

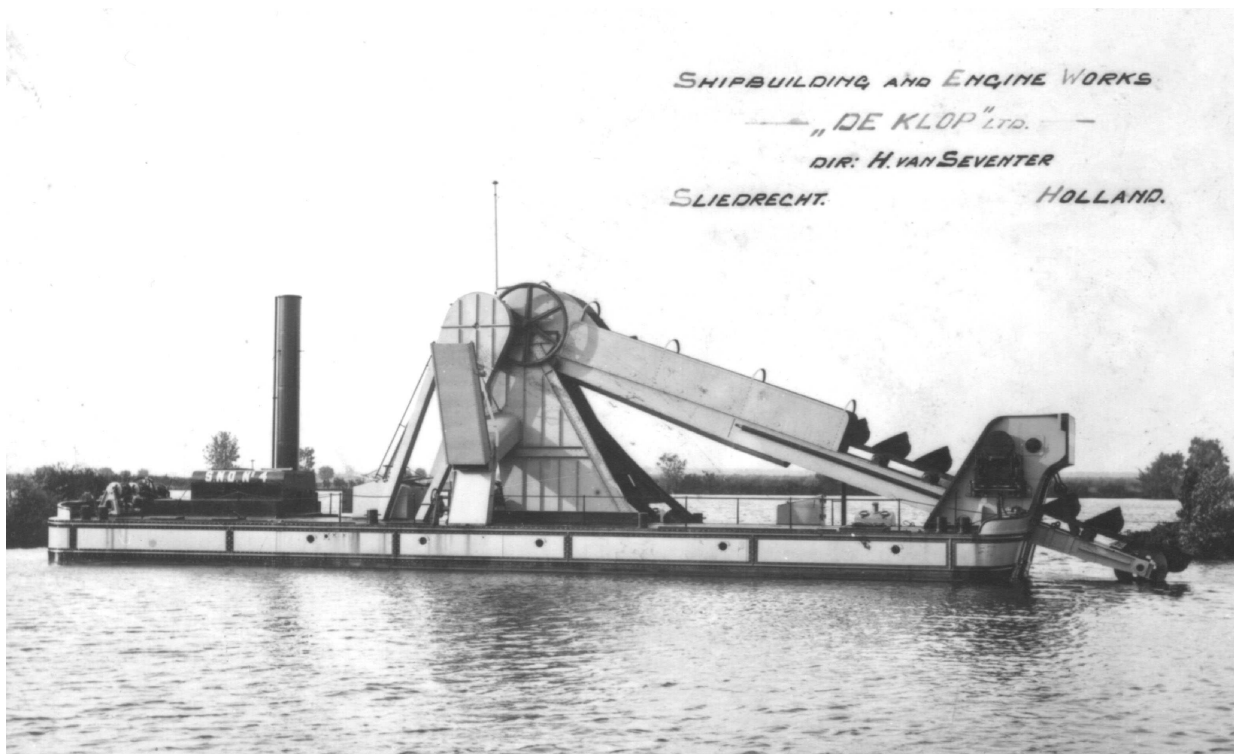
Gloucester Waterways Museum

The Gloucester Dredger In Action

By Richard Trelfa

The Need for Dredging

Water is lost from the Gloucester & Sharpness Canal because of the operation of the locks at each end and because the canal feeds Bristol's water supply. The make up water is from the small rivers and streams which run off the Cotswolds and by pumping River Severn water into Gloucester dock. This water is muddy, and although some of it is carried towards Sharpness, the majority is deposited in a mud bank from the West Quay to the Reynolds Warehouse. At Sharpness the tide brings mud into the dock when the locks are operated at high tide. In addition, the entrance to Sharpness dock, in the estuary itself, can become silted up simply at the whim of the tide. The dredger now at the Museum was used to clear the mud that accumulated. She is the fourth in a series built for the Sharpness New Docks & Gloucester & Birmingham Navigation Company, hence her name - SND No 4.



The Dredger's Story

The dredger, ("de baggermolen" in Dutch), was built in Holland in 1925. She was towed round Lands End to Sharpness, and on arrival at Gloucester she was dry docked for examination. The bucket chain, which had been removed for the voyage, was reassembled. The Dutch commissioning engineers provided two pairs of clogs to go with the dredger, a pair for the fireman and a pair for the engine driver. After commissioning trials in Monk Meadow dock she began work in 1926.

She was in Sharpness dock when the General Strike started in May 1926 and was tied up there till October 1927. Due to lack of attention during that period, the pistons in the main engine seized so that, when the strike ended, she had to go to Gloucester to have them re-fitted.

The dredger has a flat bottom which allows it to rest on the sand at the entrance to Sharpness harbour when the tide is out. On one of the first occasions she did so, the Driver, who was asleep in his cabin, woke to see water coming down the steps; she had stuck on the bottom! Fortunately there was steam on the boiler, and he had the bright idea of shaking the bucket chain up and down using the bucket winch, and up she popped. For saving the dredger, the Company gave him two months wages. This happened several times until blocks of wood were fitted underneath and this solved the problem.

During the Second World War, the crew were instructed to work all hours. In Gloucester docks they used the cellars under the warehouses as air raid shelters.

In 1963, the vessel sank due to frost damage. Its salvage, an engineering feat at least equal to the building of the dredger in the first place, is described later. Also, the original natural draught coal fired boiler had reached the end of its days due to water side corrosion. The decision then had to be taken as to whether to scrap the 38 year old dredger or to re-boiler it. It had become difficult to find staff willing to carry out the dirty but skilled job of coal firing. In the event, it was decided to go for a light oil fired boiler but with a furnace which could take a grate for coal firing. If you examine the casing, on deck, you can see where it was cut and removed to allow the new boiler to be dropped in.

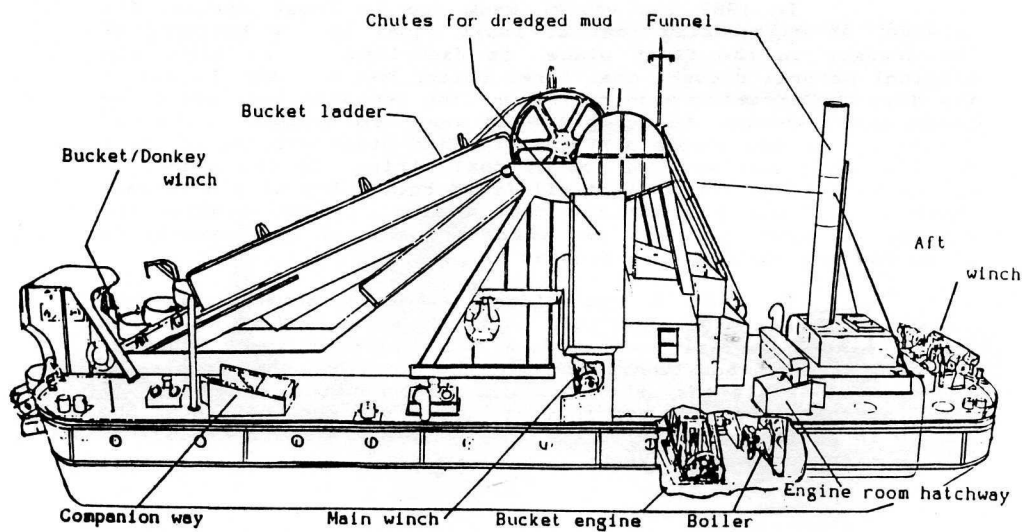
In 1982 a new diesel electric powered dredger, named Thomas Fletcher, took over the work. SND No 4 then had to pass one final trial before being with us today: that of being abandoned and scrapped. To the men of the Canal she represented skills that they learned as apprentices and a way of life that was slipping away. They oiled her and kept her safe until she was taken over by the Museum. She is now in perfect working order, and the buckets are turned on special occasions throughout the year.

Working the Dredger

The main fuel tanks are below decks on either side of the boiler where the coal bunkers used to be. There is a corner of the old starboard coal bunker in front of the Petter diesel that drives the air fan. A hand pump at the port tank is used to fill up a day tank above deck, and the fuel oil then drains down from that by gravity to the burner on the boiler front. The Petter diesel engine drives the fan providing air for atomisation and combustion. It also drives a dynamo for the dredger's lighting system. In the boiler the burner fires down a furnace tube to a transfer chamber mounted in the water space at the end of the boiler shell, where the hot gases are turned back to the front of the boiler along 114 smoke tubes. The smoke box above the burner at the boiler front collects the gases from the smoke tubes and passes them to the funnel.

Steam is supplied to the engine for turning the buckets, the main and aft winches for propulsion (see next page) whilst dredging, the bucket donkey winch for adjusting dredging depth, the steam injector for filling the boiler with water, three steam ejectors for emptying the bilges, the Worthington Simpson pump for washing the decks and buckets with canal water, the kettle for making tea and the whistle. The steam powered injector, mounted on the port oil tank, can not only be used to fill the boiler, but also the balance pipe can be used to suck up chemicals out of a bucket into the boiler to reduce

corrosion. In addition, the injector valve can be adjusted to blow steam into a bucket full of cold water to heat it for washing hands - hence the soap dish just above it.



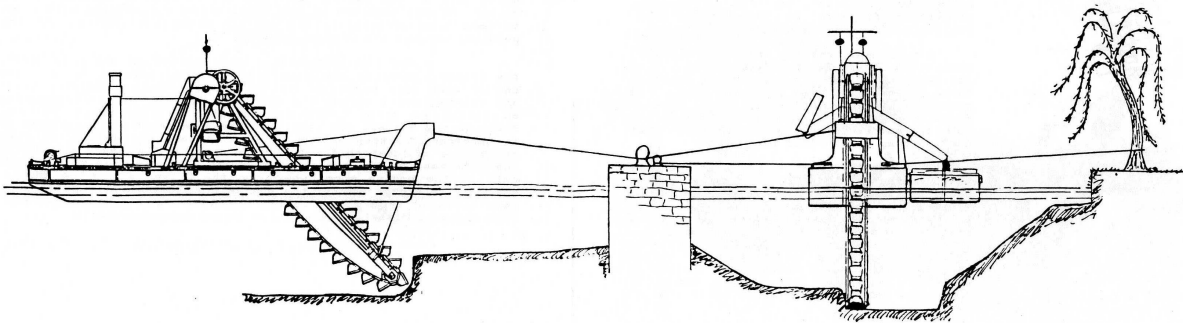
The bucket drive engine is of the twin cylinder compound condensing type. The steam enters the High Pressure cylinder through a stop valve and centrifugal governor. After doing work in the H. P. cylinder, the steam passes to the Low Pressure cylinder, from where it exhausts to the Jet Condenser. Here it is mixed with water from the canal and condensed, and then the Air Pump, driven by the crank shaft cross head, exhausts the mixture through the side of the vessel. The buckets are driven by belt drive from each end of the crankshaft. The belts are of three ply leather with copper rivets. To stop the belts slipping, Black Jack in stick form is melted on to the pulleys. Every month the belts are cleaned off and coated with castor oil. The engine has reversing gear in the form of Stevenson Links driven by eccentrics from the crank shaft. This gear is used for positioning the crank for starting and for inching the bucket chain backwards to put the buckets back on if they come off the tumblers. The buckets can come off if they hit an obstruction, or if the slewing is incorrectly controlled. To put the buckets back on baulks of timber on the end of ropes are used as levers. The Aft Locker is used for the storage of this equipment.

Each bucket contains about one third of a tonne of mud. Some of the water drains off on the way up the bucket ladder. The mud is discharged sideways (either side) down a chute into a Hopper Barge moored alongside. When Hopper Barges were full (180 tonne in about 20 minutes), they were taken by tug to Purton on the canal where the Severn estuary is directly alongside the canal. Here, the Suction Plant adds water and then pumps the resultant weaker mixture into the estuary.

Sharpness dock was dredged to a depth of 25 ft. 3 in. (7.7 m) and the canal and Gloucester dock to 18ft. 6in. (5.64 m). However, that depth is not maintained all the way across the dock, or canal, since a bank of mud called "the batter" has to be left at the quays to hold them up, and the canal has the full depth only at the centre, with the bottom sloping upwards to the batter. On the sections of the canal which are puddled with clay to make them watertight, the Captain knew when he hit the pudding because the dredger shuddered.

The crew consisted of the Captain on the Main Winch, the Driver operating the Main Engine and firing the Boiler, and one or more deck hands on the Aft Winch, the Bucket Donkey Winch and raising and lowering the discharge chutes. The crew has been as little as three, depending on the availability of labour. Although the buckets can remain at the same depth for some time it is necessary to keep an eye on them in case of jamming or the appearance of desirable/undesirable objects. In case of trouble, the deck hand on the bucket winch pulled a handle ringing an alarm bell in the engine room, whereupon the Driver stopped the engine. The bell/telegraph now in the engine room is not original, having been salvaged from a tug called the Addie during its conversion from steam to diesel power.

Propulsion



The dredger was towed, stern first, to the dredging site with the buckets acting as a rudder and lowered to act as a brake if necessary. Movement for dredging was produced by three steam powered winches on deck. They are the Main Winch, the Aft Winch and the Bucket Donkey Winch. Each winch has twin steam cylinders acting in parallel with Stevenson link reversing gear. The wire drums have band brakes and cone clutches. The Main Winch, at the bottom of the tower, has three drums on it. Wires from the drums were led through fairleads in the bow. One breast wire went sideways to the port bank and the other to the starboard bank. The third drum controlled a head wire which was led about 600 ft. (183 m) forwards to the starboard bank. The Aft Winch controlled two more Breast Wires. The Captain operated the Main winch to take the dredger sideways across the dock, or canal, with the buckets dredging mud. The Aft Winch man controlled his wires to keep the stern trailing just behind the bow. When the pitch had been traversed, the Captain took up some of the head wire to pull the buckets forward into the mud face. The dredger then worked back across the dock and thus spent more time moving sideways than forwards. Mud faces of up to 10ft. (3 m) could be worked.

As well as around 140,000 tonnes of mud per year, objects recovered have included a groat (a silver fourpenny piece), three safes stolen from Cheltenham, a 28 lb (12.7 kg) jar of pickled onions, a case of preserved chicken, a 500 lb (227 kg) bomb and a drowned stag from the Berkeley estate.

Signalling

When the dredger was working, shipping could not pass because of the wires attached to the banks. Red balls were hoisted at each side of the mast head to signal the danger. Red lights were also lit. However, the rule was that the dredger gave way to shipping. So to allow it to pass, the Captain had to slacken off the wires on one side and

then swap the red mast head ball and light for a white ball and light on that side. Shipping then knew that it was safe to pass on the white side. On occasion, a passing ship or tug picked up a wire on its propeller because the wire had not been slackened off enough, or was lying on shallow mud. The diver then had to be called out to cut the wire off with hammer and chisel.

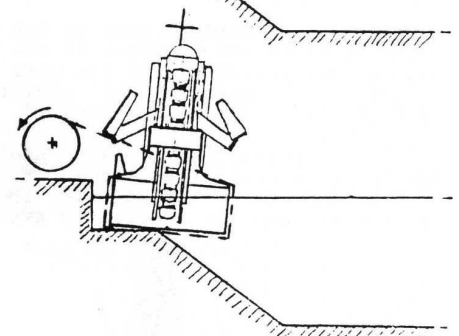
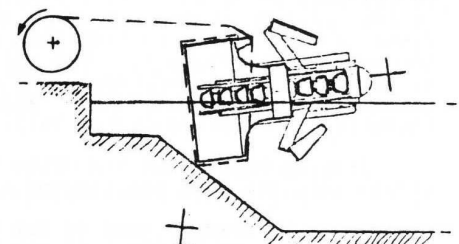
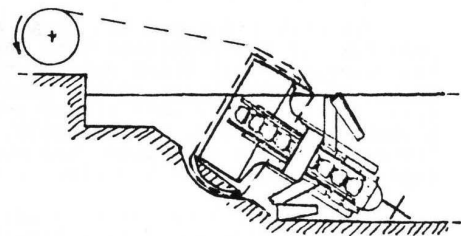
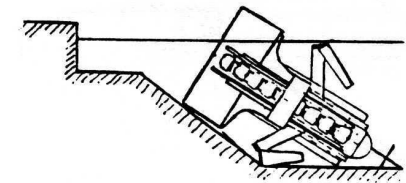
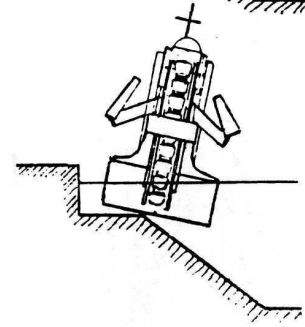
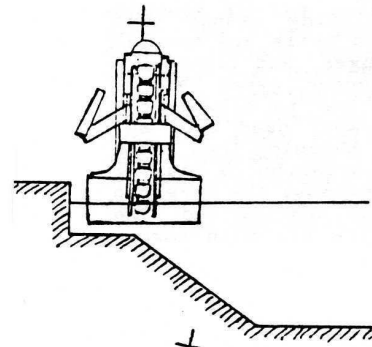
Sinking

The big freeze began on Boxing Day 1962. Eventually, SND No 4 had to stop work and was moored at the end of Price Walker's yard, opposite the entrance to Monk Meadow Dock. At first light on the morning of Monday 28th January 1963, she was found to have sunk. That part of the hull above water was partially concealed by piled ice but the mooring ropes were found to be still attached. The cause of the sinking, although not known at the time, was frost fracture within the hull of the pipe feeding the boiler with canal water on the port side. The diagram shows the dredger settling down on to the "batter", or mud buttress, pivoting on the edge of the batter, then rolling over on to its side.

Salvage

A team was formed to raise the vessel, consisting of the Repair Yard foreman and his gang, the Canal foreman and his gang and three divers. It was decided that the operation would consist of two phases. First, to get her as nearly upright as possible and secure her, and second, to seal her up, pump her out and refloat her. The first phase was achieved by "parbuckling". At three points along the length of the dredger, a diver bored a hole through the mud under the hull with an air lance. Then a wire was passed through each hole, given one turn round the vessel and attached to a port side bollard. Then three steam powered timber hauling tractors, anchored to baulks of timber buried in the bank, heaved on the wires to roll the dredger upright.

The advantage of this method was that the diver did not have to go to the deep water side of the dredger. However, there were two problems to consider. Firstly, when the dredger is the right way up, the buckets hang down in a pronounced curve on the underside of the ladder. With the dredger almost upside down, the buckets had attempted to fall out the other way and had got into a terrible



jumble. It was suggested that these should be cut off, but the final decision was to leave them. Secondly there was concern that the heaving wire at the bow would pinch in the bucket well. Therefore, across the width of the well, the diver fitted about six 1 ft. square baulks of wet elm held in position by wedges (wet elm is a timber which sinks). The heaving was successful, and the vessel was secured so that the diver could work all the way round the hull.

The next stage was to plug as many holes in the hull as possible. It was fortunate that the diver had previously worked on the dredger as Aft Winch man and knew where all the openings were. He fitted wooden plugs in all round holes such as port holes left open. Canvas covers were fitted to the door openings. The four coal bunker hatch covers, two per side, had fallen off and were lost. Temporary covers were made. The access doors at the top of the engine were sealed with a line of wedges.

The pump suction pipes were to pass through the ventilation opening in the deck above the burner front. So to this was fitted with a 14ft. (4.25m) high trunking. The 10 in. (250mm) suction pipe of the Suction Plant (normally used for emptying hopper barges) was passed down through this trunking into the hull, together with the suction pipes of three to four other pumps. As they all pumped water out, so the trunking around them allowed in air, thus preventing the formation of a vacuum in the hull. As pumping continued, the diver went round feeling for water being sucked into the hull and plugged any such leaks with oakum.

When the dredger came up, she popped up, having stuck on the mud. Because there was no slack in the suction hoses of the pumps, the pumps were pulled across the quay causing a bit of a scare. The buckets had fallen into their correct position, so the decision to leave them alone had been correct. The pieces of wet elm timber had fallen out and were lost. The only damage to the outside of the dredger was a slightly skew chimney and a bent mast head.

Acknowledgements

Fred Carpenter (diver), Bill Deacon (dredger captain), Roger Monk (diver), Reg Price (tug captain), Ralph Smith (dredger engineer) and John Tytherleigh (dredger captain).

Specification

Date Built – 1925.

Builder - N. V. Scheepsbouwverfen Machinefabriek De Klop, Sliedrecht, Holland.

Type - Bucket Dredger.

Propulsion - Towed to dredging site then five wire drive from two on-board steam winches.

Weight - 150 tonnes.

Length - 82 ft 6 ins (25.15 m).

Beam - 18 ft 3 ins (5.56 m).

Draught - 4ft (1.22 m).

Freeboard - 3ft 2 ins (0.97 m).

Design Dredging Range - zero to 26 ft (7.92 m).

Maximum Dredging Rate - 360 tonnes/hour.

Number of buckets – 34.

Bucket Drive Engine - Twin compound steam engine (HP/LP) governed at 140 rpm exhausting to a jet condenser exhausted by a crosshead driven air pump and using canal water as cooling medium. Original De Klop make.

Main and Aft Propulsion Winches - Each consisting of a twin parallel cylinder steam engine exhausting straight to just below water level. Stevenson link reversing gear. Each wire drum has a cone clutch operated by hammer and a band brake.

Bucket/Donkey Winch - Similar to drive winches.

Boiler Maker - Marshall Anderson of Motherwell, Scotland.

Boiler Type - Wet Back Economic Shell/Scotch Marine.

Boiler Working Pressure - 70 to 130 psi (8.8 bar).

Boiler Safety Valve Lift Pressure - 145 psi (10 bar).

Boiler Steam Temperature - Saturation (180 deg.C).

Fuel - Diesel/Gas oil.

Burner - Medium pressure air atomised, made by Laidlaw Drew, Edinburgh, Scotland.

Air Fan Drive - Potter AVA diesel.

Fuel Oil Storage Tanks - On each side of boiler.

Fuel Oil Day Tank - On deck at base of tower.

Water Tanks - On each side, aft of Fuel Oil Tank.

Workshop/Lazarette - Starboard side forward, used for storage and splicing of ropes and wires.

Accommodation – Four berths on port side.

Toilet - Chemical, in workshop.

Cooking - Coal fired stove in galley on port side.

Steam Kettle - In engine room on starboard side.