

Sept. 6, 1955

A. BIBER

2,716,915

SMOKE SUPPRESSING SYSTEM FOR USE WITH MACHINE TOOLS

Filed May 9, 1952

2 Sheets-Sheet 1

Fig. 1.

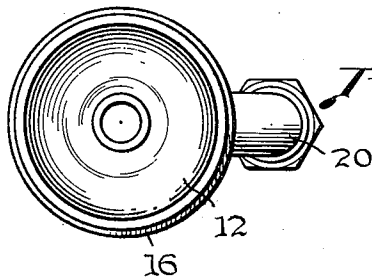
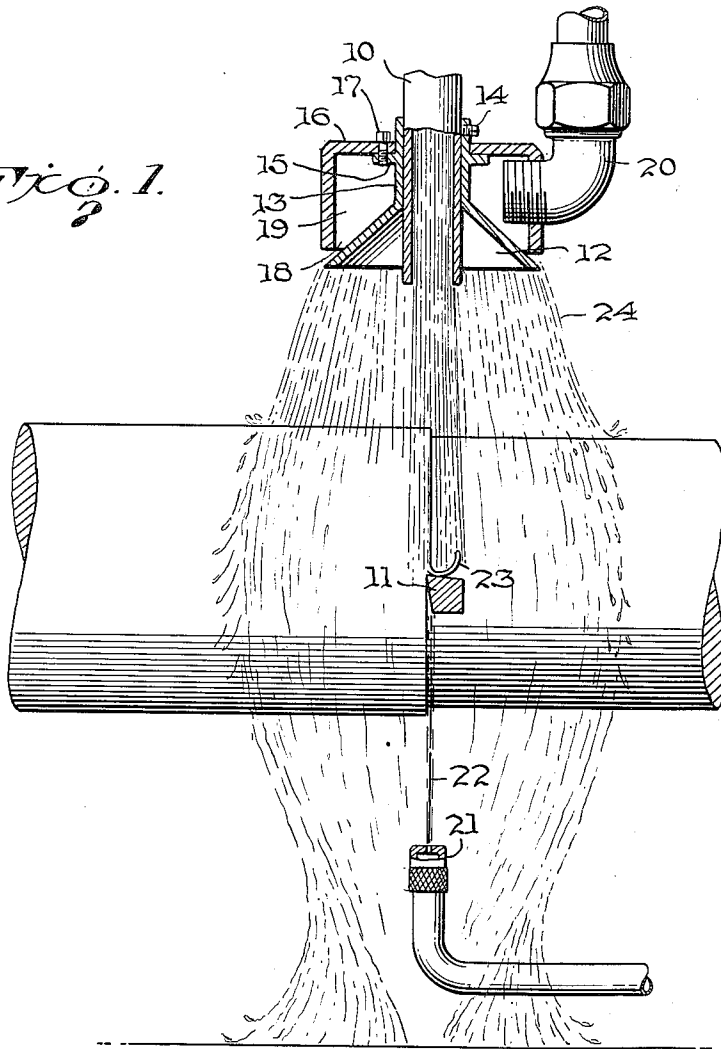


Fig. 2.

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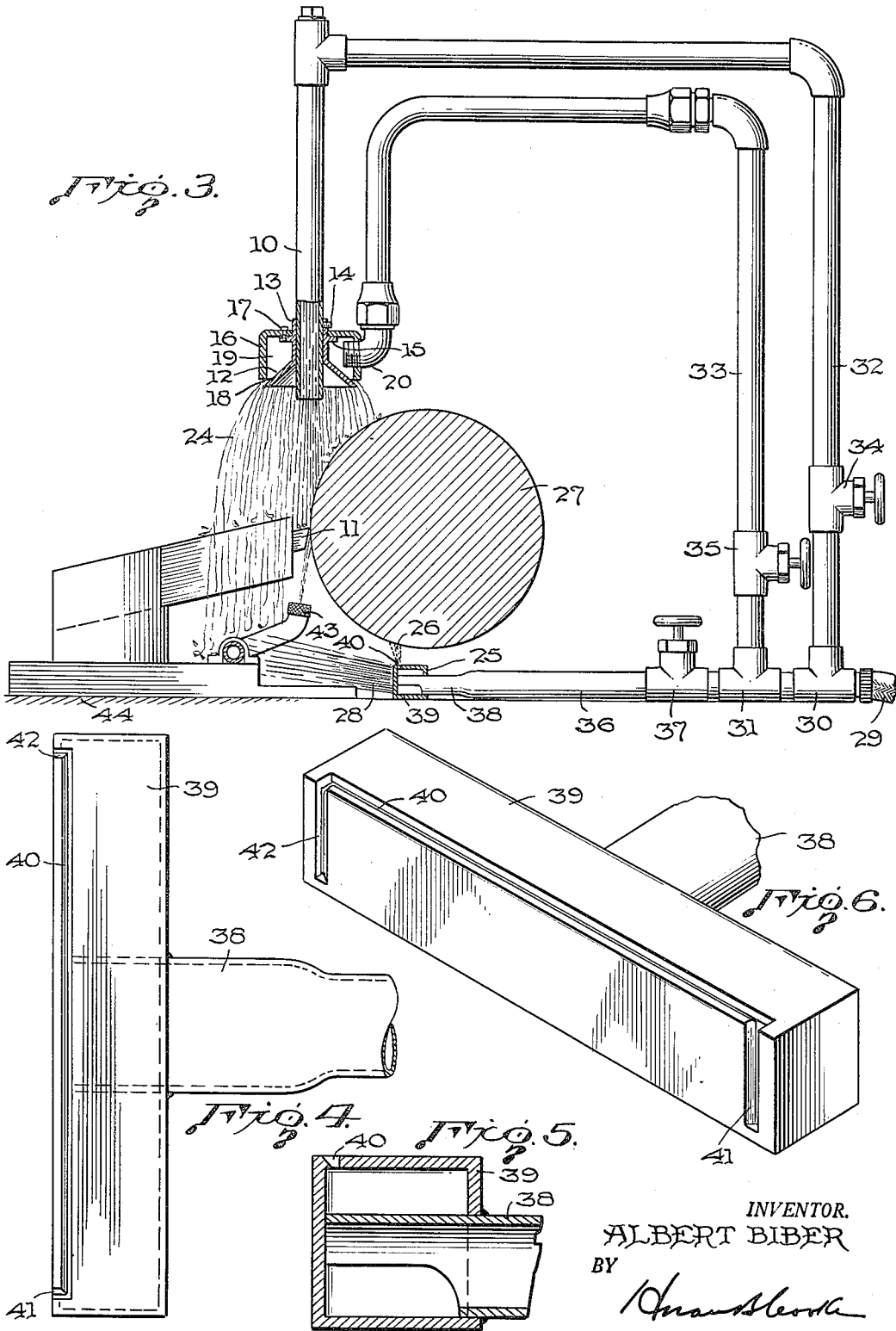
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SMOKE SUPPRESSING SYSTEM FOR USE WITH MACHINE TOOLS

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Application May 9, 1952, Serial No. 287,059

2 Claims. (Cl. 82-34)

This invention relates to a smoke suppressing system for machine tools, wherein an enveloping curtain of liquid is discharged over the cutting tool and work to confine and absorb smoke, vapors, and fumes which are produced in a machining operation. More particularly, the invention comprises a system of the aforementioned type wherein the liquid is discharged in a continuous sheet rather than in separate sprays, with the resulting formation of a thin-walled, bubble-like envelope which encloses the cutting area and which, in addition to being highly impenetrable to smoke is substantially transparent so that the cutting operation may be readily observed.

High heat is generated in the cutting and shaping of metals. In a lathe turning operation, for example, the tool engages the work at a pressure of the order of 50,000 pounds per square inch and the continuously removed chip rubs heavily on the tool. In order to reduce this heat and thereby prolong tool life it has been customary to flow oil or other coolant over the chip and tool shank, but because the chip overlies and shields the cutting edge of the tool the cooling effect of the cutting oil is largely confined to the chip and to the tool shank at an appreciable distance back from the cutting edge. Notwithstanding that little, if any, oil reaches the tool edge where temperature is highest an appreciable amount of smoke and vapor are produced on contact with the hot metal and this has not infrequently required the expensive installation of hoods, ducts, washers and the like to alleviate the nuisance.

In a new method of applying cutting fluid, disclosed and claimed in a copending application of R. J. S. Pigott, Serial No. 228,843, now Patent No. 2,653,517, issued September 29, 1953 a thin, solid jet of fluid is projected under high pressure into the space between the tool and work so that it reaches the cutting edge. But since the fluid now directly impinges upon the highly heated metal at the point of cut more smoke is formed than where the conventional overhead stream is employed.

In order to suppress the smoke it has been proposed to mount a shower head above, or both above and below, the cutting tool in order to surround the point of cut with a curtain of closely spaced sprays. Such a system is disclosed in the copending application of R. J. S. Pigott, Serial No. 272,670.

The present invention is an improvement over the device above referred to and has as an object to provide a liquid curtain in the form of a continuous, transparent sheet which permits observation of the progress of the cutting operation, and which tends to close at the bottom, as a bubble, thereby more effectively confining smoke, vapors and fumes with only a single, overhead liquid distributor. Furthermore, since such a system includes a distributor discharging a sheet of liquid, and hence circulates more liquid than where separate sprays are employed, smoke confinement and absorption are more readily achieved and small particles collecting around the point of cut are continuously washed away. Additionally, the high surface tension and smoother flow

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of the liquid discharged as a sheet rather than as individual sprays reduces its tendency to splash and scatter upon striking the work piece and tool, with the result that there is more secure sealing around those parts. Still further the annular orifice is not as susceptible to clogging as a multiplicity of small individual orifices and as a consequence the danger of partial stoppage and disruption of the enveloping liquid curtain is minimized.

The foregoing and other objects and advantages of the invention will be apparent from the following description and drawings, in which

Figure 1 is a side view showing the liquid distributor in vertical section.

Figure 2 is a bottom view of the distributor.

Figure 3 is a side view, partly in section, showing the system mounted upon a lathe carriage and provided with an underlying nozzle for discharging supplementary curtains of liquid upwardly upon the under side of the work and also toward the tool post, to form a bottom liquid wall.

Figure 4 is a top view of the nozzle shown in Figure 3.

Figure 5 is a vertical sectional view of the nozzle taken at midpoint.

Figure 6 is a perspective view of the nozzle.

Referring more particularly to the drawings, a pipe 10 which is directed to discharge cutting oil or other suitable fluid downwardly upon the cutting tool 11, has mounted thereon a frusto-conical member 12 having a tubular extension 13 which is secured to pipe 10 by set screw 14, and an outwardly extending annular flange 15 on the tubular portion 13 supports an inverted cup-like body 16 which is secured to it by screws 17. The depending rim of the body 16 is spaced from the flaring wall of member 12 to define an annular orifice 18 communicating with a chamber 19 within the body which is supplied with fluid by the pipe 20 extending through the side wall or rim.

Where the device is used with the aforesaid Pigott system of applying cutting fluid in a small, high speed jet, a nozzle 21 which may be conveniently mounted on the tool post of the lathe is directed upwardly, from underneath the tool to project a thin, solid jet 22 of the cutting fluid into the space between the tool and work on the opposite side from the chip 23.

Pipes 10 and 20 may conveniently branch from a common supply pipe as shown in Figure 3. A heavy, solid stream of the liquid issues from pipe 10 and pours over the chip 23 while the upwardly directed, thin jet 22 is applied from underneath the tool. Additional liquid filling the chamber 19 and emerging from the annular orifice 18 flows downwardly over the tool and work as a continuous, unbroken curtain 24 surrounding the point of cut and tending to close beneath the tool, as shown in Figure 1, thereby enclosing the space from which the smoke and vapors emanate.

In order to assure that the surrounding liquid curtain forms a complete enclosure, both at bottom as well as at the sides, the system may include an underlying nozzle 25, as shown in Figure 3, which produces an upwardly directed sheet of liquid 26 impinging upon the under side of the work 27, as well as spaced side sheets of the liquid, indicated at 28, to box the space beneath the tool. In this form of the invention, the cutting liquid is supplied by a pipe 29 having T-fittings 30 and 31 connecting to branch pipes 32 and 33 which, respectively, supply the pipes 10 and 20 of the liquid distributor. Valves 34 and 35 control the flow to pipes 10 and 20. A third branch 36 from the common supply pipe, controlled by valve 37, leads to an underlying nozzle between the machine bed and work, as shown.

The nozzle comprises a tubular inlet portion 38, the end of which projects into a rectangular head 39

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and which is cut away along its lower surface within the head to reduce obstruction to the flow and for more even distribution of the liquid throughout the head. An elongated, narrow slot 40 is provided in the top of the head 39, along its forward edge, which merges at its ends with vertical slots 41, 42 in the front wall, as shown in detail in Figures 4 to 6, whereby an upwardly directed sheet of liquid and spaced side sheets are discharged from the nozzle to form confining liquid walls beneath the tool in the region of cut. As shown in Figure 3, a nozzle 43 for projecting a thin stream of cutting fluid into the space between the tool and work may be employed as hereinbefore described, the whole assembly being mounted on the carriage 44 of the machine to move with the feed of the tool. Thus, the point of cut is surrounded by the liquid curtain as the machining operation proceeds and the upwardly directed jet is constantly trained on the point of cut without interference from the downflowing liquid since the jet nozzle projects through the curtain and into the confined space beneath the cutting tool.

From the foregoing it will be understood that the system of this invention may be usefully employed to suppress smoke, vapors and fumes where only a conventional overhead stream of cutting liquid is employed as well as where the cutting liquid is applied in a small, high speed jet as above described, or with a combination of the two, as illustrated in the drawings, and either with or without a supplementary nozzle for discharging liquid to close the curtain at bottom if this should be necessary in certain installations.

I claim:

1. In combination with a metal-cutting machine having a cutting tool, a liquid distributor positioned above the cutting tool and workpiece engaged thereby for discharging a curtain of liquid downwardly to surround the point of cut and spaced therefrom to provide a continuous liquid surface of large area within which smoke generated in the cutting operation is confined, a second liquid distributor extending beneath the work piece and

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comprising an elongated head provided with conduit means for supplying liquid thereto, said head being formed with an upwardly opening slot and communicating slots angularly related thereto at the ends thereof whereby liquid is discharged from said head in sheets which substantially box the space beneath the point of cut.

2. In combination with a metal-cutting machine having a cutting tool, a liquid distributor positioned above the cutting tool and work piece engaged thereby for discharging a curtain of liquid downwardly to surround the point of cut and spaced therefrom to provide a continuous liquid surface of large area within which smoke generated in the cutting operation is confined, a second liquid distributor extending beneath the work piece, said second distributor comprising an elongated head positioned longitudinally of the work piece and formed with an elongated slot through which liquid is projected upwardly in a sheet against the under side of the work piece, said head further being formed with forwardly facing slots angularly related to said first-named slot and communicating therewith at its ends for boxing the space beneath the point of cut by spaced sheets of liquid merging with the upwardly projected sheet, and a conduit for conveying liquid from a source of supply to said elongated head.

References Cited in the file of this patent

UNITED STATES PATENTS

465,533	Morse	Dec. 22, 1891
1,100,845	Richter	June 23, 1914
1,832,104	Drake	Nov. 17, 1931
2,387,345	Pearl	Oct. 23, 1945
2,418,646	Janson	Apr. 8, 1947
2,489,437	Sandoz	Nov. 29, 1949
2,541,057	Henroteau	Feb. 13, 1951
2,643,867	Schneible	June 30, 1953

FOREIGN PATENTS

208,032	Switzerland	Dec. 31, 1939
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