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A CAST-IRON HAND PUMP IN WINSTER SOUGH, DERBYSHIRE

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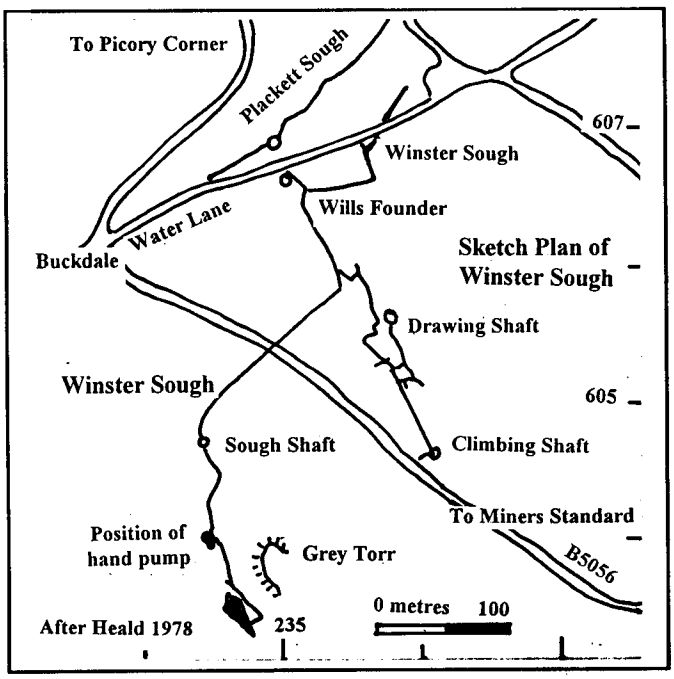
Abstract: The construction-details of a cast-iron, hand-operated water pump in Winster Sough is described. It was probably used in the mid-19th century. Associated finds suggest the use of a capstan-type windlass and modify previous ideas on the use of a windlass from Wills Founder Mine now in Peak District Mining Museum.

The hand-pump was probably first re-discovered by the North Staffordshire Mining Club in their exploration of Winster Sough (Heald 1978), though they did not remark on it in their published account. It was again noted by Peak District Mines Historical Society members during the raising of the Wills Founder water pressure engine (Willies 1977) and its pumps (Riley 1979) which are now exhibited at Peak District Mining Museum. It was intended to record it on the latter occasion, but an unfortunate accident to the cameras caused postponement. The pump again became the focus of attention in May1994 following exploration of the sough by members of "Operation Mole", taking advantage of the unprecedentedly dry summer. Recording was carried out by John Wilmot, Paul Deakin and the writer on 4 November 1995.

Winster Sough was driven in the late 17th century from the lowest part of the valley of Ladydale north-west of Winster village. It runs roughly parallel to Placket Lane and Water Lane until it intersects the vein near Wills Founder, after which it follows a hading joint or is driven using pick-and-wedge, forming a typical "coffin level" towards Grey Tor and beyond. A century later the Placket Branch of Yatestoop Sough was driven at some 140 feet (43m) deeper at Wills Founder and in the mid 19th century this difference in level was used to provide a head of water for the Wills Founder engine, operating there around 1845-55, with the discharge into the Plackett Branch.



The winch-descent of 170 feet (51.7m) was made via the Drawing Shaft (SK 2358 6056) for about 55m, followed by a scramble in pipe workings to the full depth on the vein, around 220 feet (67 m). Here there are remains of the launders which took water from Winster Sough across mined cavities: sad to report, they have deteriorated a great deal in the 20 year interval, so that little more than calcreted shadows now remain.

The coffin level section which ranges south west has become very silted, so that much needs hand-and-knees crawling whilst a section near Sough Shaft has collapsed, but a detour can can be made via the workings above. Corners on the sough have been widened by black-powder blasting, which might be interpreted as being for the pipework of the pump to pass, though it is possible some (smaller?) parts were brought down Sough Shaft. This shaft does not have a direct drop and an alternative route would be a further shaft higher up the sough.

The pump is found some 4 metres from the sough in a small working about 77 metres south west of Sough Shaft. The working has two shafts in the floor, separated by a ledge, descending about 8 metres to irregular workings below, which normally have some water standing. This area is being further investigated by "Op Mole" members and develops into a large passage heading towards and probably nearly at the Buckdale Shaft on the Portway Pipe. One possibility considered was that the pump was simply utilised as a pipe to pass water down from the sough and along these workings under pressure to join with pipework on Buckdale Level which linked via a tee on the water supply pipe on the Wills Founder Engine. It proved possible to demonstrate this was not the case, since a clack valve still present in the pump would have prevented this. The base of the pump is buried in a pile of rocks some 1.5 m deep, and since there was no other support for the pump, this was not disturbed.

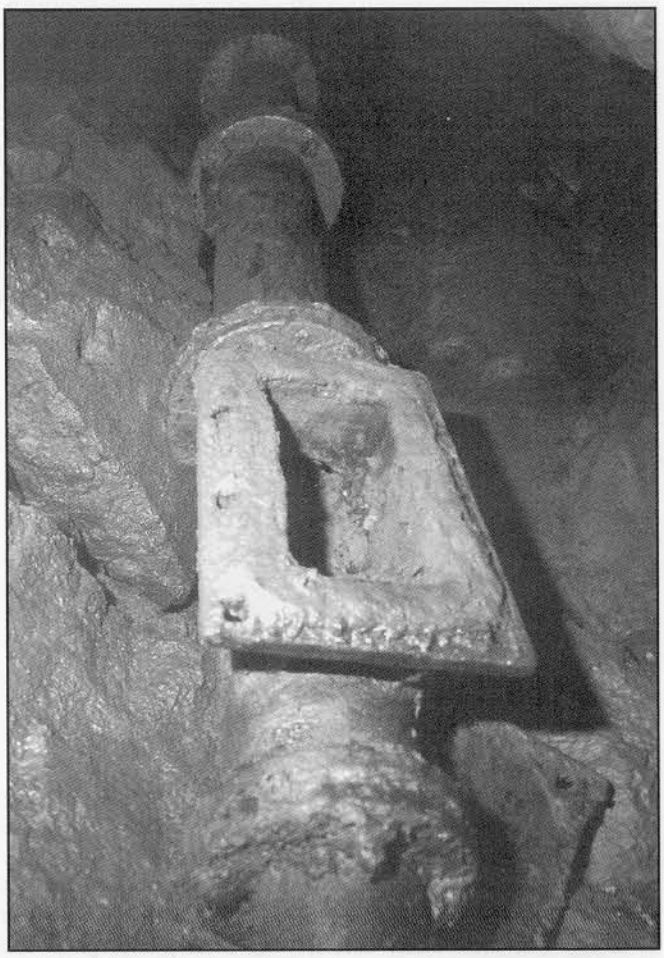
The pump was made up of a series of cast-iron pipes, each of a different length and including a pump barrel and a clack-valve box. The lid or door-piece of the box was jammed against the rock behind the pump. The base of the pump on the diagram is shown dashed as a conventional windbore, but it may have been a short length of broken pipe the remains of which were left lying in the sough. A small remaining fragment of wood at the top indicates a launder was used to deliver water into the sough. No other trace of the launder remains, but the likely route is shown dashed on the plan where it probably passed below the later pile of silt and sand thrown there presumably from cleaning-out of the sough.

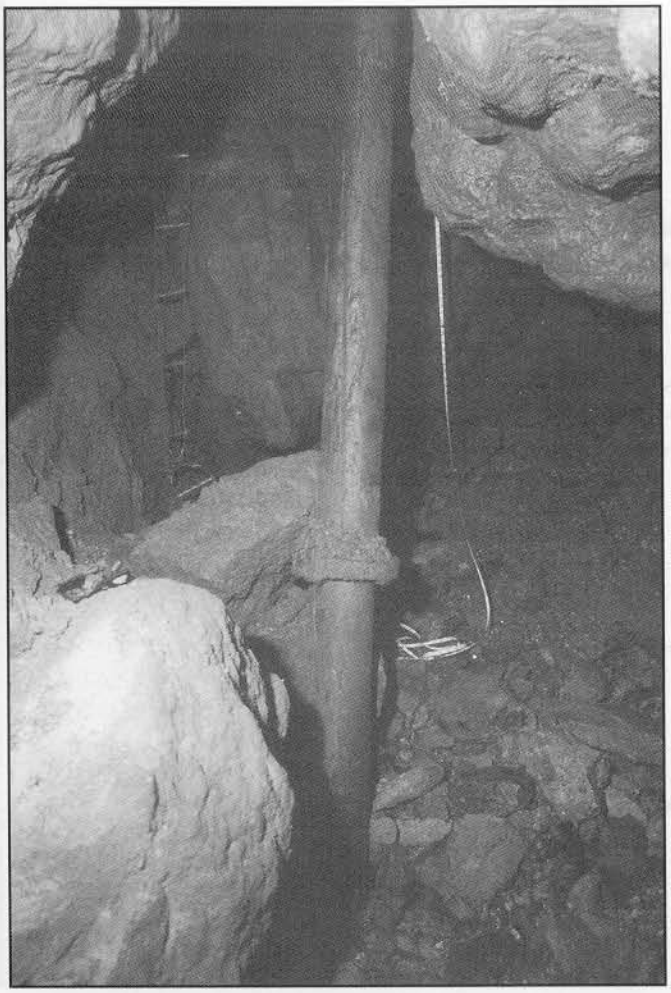
The main working feature visible on the pump was the open clack box, which, when a mud-infill was removed, proved to have the clack installed within. It was firmly in position so that only the top

part could be seen. This consisted of an iron hoop for lifting out, a body lined with either black india-rubber or gutta percha as a seal which probably tapered where it entered the base of the box, and a flap of iron with a "rubber" flap below. It was not possible to see how the hinge worked. During working there must have been a rod and piston fitted with a further clack valve in the barrel, but this was not visible even if present. Although access to the lower clack was possible via the box and doorpiece, it was necessary, in case of flooding, to be able to withdraw both clack valves from the top using a hook. This was made possible by using reducing widths of pipework.

The upper section of pipes, down to the pump barrel were about 190 mm bore (7⅝ inches). The diameter was probably reduced in the pump barrel to 150 mm (6 inches) which continued down to the clack box to where the clack fitted in the taper. The maximum diameter of the clack was about 125 mm (5 inches). Below the clack-valve box the pipe narrowed again, similar to the broken pipe lying in the sough, which was 112.5 mm (4½ inches) bore, 150 mm externally. The flanges, however, were uniform in size, at 380 mm (15 inches) diameter. Those in the top section had six fastening nuts and bolts, those below had eight. During the cleaning of the clack box, the smell of Stockholm tar was noted, which suggests the gaskets used were similar to those on the Wills Founder engine: a flat circle of iron bound with flannel and soaked in tar. The clack-valve box gasket was not found.

Several other artefacts found throw light on the pump's use. An iron bar, some 1.8 m long by 50 x 12.5 mm crossection, pierced with 25 mm holes would probably have been the pump handle. It may have had slats of wood fixed either side, which would have made it both stiffer and easier to handle. The pivot, found still with some wood attached was wide enough to allow this. Beam slots in the walls allow the reconstruction of how the pump was likely to have been actuated. An iron "saddle" was also found (see section diagram), which compares with those on a windlass which was part of the Wills Founder equipment (it is exhibited alongside the engine at the Mining Museum). Such a windlass was necessary to handle the pipes etc. the largest of which would have weighted well over 100 kg.: a 10-12 metre length of chain found suggests this type of windlass was used as a capstan. The chain was very corroded and the links rusted together, but individual links were 44.5 by 32 mm (1¾ x 1¼ inches) made from 7 or 8 mm thick round bar. It was not possible to determine where the windlass barrel was placed, but a position across the timber beam above the pump was likely.

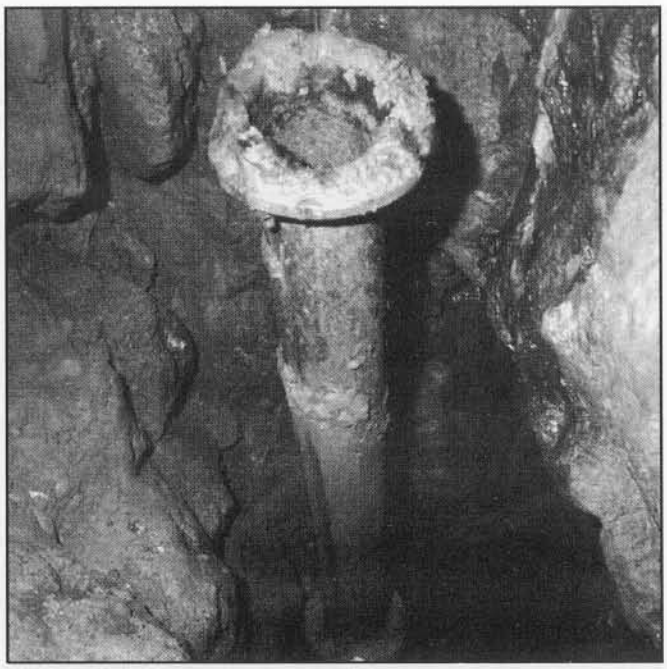




The maximum possible movement of the piston in the pump barrel was less than a metre, but the holes in the probable handle and the roof and floor clearance all suggest it was less in practice, probably about two thirds of this. A full sweep of the handle would pump about 11 litres (2.5 gallons) a stroke - and at a depth of 8 metres using full strokes this would need about 44 strokes per minute to equal the output known to have been produced from a rag and chain pump - or 66 strokes at the lesser sweep. It seems unlikely such a rate - an output of about a thirtieth of an horse-power (Willies 1979 p136) - could have been sustainably achieved. It would certainly have been hard work and would either require frequent pauses, or, to maintain maximum output, to be worked alternately by two persons. It would not have been very convenient for two persons to work the pump together, but this is not inconceivable.

(Top right) The clack-box of the pump.
(Bottom left) The base of the pump.

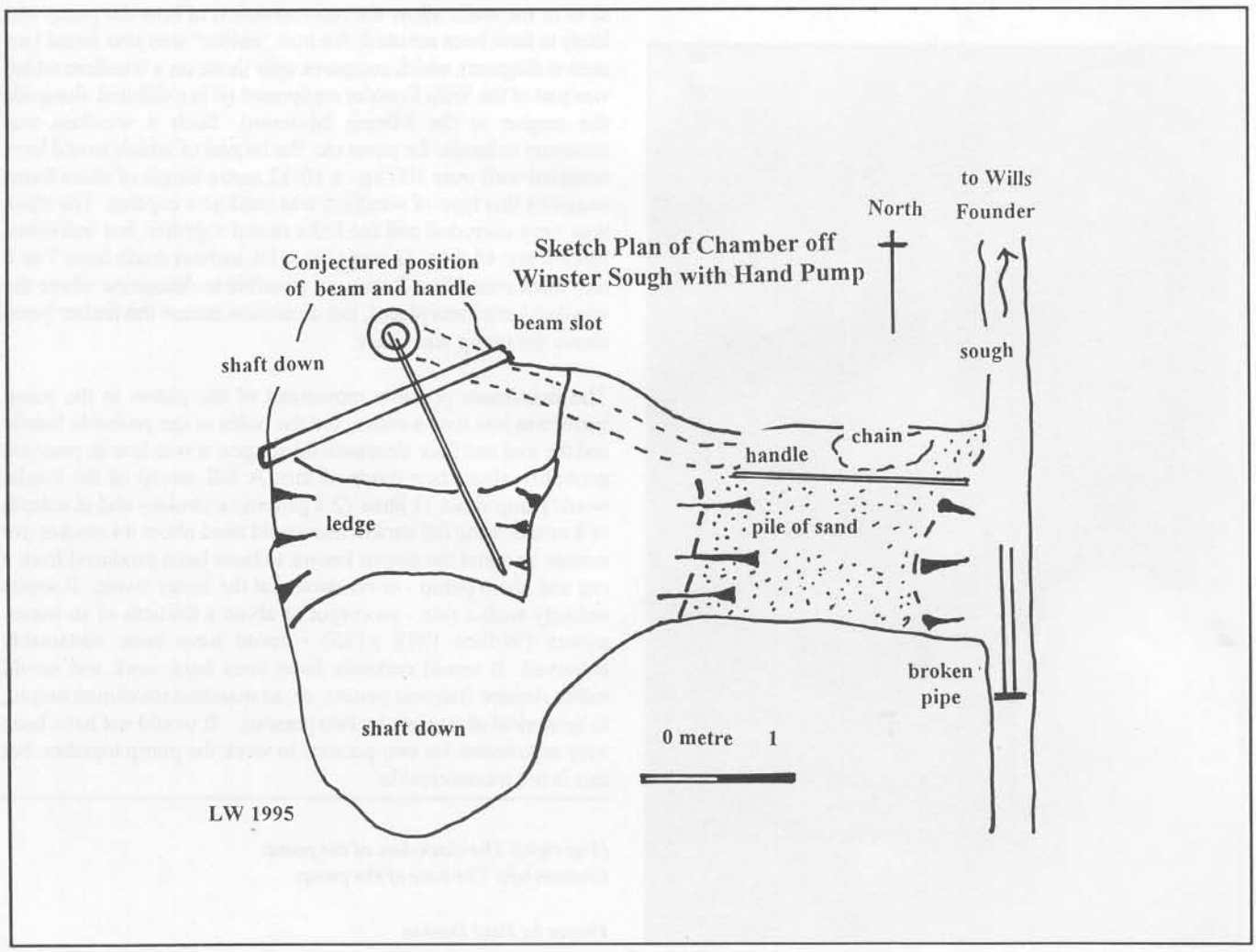
Photos by Paul Deakin.



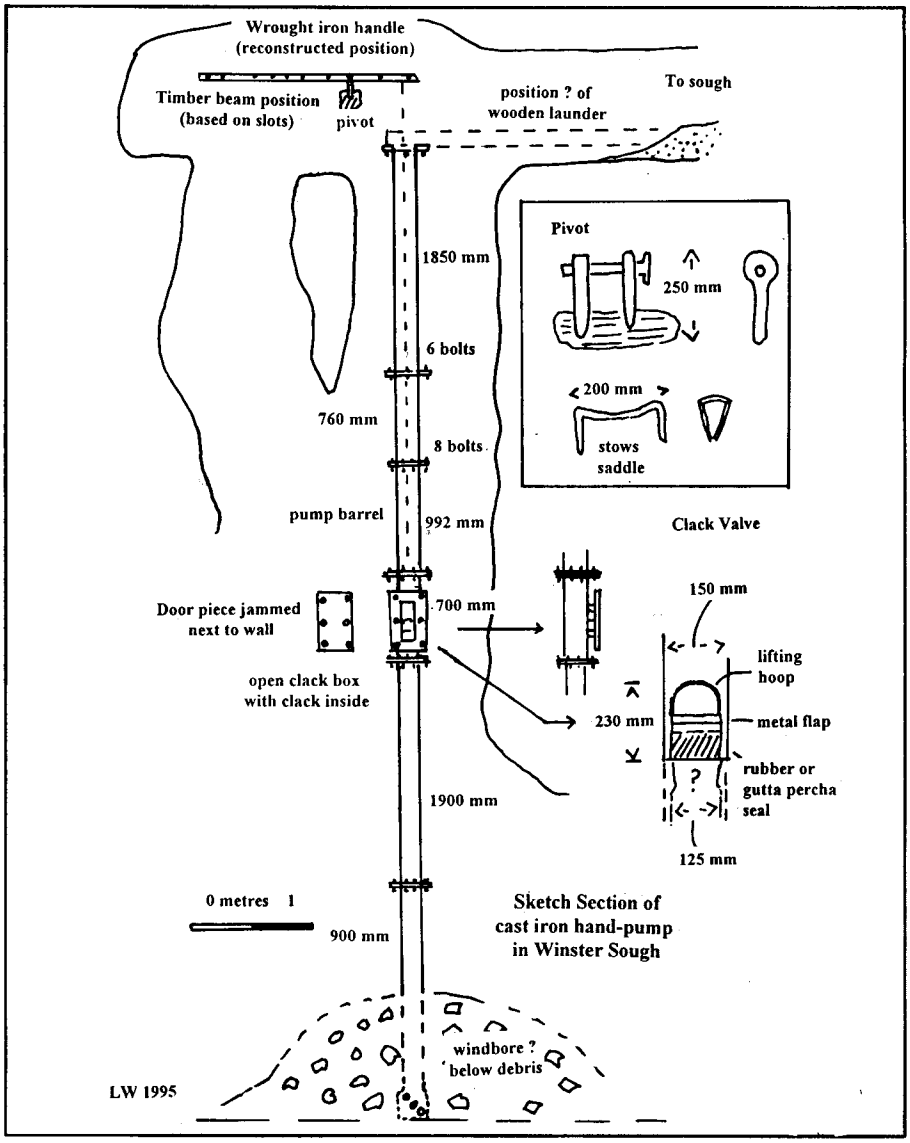
Top of pump with decayed wood of launder just visible. Photos by Paul Deakin.

The pivot, windlass saddle and nuts and bolts.

Since it is unlikely the pump was put in to be used over long periods, it is probable it was a temporary expedient to try the ground below to see if an under-level was worth bringing up. "Sweeps" are mentioned in a number of mining documents, but usually for a relatively early date and probably were usually made of wood. The most likely date for this hand pump, given the similarities in the windlass part, the use of iron and of Stockholm tar in gaskets is for the same period of the Wills Founder, the mid 19th century. So far as this writers are aware, this is the first time a sweep-type, cast-iron, hand-pump has been discovered underground and, to say the least, it is somewhat surprising this



simple and labour intensive level of technology should survive until the suggested late date, though rag and chain pumps were still in use in the district just a little earlier (Kitchen and Penney 1973). Apart from the pump itself, the association between the chain and capstan adds a little more to our information as to how heavy weights were tackled underground.



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