III

A *Festuca* from Chesters?

M. J. T. Lewis

ONE of the long-standing if minor enigmas of Hadrian's Wall is the barrel-shaped stone from the bridge across the North Tyne at Chesters. Found before 1861 "amongst the debris" of the eastern abutment[1] and now in the museum at Chesters, it is 0·76 m high with a maximum diameter of 0·44 m, one end showing signs of wear. Around its girth are eight dovetailed slots similar to lewis holes, averaging 80 mm long, 25 mm wide and 120 mm deep (fig. 1). It weighs about 225 kg. What was it for? Various suggestions have been put forward: for pounding mortar (Clayton), part of a ballista (Bruce), the counterweight for a drawbridge (Holmes), the counterweight for a portcullis under the bridge (Shaw), and the hub of a waterwheel (Richmond).[2] Though viewed with some hilarity by historians of technology, this last interpretation, with the weight of Richmond's authority behind it, ruled the archaeological roost for forty years, being repeated as a fact in countless books and papers, until it was very properly refuted by Bidwell.[3] Bidwell in turn proposed that the stone was the counterweight for a crane, the stump of whose upright was found embedded in the abutment masonry.[4] This too seems unlikely. A rectangular shape, with fewer attachment points for the suspending ropes, would be more obvious; a wooden box or barrel filled with loose stones would be more obvious still, and easier to construct.

The stone's real function is to be sought in quite another direction, closer to that first aired by Clayton. The clue lies in relatively modern accounts of similar devices. Belidor's great eighteenth-century work on engineering contains a section describing and illustrating various methods of driving piles. Before dealing with more complex devices he says: "The second [figure] is a large rammer made of a tree trunk, weighing around 200 lbs, fitted with an iron strap, provided with several handles or grips, and worked by five to six men." The illustration (fig. 2), depicting apparently eight loop handles, shows obvious affinities with the Chesters stone. Belidor continues by describing another pile-driver like an inverted three-legged stool, which can be used either way up according to the length of pile; "one or two men are put to work on each leg of this rammer, depending on its weight."[5] This arrangement will concern us shortly.

Next, we have two descriptions of twentieth-century Chinese rammers. Needham, speaking of pile-driving, says, "for smaller jobs, from four to eight men operated a punner or rammer (a cylindrical stone with bamboo handles), while themselves standing on a small platform attached near the top of the pile, so that their weight added to the blows."[6] In similar vein, Chatley tells of the Chinese consolidating earth with a stone about 2 ft in diameter, ropes being attached to it by metal rings. "Four or more men stood in a circle round this stone. They pulled on the ropes and, at the same time, stepped outwards and gave the stone a jerk. Gradually they got the stone into a swing and were really tossing it up and letting it thump down."[7]

If the Chesters stone belonged to this family, did it ram earth or drive piles? The Romans, of course, used piles aplenty, and certainly had mechanical pile-drivers.[8] Bidwell, however, excavated the abutment wall at Chesters down to the natural and found no piles. More conclusive still, he found no sign of the timber grillage which would normally transfer the load of the masonry to the pile heads and which, if present, would be unmistakably obvious. The foundations therefore seem to have been laid directly on the river gravel, as they were at the

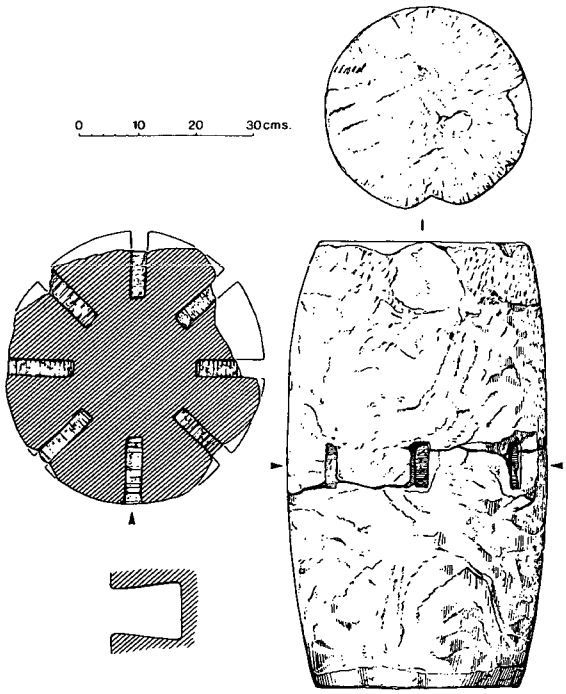

Fig. 1 The Chesters stone. (Drawn by J. Thorn; from P. T. Bidwell and N. Holbrook, Hadrian's Wall Bridges *fig. 87, copyright English Heritage.)*

other Wall bridges of Willowford and Stanwix and at the very similar Corbridge.[9] Most probably, then, the function of the Chesters stone was to ram and consolidate: the natural ground at the bottom of a foundation trench, hardcore in the footings of a wall, earth in the ramp which took the Military Way up to the bridge, or the metalling of the road itself.

The English term for such an implement is punner or rammer or—most venerably—beetle.[10] Medieval evidence of its use for such-like purposes is plentiful,[11] though no illustration is known. But some similarity to the Chesters stone is implied by Falstaff's exclamation "Fillip me with a three-man beetle!" and by the two "Three men Beetles" and one "Sixe men Beetle" found in an inventory of the wardens' stores at Rochester bridge in 1642.[12]

Latin literature reveals almost identical practice. It employs four different words for rammers. The *vectis* (a handspike or crowbar) and *pilum* (a pestle) were evidently quite light one-man tampers, made of wood and sometimes shod with iron.[13] So too, perhaps, was the *pavicula*, recorded only by agricultural writers.[14] The heavy-duty beetle was the *festuca*.[15] This could be used for simpler jobs like ramming earth round transplanted trees or round stakes.[16] More often we find it consolidating the ground before floors were laid,[17] or compacting rubble and lime up to the thickness of a foot in the foundations of pavements.[18] Heaviest of all, the gaps in the substructure of temples were arched over or rammed by *festuca* to keep the walls immovable;[19] and Cato's instructions for building an oil-press—which would impart unusually heavy downward loads—begin: "Where the base of the press is to be, make foundations 5 ft deep and 6 ft wide . . . Make the foundations for all the rest of the floor 2 ft deep. First compact the bottom with a *festuca*, then spread successive 6-inch layers of fine hardcore and sanded lime" before surfacing the floor.[20] Finally, Caesar uses the word for the ram of a mechanical pile-driver.[21] Illustrations, alas, are non-existent.

The Chesters stone, then, is surely a *festuca*. Being found in the ruins of the Severan bridge, it is presumably Severan in date. At that time, not only were the piers and abutments of the bridge built, but the adjoining section of the Wall was reconstructed with its new tower, and the ramp for the Military Way was installed. There was no shortage of consolidation work for the *festuca* to do.

How was it handled? The eight central slots imply attachments whereby eight men could lift the stone, a load of about 28 kg or 62 lbs each. The slots are too small for wooden handles of sufficient strength, and their dove-tailed shape demands attachments similar to lewis irons. There are two possiblities. One is solid handles in the form of radial iron bars which, to allow space for eight men around the stone, would need to be nearly a metre in length. If horizontal, however, they would be only about 0.35 m higher than the target, adequate perhaps for ramming the projecting head

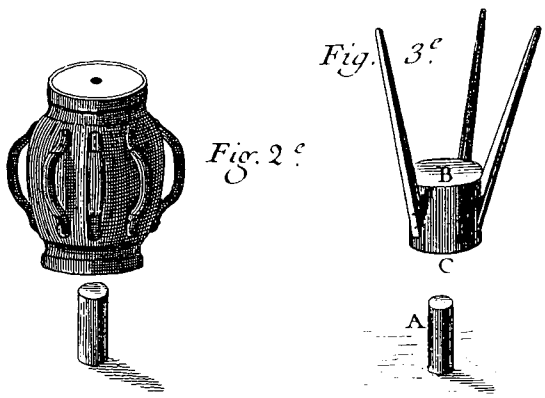

Fig. 2 Two of Belidor's rammers, 1750.

of a pile but too low for the convenient tamping of earth. The bars would therefore be more suitably inclined upwards, much as in Belidor's third figure (fig. 2), though a horizontal end section would be easier to grip. They would be held in the sockets, like lewis irons, by two wedges and a pin (fig. 3).

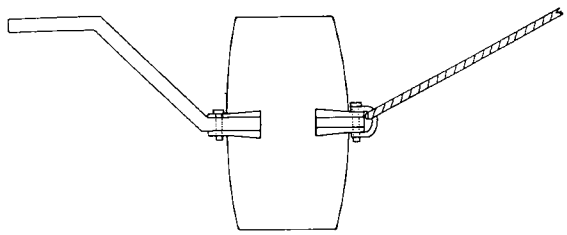

Fig. 3 Alternative reconstructions of festuca *attachments.*

The simpler and more flexible alternative is that the slots held straightforward lewis irons, each with a short rope attached. The operators could then manipulate the beetle, as in Chatley's description, to any reasonable depth below them. Why lewis irons rather than rings leaded into the stone? Possibly because leaded rings, unlike leaded clamps in static masonry, would tend to work loose under the constant shocks of use; and if the handles were iron bars it would be of obvious advantage to make them detachable. Why the attachments around the centre rather than higher up? Presumably so that the stone could be reversed when one end became too worn for satisfactory ramming.[22]

NOTES

[1] J. Clayton "The Roman Bridge at *Cilurnum*" *AA*[2] vi (1865) 84.

[2] Description, suggested uses, and full references in P. T. Bidwell and N. Holbrook *Hadrian's Wall Bridges*, English Heritage Arch. Rep. no. 9 (London 1989) 122–4. The slot depth of 20 mm there quoted is a misprint. Add to their list of suggested uses R. C. Shaw "Excavations at Willowford" *CW*[2] xxvi (1926) 477 n.

[3] Bidwell and Holbrook, op. cit. 30–1.

[4] His suggestion that the crane was for positioning such stones of the abutment as lay within reach of its arm is open to serious practical doubts: M. J. T. Lewis "Roman Navigation in Northern England? A second look" *Jnl. Railway & Canal Hist. Soc.* 31 (1995) 421.

[5] Bernard Belidor *Architecture Hydraulique* vol. 3 (Partie 2, Tome 1) (Paris 1750) 107–8 and Pl. VIII figs 2–3.

[6] Joseph Needham *Science and Civilisation in China* vol. 4 part iii (Cambridge 1971) 152.

[7] Herbert Chatley "The Development of Mechanisms in Ancient China" *Trans. Newcomen Soc.* 22 (1941–2) 118 and 135–6.

[8] The *locus classicus* for pile-driving is Caesar *Bell. Gall.* 4, 17–18. Technical commentaries on it: K. Saatmann et al, "Caesars Rheinbrücke" *Bonner Jahrbücher* 143–4 (1938–9) 83–208; J. A. Bungård "Caesar's Bridge over the Rhine" *Acta Archaeologica* 36 (1965) 87–103; Eckart Mensching "Die Koblenzer Rheinbrücke" *Bonner Jahrbücher* 181 (1981) 325–54. See also Vitruvius 3, 4, 1. For a good example of a piled bridge, D. A. Jackson and T. M. Ambrose "A Roman Timber Bridge at Aldwincle, Northamptonshire" *Britannia* 7 (1976) 39–72.

[9] Bidwell and Holbrook, op. cit. 7 and fig. 4, 19, 73, 103–110.

[10] See *Oxford English Dictionary* for the history of these words.

[11] Many examples in L. F. Salzman *Building in England down to 1540* (Oxford 1952) 83–6.

[12] *Henry IV Part 2* Act I Scene ii; M. Janet Becker *Rochester Bridge: 1387–1856* (London 1930) 78.

[13] *Vectis:* Vitruvius 7, 1, 3; 8, 6, 4. *Pilum:* Cato 18, 7; Columella 1, 6, 12.

[14] Cato 91; 129; Columella 1, 16, 13; 2, 19, 1; 11, 3, 34.

[15] Sometimes, less properly, spelt *fistuca*. It spawned two derivatives: *festuco*, to ram, and *festucatio*, ramming.

[16] Cato 28, 2; Pliny, *N.H.* 17, 87; Vitruvius 10, 2, 3.

[17] Vitruvius 7, 4, 5; Pliny, *N.H.* 36, 185 and 188.

[18] Vitruvius 7, 1, 1; Pliny, *N.H.* 36, 187

[19] Vitruvius 3, 4, 1.

[20] Cato 18, 7.

[21] Caesar, *Bell. Gall.* 4, 17, 4.

[22] Since writing this note, I find that the role of the stone as a rammer was tentatively suggested by N. A. F. Smith, "Problems of design and analysis" in A. Trevor Hodge (ed.) *Future Currents in Aqueduct Studies* (Leeds 1991) 127 n. 5.

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