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SMOKE SUPPRESSING SYSTEM FOR USE WITH MACHINE TOOLS

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Fig. 1.

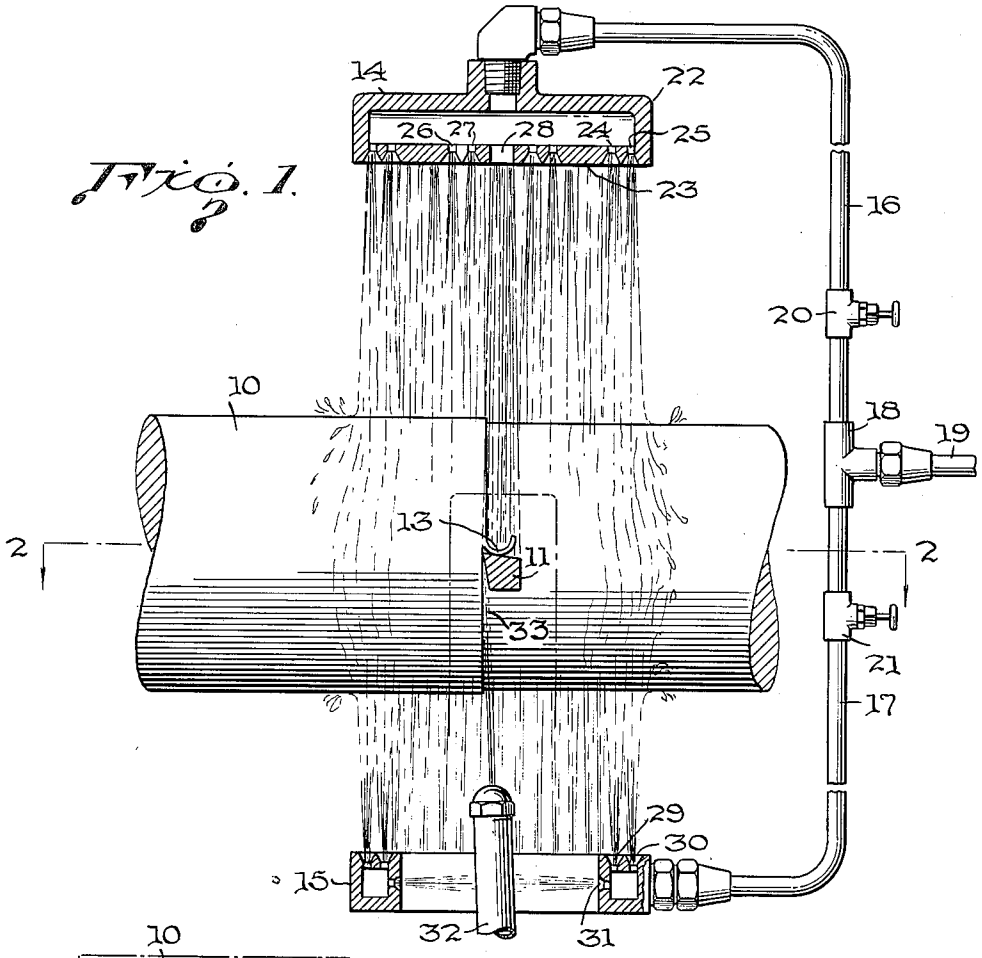
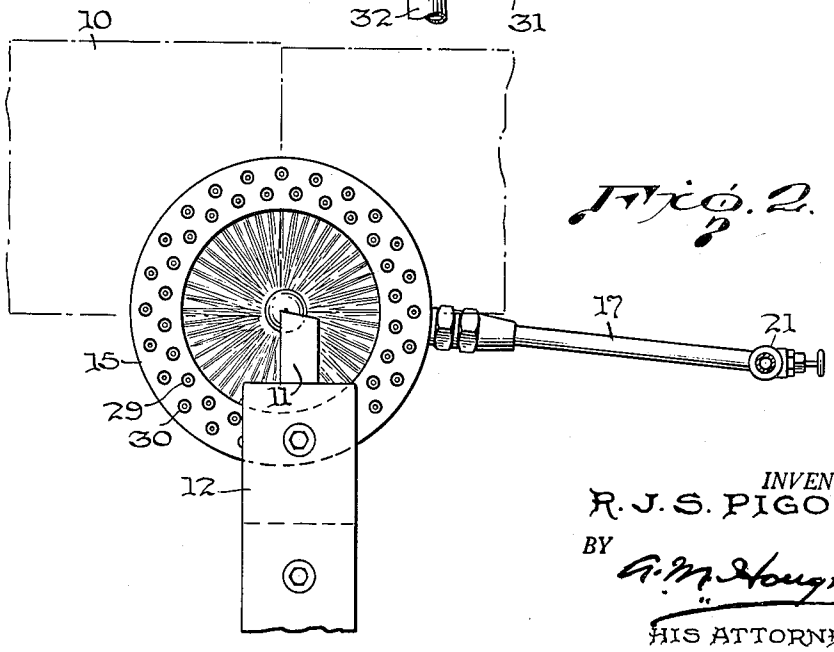


Fig. 2.



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SMOKE SUPPRESSING SYSTEM FOR USE WITH MACHINE TOOLS

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2 Claims. (Cl. 82—34)

This invention relates to a smoke suppressing system for use with machine tools. More particularly, the system is an accessory for lathes and the like, which comprises shower heads disposed above and preferably also beneath the cutting tool, receiving liquid from a connected source of supply and discharging it in an annular curtain which impinges upon the tool and work, and which envelops the region of the cut, so that smoke, vapors and fumes, as formed, are confined and immediately absorbed.

High heat is generated in the cutting and shaping of metals. In a lathe, for example, the tool engages the work under a pressure of the order of 50,000 pounds per square inch and the continuously removed chip rubs heavily on the surface of the tool. For many years it has been conventional practice to flow a solid, heavy stream of oil or other liquid coolant over the chip and tool shank in order to reduce their temperature. While this has been partly effective it does not serve to absorb the smoke which is produced on contact of the oil with the heated metal and where the smoke is excessive hoods, ducts and washers have been resorted to for alleviation of the nuisance.

In accordance with my invention disclosed in application Serial No. 228,843, which resulted from the discovery that oil flowing downwardly over the chip does not appreciably cool the highly heated tool or afford adequate lubrication of its cutting edge, a new system of applying cutting oil is provided wherein a small high speed jet of cutting fluid is projected from beneath the tool into the clearance space between the tool and work. The oil so placed vaporizes adjacent the highly heated cutting edge of the tool and passes as vapor through the microscopic clearances between the tool and work, to condense therebeyond and lubricate the edge and under surface of the chip. Tool life which previously had been limited in many cases to a matter of minutes has been increased by this new system 300 to 1200 per cent. But since the oil now reaches the hotest portion of the tool, close to the edge, more smoke is ordinarily formed than in the conventional practice wherein the highly heated cutting edge is shielded from contact with any appreciable amount of oil by the overlying chip. Thus, my present invention is not merely designed to suppress the smoke formed in cutting by conventional methods, but is also particularly desirable for use in the new method of applying cutting liquids described and claimed in my aforesaid copending application.

It is accordingly an achieved object of the invention to provide a smoke suppressing system which is compact, readily installed upon the machine and inexpensive as compared to installations employing hoods, ducts, washers, etc.

A further object of the invention is to provide a smoke and fumes suppressing system for use with machine tools in which an enveloping curtain of fluid surrounds and completely encloses the region of cut so as to confine and

absorb the smoke and fumes produced in a cutting operation.

Other and further objects and advantages of the invention will be apparent from the following description and drawings, in which

Figure 1 is a side view, partly in vertical section, showing the system as utilized in a turning operation on a lathe.

Figure 2 is a plan view of the lower shower head, taken along line 2—2 of Figure 1, with the work piece shown in broken lines.

Referring more particularly to the drawings, a rotating work piece **10** is shown being turned down to smaller diameter by a tool **11** which is clamped in tool holder **12** and which in its cutting action continuously removes a chip **13** from the work piece. Mounted adjacent the work piece, and desirably mounted on the carriage of the machine (not shown), so that it will move with the tool, there is a fixture comprising an upper distributor or shower head **14** and a lower distributor or shower head **15** connected by pipes **16** and **17** to a T-fitting **18** which communicates through pipe **19** with a source of fluid coolant. While oil is preferred as a coolant, the use of water or other liquid or gaseous medium capable of absorbing smoke and fumes is within the purview of this invention. Solely for purposes of description, however, liquid is specified as the fluid used.

Valves **20** and **21** control flow of the liquid in the branch pipes **16** and **17**. The upper distributor **14** which overlies the cutting area comprises a dished body **22** with a covering face plate **23** which is formed with two circular series of closely spaced orifices **24** and **25** adjacent its periphery, the orifices of one series being staggered with respect to those of the other, and a similarly arranged inner series of orifices **26** and **27** surrounding a larger center opening **28** positioned above the cutting edge of the tool.

The lower distributor or shower head **15** comprises an annular hollow member having two concentric series of staggered orifices **29** and **30** in its upper surface and an annular series of orifices **31** in its inner wall through which liquid is discharged laterally in converging streams, as shown more particularly in Figure 2.

Where the installation includes a small, high speed jet directed upwardly from beneath the tool a nozzle **32** is mounted to project through the curtain of spray discharged from the orifices **31** in the lower shower head, which nozzle discharges a fine, thin jet of liquid **33** into the clearance between the tool and the work, as shown in Figure 1. The lateral spray through which the nozzle **32** projects forms an effective smoke-impenetrable wall which forms the bottom of the liquid envelope surrounding the tool and work.

Liquid discharged from the upper shower head **14** flows downwardly in an annular, dense curtain which is impenetrable to smoke and fumes by reason of the fact that the orifices of the outer concentric series are closely spaced and in staggered relation. The annular curtain of liquid so discharged from the upper shower head has a tendency to spatter as it impinges upon the work, and in order to prevent escape of smoke and fumes due to this disruption of the curtain the lower shower head discharges a similar annular liquid curtain upwardly against the work. The merging streams from above and below form an effective liquid seal around the cutting edge of the tool. It is, however, possible in some cases to suppress smoke and fumes effectively by use of one distributor or shower head alone, instead of two discharging in opposition to each other, and my invention contemplates such an installation.

The central opening **28** in the upper shower head **14**

directs a heavy, solid stream of liquid downwardly over the chip and tool shank while the staggered series of orifices 26 and 27 direct additional sprays of liquid to the region of cut, to assist in the cooling action.

Since smoke which is formed in a cutting operation emerges principally from beneath the tool and rises around the work piece the enclosed chamber which is produced by the surrounding liquid wall not only serves to confine the smoke but to absorb it and wash it away as the liquid drains to an underlying sump from which it may be pumped and recirculated.

While it will be understood that my invention is not restricted in its applicability to a system employing a thin high-speed jet of cutting fluid, since it is equally desirable to suppress smoke where the older conventional methods of applying cutting fluid are employed, it will be apparent that this invention provides a simple and effective means of suppressing smoke which avoids the use of elaborate and costly accessory equipment such as hoods, blowers, ducts, washers, and the like.

It is also to be understood that wherever the word "smoke" is used in a general sense in the foregoing specification and in the claims it is intended to include within its meaning vapors and fumes which are produced in the metal working operation.

What I claim as my invention is:

1. A metal cutting machine comprising a work piece support, a cutting tool for traversing a work piece held in the support, a source of liquid supply, an upper liquid distributor positioned above the area where the tool engages the work and connected by piping to said source of supply, said upper distributor comprising an enlarged head having a face plate formed with a central opening overlying the point of cut and small, closely spaced orifices adjacent its periphery, whereby a heavy stream of liquid discharges through said central opening onto the chip formed in cutting and a spaced, surrounding liquid curtain is formed by the plurality of jets discharged from the peripheral orifices which encloses a space about the point of cut and thereabove, a lower liquid distributor positioned below the area where the tool engages the work and connected by piping to said source of supply, said lower distributor comprising an annular conduit formed with a series of closely spaced orifices directed upwardly toward the work and having in its inner annular wall a series of orifices discharging radially inward, whereby an enveloping curtain of spray will be discharged upwardly to merge with the descending spray from above, the liquid-walled chamber so formed by the upper and lower spray jets being closed at its bottom by the radially directed jets, whereby smoke produced in the cutting operation will be confined and absorbed by contact with the liquid sprays and chips from the cutting operation are removable at bottom without disruption of the seal provided by the radial jets.

2. A metal working machine comprising a work support, a cutting tool for traversing a work piece held in the support, a liquid distributor mounted to overlie the work piece in the region of its engagement by the tool, said distributor comprising a hollow cup-shaped body connected to a source of liquid supply and a face plate formed with a central orifice in vertical alignment with the point of cut and further formed with concentrically spaced orifice means for directing liquid in a downwardly flowing curtain impinging upon the work piece and tool in engagement therewith, a second distributor connected to said source of liquid supply and comprising a hollow ring formed with annular orifice means for discharging a curtain of liquid upwardly against the work piece and tool, and being further formed with orifice means in its inner annular wall for discharging liquid transversely of the ring, thereby to produce a smoke impenetrable liquid curtain which extends around the section of work piece being cut and which is boxed in at bottom without impediment to the washing away of removed chips.

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