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by

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The Canadian Forestry Service Flying Drip Torch

Background

It is unfortunate that the man who started the flying drip torch revolution, John Muraro, formerly a fire research scientist with the Canadian Forestry Service, P.F.R.C., is not here to present this paper. Having worked with John for four years and being one of the four people present in the Prince George motel room in 1973 when John proposed the idea, I was asked to fill in for John and give you an idea of the thought behind the drip torch development.

To make a long story a little bit shorter, I have scoured through my slides to show how the drip torch evolved.

The first six slides show the more conventional methods of slash disposal by hand ignition of some of the fuel complexes encountered in British Columbia. Some of these pictures are fifteen years old and logging practices have changed quite a bit since then. The danger of being injured and trapped inside a fire remains.

Through extensive use in slash burning and in spite of efforts to find a more suitable ignition device, the hand drip torch always seemed to give the best results with a minimum cost and fatigue to the person using it. The continuous line of fire made it ideal for burning from a control line.

John's original concept was to just make a larger drip torch and hang it from a helicopter. It seemed like a good way to get the ignition system elevated above the fuel complex to improve safety and efficiency.

The Prototype Drip Torch

A prototype drip torch, was designed and built in Northwood Pulp and Paper service shop in Prince George in August 1973. The basic frame work was 2" right angle black iron with a 10 gallon drum for the diesel-gas mixture. A quick-disconnect fitting was used to enable the rapid changing of an empty barrel for a full one. Fuel was conducted through a one way flapper valve, a manual gate valve for fuel volume control, and an electric solenoid valve for on and off control. From the valves the 1/4 inch black pipe was bent to form a flashback loop before entering a small shrouded nozzle that dropped the diesel-gas mixture onto an asbestos pad that was to act as a wick to supply ignition.

We tested the torch over a clay bank and it appeared to work reasonably well, so we took it out to the airport to see if it would fly. It had a tendency to twist and turn as it flew and we decided to work on that aspect later, but first the operational test was attempted. John's exuberence was a bit premature as he had lined up about 40 people to witness the first operational test of the flying drip torch only to find that the torch would not stay lit. The roter wash from the helicopter kept blowing out the flame in the nozzle head. Although the demonstration was an embarrassment, the concept had been made public and some observers could see merit in the torch.

Back at the drawing board we added a fin for stability and worked on the nozzle end of the torch. The next test was conducted without observers and as luck would have it, this torch worked reasonably well. A successful slash burn was then demonstrated on a 200 acre block in the Summit Lake District near Prince George. During September and October 1973, Northwood using Northern Mountain Helicopters burned 2200 acres of slash with this torch.

The performance of the drip torch was so encouraging that two additional models were constructed by the Prince George and Kamloops forest districts in the fall of 1973. Although little operational use was made of these units they allowed further non-operational trials. A cooperative development project was initiated by John Young of the B.C. Forest Service and Okanagan Helicopters in the fall of 1973.

While we were developing the burner head and working on the efficiency of the torch inflight stability had been accomplished on the BCFS-Okanagan torch by using a hockey stick shaped stabilizer bar to keep the torch from twisting.
18 This was set in place while the helicopter hovered overhead. Other significant developments on the BCFS OK torch were fuel flow control with a motorized gate valve and electronic ignition.

19. On our torch stability and rotor wash remained a problem and it was felt that if we hung the torch vertically, we could solve both problems. As our field operating budget was already strained, we improvised and used the Pacific Forest Research Centre's skyworker [20] as a helicopter [21] and "flew" [22] the torch around in a gravel pit. [23+24+25+26] We had made some modifications to the burner head by incorporating a preheating bend in the outlet tube and shrouded the nozzle to prevent the rotor wash from cooling the burner. Shortly after the gravel pit testing, we travelled to Golden to burn some slash for Evans Products Ltd.[27] The next slides are of an area in the Beaverfoot burned using the small vertical torch.[28,29,30,]

Unfortunately the train of thought was altered from a portable, use any model of helicopter type of torch, to a 45 gallon capacity torch with increased ignition time. Refuelling the larger torch takes longer as the fuel has to be pumped into the empty torch from a tank [32] mounted in the back of a truck or as most often is done the torch is set down [33] beside barrels that have previously been dropped off. Refuelling operations are often one of the most dangerous as very few people take the time to properly electrically ground the apparatus. Transportation of the larger torches becomes a problem, several men are necessary to load even an empty torch into a truck. Flying speed is reduced when slinging the larger torch and the ferrying costs to widely separated areas is increased as a result. The most important disadvantage of the larger torch is the added weight. Some pilots do not like to have the slash burning officer in the helicopter as the added weight and distraction make the job of flying the helicopter more difficult. Blank.

The advent of the flying drip torch has had a significant effect on the helicopter industry and as a result many small companies fabricated torches of their own design to cash in on the extra hours of flying time relating to slash burning.

An unpublished rough manuscript and drawing of our small torch was one of the most widely distributed reports of 1973, some photocopies finding their way to Australia and New Zealand. Working drawings of the BCFS-Okanagan torch were published in a final report by Fielder in 1975.

Through the development and use of the flying drip torch we have learned some valuable lessons about fire use and control. The more important are:

(1) Efficient use of the drip torch requires good planning and ground support to provide extra fuel for both the torch and the helicopter.

(2) Aerial ignition should be planned to include as large an acreage as possible in the same trip to write off ferry time, either on one large block or a number of small blocks.

(3) The removal of responsibility for the ignition pattern from the pilot allowing his total concentration on the flying of the helicopter by having the

slash burning officer in the helicopter operating the torch and in direct control of the ignition.

The Diesel Prototype

Safety considerations forced us to take a new look at the torch. In the fall and spring of '77, '78 the Pacific Forest Research Centre felt a moral obligation to develop a safer more efficient torch. The conventional torches as they have been referred to use a 50% gas-diesel mix and some have been used with straight turbo fuel. We felt that possibly we should try for a torch that used straight diesel fuel. Diesel fuel has a much higher flash point than gasoline and without some form of preheating is more difficult to ignite. Effects of forward speed and rotor wash will not permit effective use of pure diesel fuel in a conventional flying drip torch. Various nozzles [34] were instrumented with thermocouples for measuring the temperature of the preheated diesel fuel and [35] recorded in conjunction with a video recorder to determine the temperature diesel fuel had to be heated to in order to drop the fuel in an ignited form from a helicopter. An elaborate beam [36] system [37] was [38] constructed and attached to an old truck and was dubbed the "International Helicopter". We used the "International H" in our initial design and testing phases of the project, amid much ridicule from P.F.R.C. staff.

Our final nozzle is a 20 foot [39] length of 3/8" I.D. steel pipe bent in a 3" diameter coil. Diesel fuel is pumped through the coil by a high performance electric fuel [40] pump from a dragster. Propane, [41] turned on and controlled with a solenoid valve is used to preheat the diesel fuel by means of a 75,000 B.T.U. torch with the flame directed through the center of the coiled nozzle. Ignition of the propane is accomplished with a modified transistorized [42] ignition system connected to a spark plug on the nozzle [43] housing.

The entire torch is easily handled by two men and can be readily refueled in seconds by means of a quick disconnect coupling and replacing the empty drum with a full one. Control involves 1 switch to turn on the propane, 1 push button to ignite the propane and 1 switch to turn on the diesel fuel pump.

As soon as we had the basic performance features we were looking for, we graduated back to the lab's skyworker for some higher elevation testing. Our very limited flight testing of this torch has not been sufficient to enable a concrete evaluation on the maximum or minimum height that we can successfully operate. The torch will operate for 20 minutes with a 10 gallon drum.

At the present time our involvement in further development of the drip torch has been placed in limbo. Possible addition of a built-in remotely operated fire extinguisher has been suggested. Much controversy has resulted in a lack of clarification of regulations covering aerial drip torch operations and has been one of the reasons we have suspended further development. Another factor was the further development of the AID dispenser and its possible use for slash burning. That however, is another story that will be covered later.

References

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