

Wildfire Research Update

Welcome to our latest Wildfire Research Update.

Previous updates were published under the name Rural Fire Research.

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Powered back-pump

Firefighters traditionally use a backpack pump (back-pump) for fire suppression in slow-spreading fires in light fuels. The back-pump can be carried into remote places where hose access is difficult. Water from a back-pump supplements dry firefighting techniques and is especially good for mop-up operations. The pump (trombone) is hand operated and ejects a solid stream of water. Back-pumps are also used when fuels are heavier and heat from the flames prevents the firefighter from working close to the flame front. Trombone back-pumps can be difficult to use accurately but are relatively simple to repair and maintain.

To make the back-pump system easier to use Scion researchers replaced the manual trombone pump with a battery powered water blaster and tested it for accuracy in a simple trial. When

assessed for water spraying accuracy the battery powered back-pump was superior to the trombone pump. To date, the battery powered back-pump has been successfully used at two real fires by firefighters in isolated areas with no hose access. The unit was particularly good at wetting down smouldering fence posts because the water could be directed accurately at the burning material with little wastage. The unit was also used to extinguish burning embers dug out of the ground. Long term tests are underway to assess the battery powered pump's utility as a firefighting tool and to assess the robustness of the electric pump under normal operational use.



Firefighter using a trombone pump in steep and difficult conditions.

History – The Smith Indian Fire Pump

The Smith Indian Fire Pump was introduced to the US Forest Service in 1925 and is the first known brand used specifically for wildland fire fighting. Historical background¹ states: “In early 1926, District Ranger Ernest Blue, headquartered at Cold Brook, approached the D B Smith Co of Utica NY, manufacturers of agricultural sprayers since 1888. The collaboration between Blue and D B Smith resulted in making minor modifications to one of their existing products, and resulted in an effective pump for combating forest fires. Known as the Smith Indian Fire Pump, after rigorous testing, the Conservation Commission purchased six hundred units with federal grant monies for the Clark-McNary Act. Subsequently, four years later the now Conservation Department would have 2000 Smith Indian Fire Pumps on hand.”

**The Smith
INDIAN
Fire Pump**

is the most effective fire fighting equipment for camp, ranch, hotel, cabin, etc. Uses only clear water, 5 or 7 gal. tank straps on back like a pack basket. Brass pump throws with ease, powerful 50 ft. stream. Built strong. Choice of forest rangers. Greatest protection at lowest cost. Prompt shipments made anywhere.

COMBINATION BRASS NOZZLE FOR 50 FOOT STREAM OR LONG COARSE SPRAY

NEW COMBINATION HANDLE FOR CARRYING TANK AND FOR HOLDING PUMP

1 Pat. applied for

STRONG AND DURABLE

TANK MAY BE CARRIED IN THE HAND OR ON THE BACK

EXTRA HEAVY TANK IS CURVED BY SHAPE TO FIT BACK, SHOULDER AND HIPS

ALL TANK JOINTS LOCKED AND SOLDERED

BUILT STRONG

Patented

Illustrated folder, price list and copies of testimonials sent on request.

D. B. Smith & Co. 411A Main St. Utica, N. Y.
Pacific Coast Agts. Fire Protection Eng. Co.,
369 Pine St., San Francisco, Cal.

Early fire pump advertisement.

Project background

Vegetation fires are often fought in locations where water is scarce, such as in the high country. On other occasions water cannot be taken to the fire because helicopters, tankers or fire appliances are not available. In these situations, the firefighter must carry their own water in a 20-litre backpack on their back. Often the water is not used for ‘initial attack’ - extinguishing flaming vegetation - but for ‘mopping up’ - extinguishing smouldering vegetation and organic material in the soil after the flames have been extinguished. The firefighter works methodically across the fireground searching for heat with bare hands or a thermal camera. Smouldering material is dug up, or cut open if it is a log, and exposed, then left to burn out or extinguished with water.

Problem

It is difficult for the firefighter to direct water at a hot spot (smouldering organic material) while using a trombone pump. Training material² states “Accuracy is achieved by keeping the hand on the piston handle stationary while pumping with the other hand at the base of the cylinder. The nozzle stream is directed with the hand on the piston handle.” Easier said than done. Considerable skill is required to keep the nozzle directed at the target while pumping. Some of the water never hits the target and is wasted. The correct method is to crouch low to the ground and get the nozzle close to the hotspot. A full backpack with 20 litres of water can unbalance the firefighter³ especially on steep terrain. Water often leaks out of the top of the backpack and down the firefighter’s back – both wasteful and uncomfortable.



Trombone pump.



Powered pump extinguishing a smoldering fence post.

Solution

The trombone pump was replaced with a commercially available battery powered water blaster. This allowed the firefighter to direct the high-pressure jet of water directly at the burning material with reduced water wastage. The battery powered water blaster also has an adjustable nozzle for a narrow high-penetration jet or a broader fine mist to cool embers.

Testing

Accuracy of the powered pump was tested against the conventional trombone pump by three users who sprayed an equal volume of water from each pump at a target three metres away. The target was seven cups arranged in a circle and the pump users aimed at the centre cup. The volume of water in each cup was measured.



Target made from seven cups.

Results

Accuracy

Users were more accurate with the powered pump, on average getting 73 ml of water into the middle cup compared with 20 ml using the trombone pump. Pumping at the same time as aiming is difficult with the trombone.

Distance

In a test of absolute distance sprayed the trombone pump projected water farther (eight metres) than the powered pump (four metres). With a greater nozzle diameter, the trombone water jet had more volume than the powered pump.

Endurance

The 4 Amp hour powered pump battery had the capacity for six bags of water (120 litres) before the battery was flat. The trombone pump is limited only by the endurance of its human operator.

Additional comments

Users found the powered pump easy to use and accurate. They could 'hunt' for hot spots by listening to the change in sound as the water spray quenched burning material in the soil. This did not seem to be a feature users reported when using the trombone pump. The trombone pump can put a greater volume of water further, but it is difficult to aim accurately. The two pump units were a similar weight (approximately 4 kg).

Specifications

The water blaster (powered pump) used was a WORX WG625.4; 20V Cordless Hydroshot Portable Power Cleaner.

Conclusions

The conventional trombone hand pump is difficult to use unless the operator is skilled. The bent stance required to correctly place the nozzle close to the burning material is unstable and often results in water flowing down the neck of the firefighter.

The battery powered pump enables the firefighter to direct a precisely controlled amount of water directly at the burning material with little wastage. The stream of water can be a narrow jet for penetration or, by adjusting the nozzle, a broad, fine spray for cooling embers.

The major disadvantage of a battery powered pump is the need for recharging. A single charge of the 4Ahr battery was sufficient for six bags of water (120 litres). We are continuing to test the powered pump system with firefighters at more fires to fully assess its utility as a firefighting tool.

Acknowledgements

Thanks to the firefighters who provided advice, encouragement and trialled the pumps.

Further information

- ¹ Hartmann, P. (2023). Birth of the Indian Tank. New York State Forest Fire Lookout Association. <https://nysfla.org/links.html>
- ² Nova Scotia Department of Natural Resources <https://novascotia.ca/natr/forestprotection/wildfire/bffsc/lessons/lesson4/backtank.asp>
- ³ Chen, J., Li, W., & Ma, L. (2009). Effects of water bag of forest fire suppression hand pump on body balance. Computational Intelligence and Design, International Symposium, Changsha, Hunan, China, 2009 pp. 429-432.



Powered pump extinguishing a hot spot.

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