

An 18th Century Engineer's Sketch Book.

H. W. Dickinson

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Notes and Communications.

An 18th Century Engineer's Sketch Book.

By H. W. Dickinson.

At the Society's Summer Meeting in 1921 at Birmingham, there was exhibited¹ by Sir Gerald Chadwyck-Healey, Bart., an old sketch book that deserves further notice on account of the use that might possibly be made of its contents by the future historian.

From internal evidence the writer was able to identify the book as being that got together in the 18th century by the industry of William Reynolds (b. 1758, d. 1803), of Ketley Ironworks, Shropshire, son of Richard Reynolds, of Coalbrookdale. This William occupied a responsible position, and was a man of an inventive turn of mind, who is remembered as having collaborated with Thomas Telford in introducing cast iron troughing for canal aqueducts and as having suggested and brought into use in 1788 at Coalport and elsewhere the inclined plane instead of locks for use on canals for raising and lowering barges.

After several vicissitudes the book passed into the possession of John Randall of Madeley, a local historian and writer of note, who published a description² of it and a partial list of the contents. He stated that he had also in his possession, from the same source, "30 vols. fol. MS., beautifully written and containing suggestions, inventions and drawings, but chiefly copies from the transactions of the Royal Society and other sources. Doubtless if these could be found they would throw further light on the contents of the book.

Soon after 1879 the book disappeared unaccountably, but was unearthed by one of the Members of the Society in the library of Sir Gerald Chadwyck-Healey. We are pleased to state that the book has now been presented by him to the nation, and can be consulted in the Library of the Science Museum, South Kensington.

It may be said at once that there is nothing in the volume of outstanding importance, but its range is a wide one; designs of steam engines, particularly those intended to give rotative motion for winding from pits, etc.; manufacture of iron; methods of winning coal; excavating plant for canals; bridges and viaducts; in fact, all the engineering questions in which Reynolds was interested are displayed. The information thus supplied on many minor aspects of

¹"Trans." I. 75.

²Madeley Herald and Borough of Wenlock Advertiser, July 19th, 1879.

engineering in an obscure period of its history may fill a gap here and there; hence no apology is needed for giving the subjoined list³ of the drawings with brief annotations where such are necessary.

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
Where the scale or date is not given, but is deduced from internal evidence, it is placed within brackets.

1. Ink drawing; elevation and cross section; scale 1.96. "Duncombe's idea of stone aqueduct for Pont-y-Cysulte, April, 1794." Pont-y-Cysylltau Aqueduct, on the Ellesmere Canal, was built of cast iron troughing by Thos. Telford 1795 to 1803.
2. Copperplate engraving; (scale 1.48). "Multiplying Wheel Bucket Engine," invented by George Gerves in 1725 for raising water, with separate printed "Explanation." Both draft and explanation prepared by Henry Beighton, F.R.S., 1727. A bucket filled with water raises a smaller bucket through three times the height that the larger descends.
3. Pencil sketch; sectional elevation; no scale. "Sadler's idea of an engine brought by him when he came from Bristol, 1794." This was not patented. The patent taken out by James Sadler in A.D. 1791, No. 1812, was for an *Æolipile* with a condenser.
4. Ink sketch; front and side elevation; no scale. "Sadler's rotative motion," with crank, for winding engine. May 30, 1793. e/
5. Ink sketch; sectional elevation; no scale. "Small engine as it worked on the hill at the Dale, made by James Sadler, 1792." "The Dale" is Coalbrookdale.
6. Pencil sketch; sectional elevation; not to scale. "S. Venables's drawg. of Sadler's engine as it stood when T. Griffiths was puttg. it up at the Bank." Sept., "1793."
7. Ink sketch; sectional elevation; no scale. "J. Sadler's new engine sent by Dr. Beddoes. May, 1793," with lettered description.
8. Ink drawings; scale 1.4. Details of parts of No. 7. On the back is "Drawings of an engine by Jas. Sadler before he went to London with Dr. Beddoes to which he wants to make additions, not being complete."
9. Ink drawing; no scale. Details of "engine for J. Sadler, but which, was never completed, 1794."
10. Ink sketch, probably full size. "Joint for cast iron plates by Mr. Betancourt. Jan., 1796."
11. Pen-and-ink sketch with description. "An account of Mr. Thos. Savory's

³ We are indebted to the Director of the Science Museum for permission to use this officially compiled list.—Ed.

- engine for raising water by the help of fire," as shown to the Royal Society. June 14th, 1699. Taken from Phil. Trans., No. 253, p. 228.
12. Ink drawing; sectional elevation and details; scale 1.24. "Watt's steam wheel." No date.
 13. Copperplate engraving; scale 1.250. John Carne's patent [No. 1,440, A.D. 1784] machine for removing earth, with printed description of savings made with it at Gloucester Canal, Dec., 1793. The machine is a transporter worked by a horse gear.
 - 815/ 14. Copperplate engraving, "William Bingley's new invented iron chain to take the place of ropes," with letterpress description. Dated August, 1795. The link is of round iron, ends interlocked and folded, not welded.
 15. Copperplate engraving; elevation and plan. "Horizontal windmill [for raising water.] Chev. de Betancourt, 1784." A pencil note states "for the 2d vol. of the Architecture hydraulique by Mr. Prony." It is, however, not to be found in that work.
 - 16 and 17. Wash drawings; plan and elevation respectively; no scale. Horizontal water wheel or turbine for winding from mines.
 18. Wash drawing; no scale. "Glazebrook's scheme to effect a perpendicular motion, 1795." Simply Watt's parallel motion. The lever is an auxiliary for driving a crank, etc.
 19. Coloured drawing; sectional elevation; scale 1.12. "Adam Heslop's engine to work without a beam." Drawn by S. Venables. This was a form of atmospheric engine with two cylinders. (See Heslop's Pat. Spec., A.D. 1790, No. 1,760.
 - 87 20. Perspective coloured drawing; no scale. Two open-topped cylinders with separate condensers, the pistons connected by a chain over a wheel which gives motion to a stand of partly grooved rolls. No date. Probably Robert Cameron's patent engine and Wilkinson's design of rolls.
 21. Wash drawing; elevation and plan; (scale, say, 1.96). Horse-drawn hoist for raising earth (e.g., canal excavation) to a gantry with run-off for the spoil. No date, but watermark 1794.
 22. Ink drawing; sectional elevation; no scale. "R. Speed's first copy of Venables's drawing of engine, June 1st, 1796." Apparently Sadler's engine with boiler, arranged for winding from a mine.
 23. Coloured drawing; sectional elevation; scale 1.12. Appears to be atmospheric return connecting rod engine geared for winding from mines. By S. Venables, dated April 16th, 1795. Part of Set 24 and 25.
 24. Coloured drawing; plan; scale 1.12. Appears to be atmospheric return connecting rod engine geared for winding from mines. By S. Venables, dated April 16th, 1795. Part of Set 23 and 25.

25. Coloured drawing; side elevation; scale 1.12. Appears to be atmospheric return connecting rod engine geared for winding from mines, by S. Venables, dated April 16th, 1795. Part of Set 23 and 24.
26. Coloured drawing; sectional elevation; no scale. Apparently Watt type single acting engine with connecting rod for winding. No date.
27. Coloured drawing; side elevation and plan; scale 1.24. "The engine without a beam erected at Wombridge, Dec. 5, 1794." This is an engine similar to 23-25 *ante*.
28. Coloured drawing; sectional elevation; no scale. Apparently an atmospheric beam engine with crank, connecting rod and flywheel. No date.
- 29 and 30. Shaded coloured drawings, duplicates; scale 1.12. "Details de la machine pour transporter les terres"; apparently a suspension gravity railway. No date. (For general drawing see Nos. 104 and 105.)
31. Coloured drawing; sectional elevation and plan; scale 1.36. Apparently an engine of the Watt double acting type, with wagon boiler. No date.
32. Coloured drawing; elevation; no scale. "Lower working gear" apparently of Watt type double acting engine. No date.
33. Wash drawing front elevation; no scale. Apparently of atmospheric beam engine with crank, connecting rod, flywheel and gearing. No date.
34. Coloured drawing; side and end elevations; scale 1.24. "General section of an engine for winding coals," dated July 27, 1793. Apparently a Heslop engine.
35. Coloured drawing; end elevation; scale 1.36. "Horsehay's forge engine. Feb. 21, 1793." Shows connecting rod with sun and planet gear working a tilt hammer.
36. Coloured drawing; sectional elevation; scale 1.48. "Hollins Wood Blast Engine," dated Sept. 12, 1793, by William Minor. Shows atmospheric beam engine working blowing cylinder communicating with water-sealed blast regulator and shows section of blast furnace. (Compare No. 41 with this.)
37. Coloured drawings; sectional elevation; scale 1.12. "The engine for winding coals." No date. Engine is of the double-acting Watt type with crank and connecting rod. Nos. 70 and 101 are copies of this.
38. Pencil drawing partly inked in; no scale. Exterior of canal incline winding engine and house. No date. (Compare Nos. 48 and 98 with this.)
39. Coloured drawing; sectional elevation; no scale. Apparently a Heslop engine for rotative motion. By Samuel Venables, dated September 1st, 1793.
40. Ink drawing; sectional elevation and plan of engine and boiler; scale 1.24. "W. Reynolds's idea of the application of Sadler's engine to a rotative motion, the lower cylinder communicating with the boiler; this ~~motion~~ is


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- cores/* applicable to rowing boats with circular ~~also~~, 1795." By S. Venables, dated February 13th, 1796.
41. Coloured drawing; no scale or date; blast furnace blowing plant. Practically a duplicate of No. 36.
 42. Pencil perspective drawing; no size. Atmospheric engine pumping plant for colliery. No date.
 43. Wash drawing. No scale or title. Pumps. No date.
 44. Coloured drawing; plan and elevation; no scale. Winding gear used on the Ketley Canal inclined plane.
 45. Pen-and-ink sketch; vertical section. No scale. Appears to be a Savery engine.
 46. Ink drawing; sectional elevation and plan; scale 1.12. "Richard Bank's idea of a boiler, 1796." Appears to be superimposed cheese-shaped vessels.
 47. Ink drawing; end elevation; scale 1.12. Portable engine for winding coals, 1792. Part of the set Nos. 49, 50 and 76.
 48. Pen-and-ink perspective sketch; elevation; no size. Exterior of canal incline winding engine. No date. (Compare Nos. 38 and 98 with this.)
 49. Ink drawing; front and side view; scale 1.4. "Working gear," obviously for the portable winding engine, 1792. Part of the set Nos. 47, 50 and 76.
 50. Ink drawing; front elevation; scale 1.12. Portable "engine for winding coals," with connecting rod, sun and planet motion and flywheel, "90 strokes per minute," dated November 1792. Part of the set Nos. 47, 49 and 76.
 51. Pen-and-ink sketch; elevation (scale may be 1.48). No date. Appears to be a Savery engine.
 52. Pencil sketch; elevation; no scale. "Mr. Fulton's idea of moving boats [i.e., on canals.], April, 1795." His patent was No. 1,988, A.D. 1794.
 53. Pencil drawing; elevation; no scale or date. Brake drum and winding gear for inclined plane.
 54. Pencil perspective drawing and details; no scale. Coal screen. No date.
 55. Ink drawing; section; no scale. Loose bevel wheel gear. No date.
 56. Pen perspective sketch; no size. Atmospheric pumping engine. No date.
 57. Pen perspective sketch; no size. Blast furnace plant. No date.
 58. Pencil perspective drawing; no size. Winding engine plant. No date. Same engine as 61.
 59. Pen perspective drawing; no size. Winding engine plant. No date.
 60. Pencil perspective drawing partially inked; no size. Beam pumping engine plant. No date.
 61. Pencil perspective drawing partially inked in; no size. Winding engine plant. No date. Same engine as 58.
 62. Pen perspective sketch; no size. Winding engine plant. No date.

63. Pen perspective sketch; no size. Winding engine plant, another view. No date.
64. Pencil perspective sketch; no size. Pumping engine plant. No date.
65. Pencil perspective sketch; no size. Winding engine plant. No date.
66. Pencil sketch; section and part plan; no scale. Apparently return connecting rod engine plant. No date.
67. Pencil perspective sketch; no size. Apparently winding gear with brake drum. No date.
68. Pen-and-ink sketch; not to scale. Apparently a Savery engine. No date. (Compare with No. 83.)
69. Ink drawing; plan; no scale. "Mode of getting the coal near Brierley Hill, by T. Price. May, 1803."
70. Ink drawing; sectional elevation; no scale. Watt type rotative beam engine with crank and connecting rod. A duplicate of Nos. 37 and 101.
71. Pencil sketch; section; not to scale. "Hornblower's air pump," dated 1793.
72. Ink drawing; end and side elevation; scale 1.24. "Jinney for conveying wheeled corves down descents." No date.
73. Explanatory diagram; scale 1.24. "Calculation of the power of Mr. Anstice's rotative engine by D. Rose. March ~~1803~~, 1799."
74. Ink drawing plan; no scale. "Mode of getting coal near a roll. T. Price. March, 1803."
75. Wash drawing; elevation; no scale. Steam cylinder marked "Thos. Sadler, 1793."
76. Ink drawing; plan; scale 1.12. Portable engine for winding coals. 1792. Part of the set Nos. 47, 49 and 50.
77. Rough pencil sketches; not to scale. Horse gear, bridge, etc. No date.
78. Rough pencil sketches; not to scale. "Corn Market Roof at Paris" (on de Lolme's principle): "Brick machinery, 1794." Lord Dundonald's (?). No date.
79. Rough pencil sketches; no scale. Ships, etc. No date.
80. Pencil sketch; elevation. "Elephant's jaw for extracting [boring] rods when broken, made by Thos. Price of Oaken Gates. March, 1803."
81. Pencil sketch; elevation and plan; no scale. "1st sketch of River Mill by W. R. (i.e., William Reynolds). Jan., 1796. Improved by ~~W~~ Betancourt." Obviously the rough sketches for the finished drawings 99, 100, 102 and 103 below.
82. Ink sketch; vertical section; no scale. "New method of boring used by T. Price at the Bumble Hole Coll~~y~~, near the Level." March, 1803. Shows boring with rods.

27

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83. Pen drawing; elevation; details to scale 1.7. Apparently a Savery type engine. No date. Resembles No. 68.
84. Pen drawing; outline elevation; not to scale. Obviously Coalbrookdale Iron Bridge. No date.
85. Pen drawing; plan; no scale. "Mode of getting the 10 yard [coal] near Gospel Oak, by T. Price." Date torn off, but probably 1803.
86. Pen sketch; no scale. Unspecified. No date.
87. Coloured drawing; no scale. Obviously a Savery engine. No date.
88. Pencil drawing; no scale. (?) Tilt hammer heads. No date.
89. Rough pencil sketches; no scale. "Sundry ideas, 1793." Roller bearing, etc.
90. Pencil sketch; no scale. "Hornblower's air pump." No date.
91. Pen-and-ink sketch; sectional elevation. No scale. Blakey's fire engine, with legend (Pat. No. 848, A.D. 1766), intended for raising water for Horsehay and Ketley furnaces, with autograph letter from R. R[eynolds], dated Jan., 1767.
92. Engraved book illustration; elevation and plan. Horizontal windmill. No date.
93. Engraved book illustration; elevation. "Blakey's fire engine for raising water." No date.
94. Aquatint; general elevation; plan and sections; scale 1.50. "Machine for cutting weeds on rivers and canals invented by A. de Betancourt," dated "Sept., 1796." Apparently from a Spanish book.
95. Engraved book illustration; no scale. Air pump and details. No date.
96. Pen-and-ink sketch; no scale. Unspecified. Perhaps copied from a book. No date.
97. Pen-and-ink sketch; no scale. "Mode of gettg. the Ironstone in Brockmoor Colliery, by T. Price. Mar., 1803."
98. Perspective ~~was~~ drawing; elevation. "Donnington Wood incline plane and engine, etc.," by William Minor. September 28th, 1793. William Reynolds introduced the inclined plane for canals to take the place of locks in 1788. (Compare 38 and 48 with this.)
99. Coloured drawing; sectional elevation; scale 1.60. Float wheel arranged to drive corn mill, by (?) A. de Bétancourt [1796.]
100. Coloured drawing; front and side views; scale 1.30. Details of roller and thrust bearings for 99.
101. Ink drawing; side elevation; scale 1.12. Watt type rotative engine with crank marked "Richard Speed, June 4th, 1796." Obviously a duplicate of Nos. 37 and 70.

102. Coloured drawing; two plans superposed; scale 1.60. Float wheel arranged to drive a corn mill. No date. Part of set 99, 100 and 103.
103. Coloured drawing; elevation; scale 1.60. Float wheel arranged to drive a corn mill. No date. Part of set 99, 100 and 102.
104. Wash drawing; elevation and plan; no scale. Machine for transporting earth in making a cutting. No date. Duplicate of 105. (For details see Nos. 29 and 30.)
105. Coloured drawing; elevation and plan; no scale. "Machine pour transporter les terres." No date. Duplicate of 104, q.v.
106. Water-colour drawing; no size. Horse gin for transporting earth. No date, but paper has watermark 1794.
107. Water-coloured drawing; no size. Horse gin for transporting earth. No date. Duplicate of 106.
108. Wash drawing; cross section and plan; scale 1.12. Cylinder cover. No date.
109. Wash drawing; plan; no scale. Horse run for transporting material. No date [1794.] Obviously cut off No. 21 q.v.
110. Ink drawing; elevation and sections; scale 1.240. Plan for a canal aqueduct with spans of 100 feet over a river. Signed "March, 1794, Thos. Telford." (Compare with No. 117.)
111. Perspective drawing. Fire engine for raising water, and description, copied from Emerson's "Principles of Mechanics," 1758.
112. Ink sketch and description; vertical section; no scale. Improvements in machinery for pumping, by R. Banks. No date.
113. A.L. from John Chinn, Tewkesbury, June 11th, 1798, to W. Reynolds, Ketley, with perspective sketch, back view, no size, and description of a catapult.
114. Ink sketch. "Frame or instrument to determine the strongest possible arch for a bridge," with long description. Dated Bridgwater, March 7th, 1796.
115. Coloured drawing; sectional elevation and plans; scale 1.12. "Cupola furnace put up at Coalbrookdale by Rogerson, wch. will melt two tons of scrap in a short time." By Jno. Hornblower, dated Jany., 1801.
116. Sepia drawing; front and side elevations; no scale. "Scotch barley mill." No date.
117. Ink drawing; two plans; scale 1.12. Cast iron framing for aqueduct showing alternative methods of connection. Signed "Thos. Telford." No date [1794.] (Compare with No. 110.)
118. Pen-and-ink drawing; sectional elevation and plan; no scale. "J. Wilkinson's Idea of Chimney Boiler given by him to W. R[eynolds], November, 1799."

119. Engraving; scale 1 in. = 2 miles. "Plan of the intended Shrewsbury Canal, by George Young, 1793."
120. Engraving; scale 1 in. = 1 mile. "Plan of a canal from the parish of Mirthyr Tidvil to or near the town of Cardiff in the county of Glamorgan, by T. Dadford, 1790."
121. Engraving; scale 0.4 in. = 1 mile, or 1:153,800. "A plan of the navigable canal and collateral cuts between Birmingham, the different coal-mines, and the town of Walsall, with the proposed extensions." No date.
122. Coloured drawing; sectional elevation; scale 1.32. "Engine under James Glazebrook's patent." No date, but watermark 1798. Glazebrook's patents were: No. 2,164 A.D. 1797 and No. 2,504 A.D. 1801 for hot air engines.
123. Ink drawing; sectional plan and elevation; no scale. Steam wheel marked "J. Glazebrook, February 24th, 1799."
124. Ink drawing; elevation and plan; scale 1.48. "Inclined plane at Cyfarthfa," with legend. No date.
125. Ink drawing; sectional elevation and plan. Glazebrook's engine? No date.
126. Ink drawing; scale 1.4. Details of engine. No date. Apparently Glazebrook's patent engine.
127. Aquatint; scales 1.240 and 1.180. "Plan and section of a coalwork with the strata commonly met with in sinking near Wednesbury, Staffordshire." With legend in letterpress. Drawn by Thos. Westwood, engraved by F. Eginton, Birmingham. No date.
128. Aquatint; scales 1.240 and 1.180. "Perspective plan and section of a coalwork with the strata commonly met with near Wednesbury, Staffordshire." With legend in letterpress. Drawn by T. Westwood, engraved by F. Eginton. No date.

MEMORIAL TO "SCREW" SMITH.

A tablet on the wall of 31, High Street, Hythe, Kent, to the memory of Sir Francis Pettit Smith, F.R.S.E., who introduced the screw propeller for steam navigation, was unveiled on Wednesday, May 11th, 1922, by Lady Rocksavage. The tablet is the gift of the Rev. A. Winnifrith, M.A., D.Litt., whose researches have established the fact that it was at this house that the inventor was born on the 9th February, 1808.

H.W.D.