carrying the oil to a precipitator, adding to the air in advance of the precipitator and in the form of a mist unoxidized oil of the same type as was partially oxidized and removing the unoxidized and partially oxidized oils from the air by the precipitator.

References Cited in the file of this patent

UNITED STATES PATENTS

1,204,906	Schmidt et al.	Nov. 14, 1916
1,221,505	Bradley et al.	Apr. 3, 1917
1,944,523	Miller	Jan. 23, 1934
2,171,617	Wintermute	Sept. 5, 1939
2,426,817	Charlton	Sept. 2, 1947
2,586,242	Mathews	Feb. 19, 1952

FOREIGN PATENTS

941,057	France	Dec. 31, 1948
---------	--------------	---------------