

A New Idea

in

FIRE FIGHTING

**AIR
BLAST
LINE
BUILDING**



**BULLETIN 725
FEBRUARY, 1959
UNIVERSITY OF MISSOURI
AGRICULTURAL EXPERIMENT STATION**



A New Idea in **FIRE FIGHTING**

J. Milford Nichols and Lee K. Paulsell

Using forced air to build fire lines by blowing away ground litter is a new idea in forest fire control that has had considerable attention in the past few years.

Research workers with the University of Missouri School of Forestry have tested two types of blower equipment developed for this job.

One is the tractor-mounted axial flow blower. The other is a hand-propelled unit. (See cover photos.) Both of these are modifications of equipment that was already on the market for other uses.

The axial flow blower is the main component of spraying and dusting equipment manufactured by a New York company. The hand-propelled unit, called the "Lo-Blo" by its manufacturer, was designed for sweeping golf greens, parking lots, and factory floors.

All references to air volumes and velocities are based upon manufacturers' specifications and no attempts were made to measure them in field testing the equipment.

Tractor-Mounted Axial Flow Blower

The axial flow blower was tested on a John Deere Model 420 crawler tractor of 24 drawbar horsepower. A V-belt drive transmitted power to the blower from the high speed power take-off. In this preliminary test there was no clutch to permit disengaging the blower. At full throttle of 1850 r.p.m. engine speed, the blower speed was 4400 r.p.m. However, the power of the tractor proved to be limiting and 4200 r.p.m. was the maximum blower speed possible. At this speed, air volume through the blower was 12,000 cubic feet per minute and air velocity was 150 m.p.h. Ground speed of the tractor was 0.75 m.p.h. in first gear and 2 m.p.h. in second. On a steep grade the tractor did not have enough power in second gear to pull itself and operate the blower properly. In first gear there was no appreciable difference in ground speed between uphill and downhill travel.

Testing was done under a wide variety of terrain and litter conditions. Terrain was not a limiting factor and excellent fire line 4 to 8 feet wide was built except where grass covered most of the ground. The air blast broke off and moved much of the grass, but considerable follow-up work was still necessary.

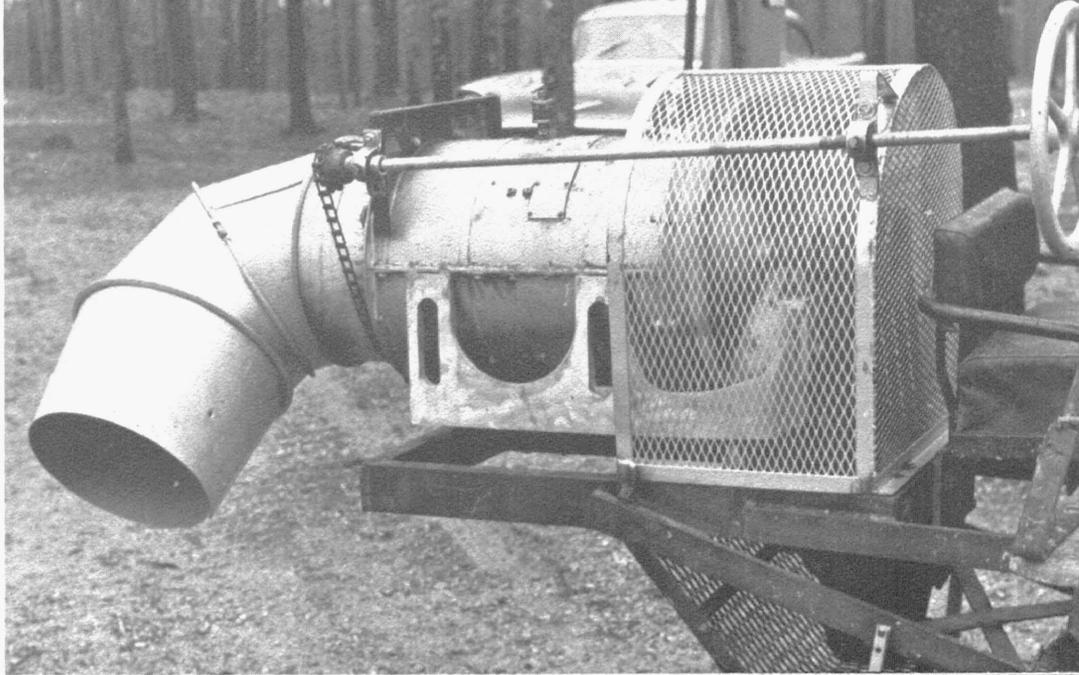
Where the litter consisted of hardwood leaves, twigs, and pine needles, scarcely any follow-up cleaning was needed. The widest line was built over rocky ground. Effective width was up to ten feet.

In one phase of testing, the tractor was operated in reverse at a ground speed of 1.5 m.p.h. This proved to be a good speed for general operation. One joint of the blower pipe was removed so the air blast hit the ground at an angle of approximately 45 degrees instead of almost straight down as in other tests. This was difficult because saplings and tree tops, which would cause no trouble in forward movement, would damage the nozzle. The operator had to choose his path more carefully. The line built this way (traveling in reverse) with the air blast directed in the direction of travel, was the same width and cleaner than the line built at half the speed traveling forward in first gear.

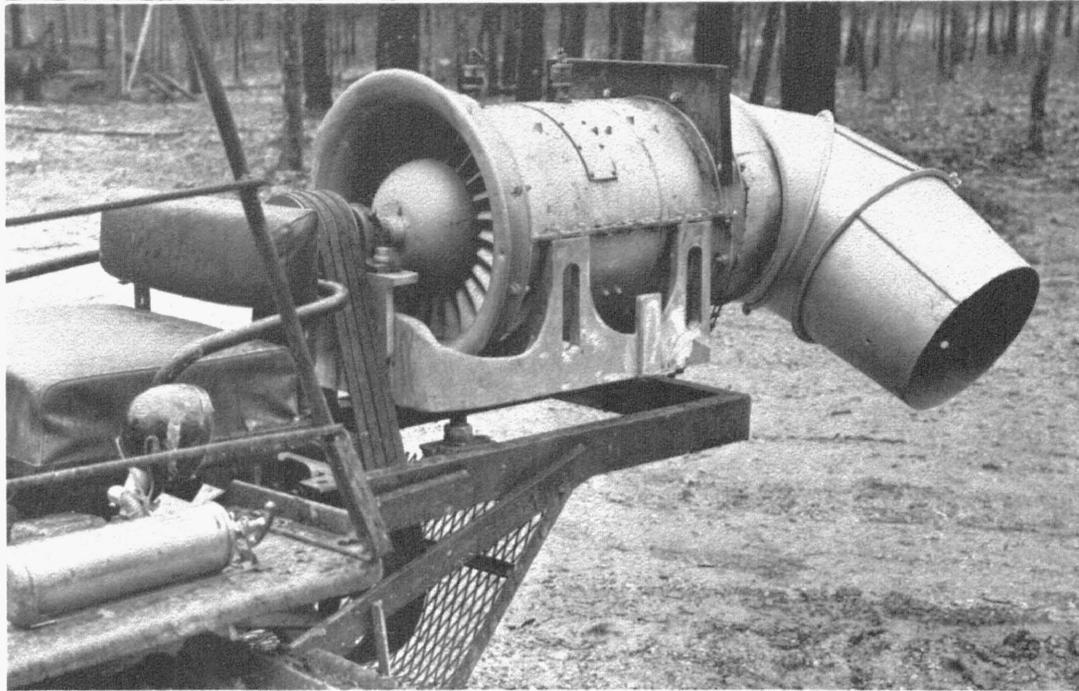
This axial flow blower is equipped to be used for dusting and spraying by adding a dust bin or spray tank. The manufacturer estimates the cost of the blower adapted for fire control work at about \$700.

*Cover photos—(Top) The hand-propelled "Lo-Blo".
(Bottom) Operator demonstrating force of the air blast from the tractor-mounted axial flow blower.*

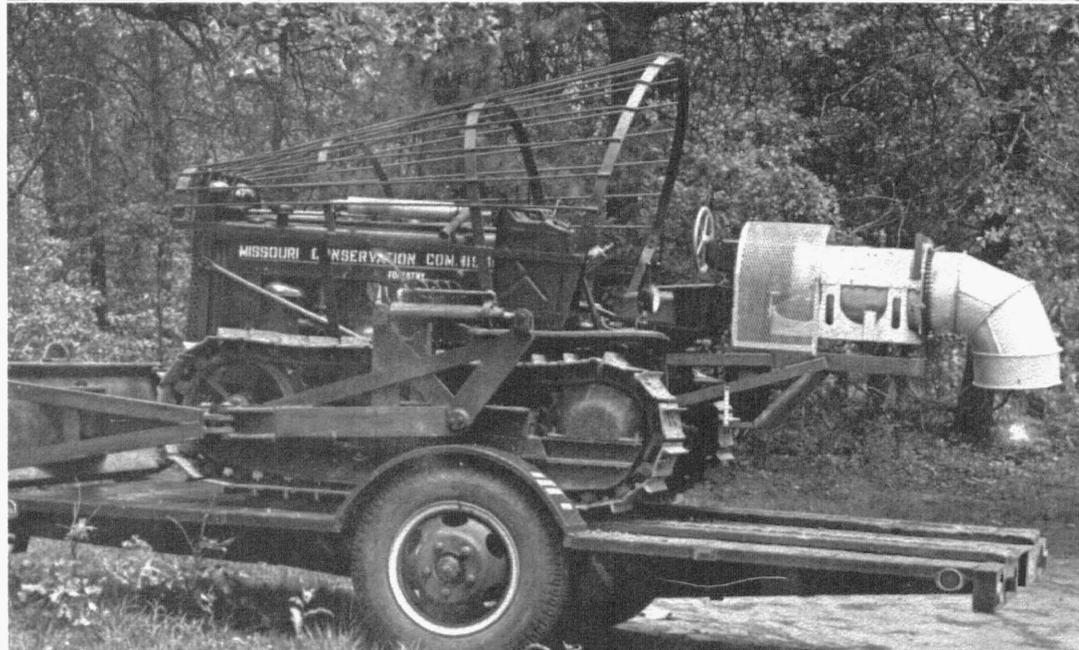
Axial flow blower. Control wheel on side of blower permits operator to rotate nozzle to blow to either side.



Axial flow blower with protective shield removed, showing fan and V-belt hook-up.



Axial flow blower mounted on Model 420 John Deere crawler tractor. Photo shows means of transportation to fire scene.





Heavy hardwood litter four inches deep on an area which had not been burned for 20 years. Note heavy accumulation of dead twigs and limbs.



Blower crossing area shown in picture above at a speed of 0.75 mph. Air blast cleans leaves from around sprouts. Debris in motion indicates power of air blast.



Completed fire line more than six feet wide across the area.



Force of air blast can be seen in close-up view of hand-propelled Lo-Blo.

Hand-Propelled “Lo-Blo”

The Lo-Blo was adapted from a model with the air outlet parallel to the ground and with small wheels for use on hard surfaced areas. Twenty-inch bicycle wheels with puncture-proof tires were added and the air outlet was angled toward the ground to give more cutting action. The wheels are offset, making it easier to climb the unit over limbs, rocks and other obstructions.

The blower is attached directly to the 3 h.p., 4 cycle, aluminum motor and turns at a maximum of 3600 r.p.m. At this speed the air velocity at the nozzle is approximately 125 m.p.h.

The unit weighs 59 pounds. With a heavy duty 4 h.p. motor the weight would go to above 80 pounds.

This unit was tested under a variety of conditions and its predecessor was used on several fires. Average width of the fire line it built was two feet.

The tool can either be pushed or pulled. The effective width of line was increased when the operator pulled the unit and scuffed the leaves with his feet ahead of the blower. Where the leaves were packed it was difficult for the air stream to break through to the ground.

With the “Lo-Blo”, one man can build line about as fast as three men with broom rakes and will not tire as quickly. Field tests indicated that two units operated one behind the other, with the second slightly offset from the path of the first, will make line three times as wide as a unit operating singly.

The Lo-Blo is very easily transported in either pick-up truck or jeep. It runs for more than two hours on one tank of gasoline. Maintenance would be confined to the motor. This should seldom present a problem. The manufacturer estimates the retail price at about \$175.



Lo-Blo being pulled up a steep slope.
Axe illustrates width of line.



Side view of Lo-Blo being pulled up steep slope.

Pros and Cons of Air-Blasted Fire Lines

1. Both blowers described here operate successfully in rocky terrain which often limits use of plows and 'dozers. The blowers are not as effective as plows in grass areas.

2. Erosion problems often common to plowed lines are eliminated through the use of blowers.

3. Lines made by the blowers are not unsightly or objectionable to farmers or other landowners.

4. Upkeep on the blowers should be a minor item, but accurate adjustments are essential.

5. In areas where permanent fire lanes are maintained, such as on experimental forest areas, blowers can be used effectively to clean existing lines periodically. Continued use of 'dozers on these lanes soon results in undesirable deepened troughs subject to erosion.

A Look Ahead

Both tools described are still in the developmental stage. However, they both show promise as valuable additions to fire fighting equipment, particularly in the hardwood regions of the United States.

Further improvements are planned. The Lo-Blo needs a better spring tine scratcher to help the air blast break through litter to the ground. More work is needed on the nozzle angle, particularly in determining the most effective angle for the air to strike the ground.

A major change is planned for the tractor-mounted unit if funds are available. The blower will be turned around and mounted beside the operator so the air blast can be directed to the front of the tractor. This will shorten the entire unit, make it more maneuverable and permit the operator to choose a good location for the fire line more easily. Now the operator must pick the way for the tractor so the blower can do its best job to one side or the other of the tractor path. As found by running the tractor in reverse, the blower is more effective, even at greater ground speed, when operated in front of the tractor. A small V-blade is planned as a substitute for the wide 'dozer blade. This could be used in conjunction with the air blast to move tree tops and other obstructions and also to make a line through grass covered areas.

The authors hope that these refinements can be made and will welcome suggestions for future improvements or applications.



Line built with the Lo-Blo up a severe slope. Blower is hidden from view.

ACKNOWLEDGEMENT

The authors are indebted to Mr. Don S. Culbertson, General Manager of the Buffalo Turbine Agricultural Equipment Company, Inc., Gowanda, New York, manufacturers of the tractor-mounted axial flow blower, and to Mr. B. P. Strong, General Manager of the Atwater Strong Company, Atwater, Ohio, manufacturers of the hand-propelled "Low-Blo" unit, for the use of their equipment and for their developmental work in adapting their equipment for use in fire fighting. Personnel of the Forestry Division, Missouri Conservation Commission, assisted materially by furnishing equipment and shop facilities. Personnel of the U. S. Forest Service assisted in testing work.

This bulletin reports on School of Forestry Research Project 290, "Fire Control." Successful tests of the forced air clearing method were conducted at the University Forest, experimental area of the School of Forestry, in 1953. These tests were reported in the Journal of Forestry, Vol. 52, No. 12, page 943. The interest in preliminary tests prompted further work and this bulletin is a report on the results.

Back cover photo courtesy Missouri Conservation Commission, Don Wooldridge.

Fire fighting is a dirty, difficult, dangerous job. Laborers won't work at it with hand tools if they can find better employment. Stand-by crews are expensive. Men wear out.

The trend in recent years is toward smaller, faster, well mechanized crews. Machines can do the fire line building job more quickly and efficiently than manpower can do it alone.

Test data on two successful air-blast line building machines tested by the University of Missouri School of Forestry are described in this bulletin.

