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of  
The Society for the Protection of Ancient Buildings

The objects of the Wind and Watermill Section are :

1. To stimulate the interest of the public in the preservation of wind and watermills.
2. To provide technical advice on questions relating to the repair of wind and watermills.
3. To make a detailed survey of wind and watermills as a permanent record with historical data of all mills in this country.
4. To encourage the craft of country milling.
5. To give financial help wherever possible.

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# TIDE MILLS

## PART ONE

by

REX WAILES

No. 2

S·P·A·B

2/6

## FOREWORD

When this paper was originally presented in 1938, Mr. Wailes expressed the hope that the history of these tide mills would one day be written. This hope has, unfortunately, not yet been fulfilled.

In the eighteen years that have passed, all the working tide mills recorded here, except that at Woodbridge, have stopped and some have been dismantled. If our knowledge of these mills is now to be increased, it must be by those who are able and willing to delve into local history for it, and it is much to be hoped that this reprint will encourage them to do so.

Owing to the length of Mr. Wailes's paper, it is necessary to publish it in two parts, and as the lithographic method of reprinting has been employed, the addenda and corrigenda which have been provided by a few kind friends will be found, duly acknowledged, at the end of the second part.

A fuller history of The Three Mills, Bromley-by-Bow, one of the most interesting mills in the country, where the wheels were turned by the tide until a comparatively recent date, will form *Tide Mills, Part III*, and will be the work of Miss E. M. Gardner, M.A., O.B.E.

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## Tide Mills in England and Wales

By REX WAILES, F.S.A., M.I.Mech.E.

PAST PRESIDENT OF THE NEWCOMEN SOCIETY

(Read at the Institution of Civil Engineers, London, October 12th, 1938).

" Amongst other commodities afforded by the sea, the Inhabitants make use of divers his creekes, for griste-milles, by thwarting a bancke from side to side, in which a floud-gate is placed with two leaves: these the flowing tyde openeth, and after full sea, the waight of the ebbe closeth fast, which no other force can doe: and so the imprisoned water payeth the ransom of dryving an under-shoote wheele for his enlargement."

—Richard Carew: *Survey of Cornwall*, 1602.

During the Summer Meeting which this Society held in London in 1936, one of the most notable of the visits made was to Messrs. Nicholson's Distillery at Bromley-by-Bow: to many Members this must have been their first introduction to a tide mill. Such a mill may be defined as a water mill which makes use of tidal water as a source of power. Some tide mills depend upon the tide alone while some use a proportion of fresh water from an impounded stream, but in every case the principle is the same. A pond is formed either by enclosing an area in a tidal creek or by damming a stream where it enters an estuary. In the dam or wall, automatic sluice gates are set and these are usually similar in appearance to lock gates (see Fig. 1). As the tide rises the pressure of water opens the gates and the pond is filled through them; when the tide turns the pressure of water in the pond is greater than that outside it and the gates close. In some cases flap valves operating in a manner similar to the valves sometimes fitted at sewer outfalls are fitted giving the same effect.

In the course of two years' work in the field twenty-three tide mills have been found: of these ten are still worked by the tide, two are worked by power, five are used for other purposes and six stand derelict with some of the machinery in place. These twenty-three mills may be divided into groups by counties in alphabetical order as follows:—

### CORNWALL:

Wacker Mill, Antony	Derelict, machinery remains.
Antony Passage	do. do.
Carbeal, Tor Point	Used as a barge repair shop and a stable.
Millbrook	A coal store.
West Looe	Electricity Company's store.

### DEVON:

Pomphlett Mill, Plymouth	Worked by power.
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ESSEX:  
Fingringhoe  
St. Osyth  
Stambridge  
Thorrington

A store for the power mill.  
Derelict, machinery remains.  
Working.  
Derelict, machinery remains.

HAMPSHIRE:

Ashlett  
Beaulieu  
Eling  
Quay Mill, Emsworth

A recreation club.  
Working.  
Working.  
Worked by power.

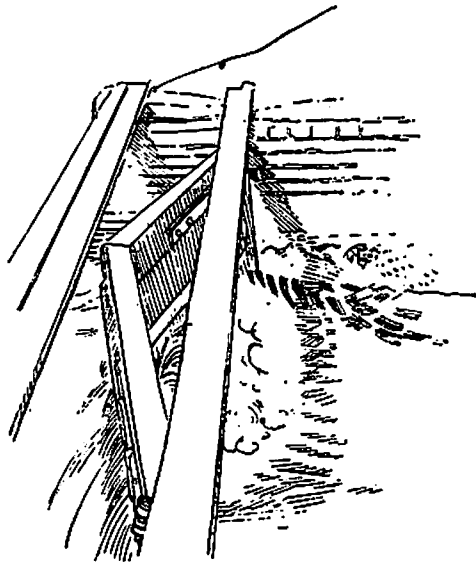


FIG. 1. BIRDHAM MILL, SUSSEX. Sluice-gate.

ISLE OF WIGHT:

East Medina Mills  
St. Helens  
Wootton

Working.  
Derelict, machinery remains.  
Working.

LONDON:

Bromley-by-Bow

Working.

PEMBROKESHIRE:

Carew  
Pembroke

Working.  
Working.

SUFFOLK:

Woodbridge

Working.

SUSSEX:

Birdham  
Slipper Mill, Emsworth

Boat repair shop.  
Working.

In addition to these there are a number of tide mill sites to be found, several cases where outbuildings remain though the mill itself has disappeared, and numerous references to tide mills of which no trace now remains.

The survey has been taken round the coast from east to west, and consequently SUFFOLK is the first county to be considered. *Dunwich Mill*<sup>1</sup> has disappeared and the only mill left is that at *Woodbridge* on the Deben Estuary. This is first mentioned about A.D. 1170 when the canons of Woodbridge Priory granted to Baldwin de Ufford a plot of land which gave access to his mill more freely than before. The mill evidently came into the possession of the Priory since at the dissolution of the monasteries it was granted by Henry VIII to Sir John Wingfield. It passed to the Crown again as Sir John and his wife died without issue and in 1564 it was granted by Queen Elizabeth to Thomas Seckford, in whose family it probably remained until 1672. The weatherboarding has given place to corrugated iron, but the tiled mansard roof remains. The mill stands on the quay beside the power mill and is served by a pond having an area of  $7\frac{1}{2}$  acres with a 6 ft. head. The wooden wheel in a small wheel-house outside the mill was renewed in 1932; it is 20 ft. diam. by 5 ft. 10 in. wide with closed wooden buckets and is mounted on an oak shaft 22 in. square. A rear vertical penstock is first raised and allows water to flow over the sluice; the wheel is then breast-shot. The sluice is independently controlled and in two horizontal sections. When the level of the water has sunk sufficiently the top half is raised about twelve inches. Finally the sluice is raised completely and the wheel becomes under-shot. It drives four pairs of stones on the first floor, all of which are controlled by a single pair of governors driven from the 22 in. diam. oak upright shaft. This was the only case in which governors were found to be used.

ESSEX: At *Barrow Hill Mill*, which has now disappeared, Mr. J. Bryant of Colchester and a fellow worker, as lads, were scared one night by the whole mill shaking violently. They left the mill in a fright and it was found next morning that a school of porpoises had dived after fish at high tide and come up under the mill floor. The foundations of two tide mills are still to be seen at *Battle Bridge* on the Crouch. This mill was built in 1771 or 1772 on a brick, stone and wood foundation, with a wooden building placed on top, and probably succeeded an earlier mill on the same site. It was pulled down in 1902 or 1903.<sup>2</sup> It is on record that the Abbey of Barking owned two tide mills at *Corringham*, and *Mucking*. The Knights Hospitallers owned a tide mill on the Mardyke at *Purfleet*, which was afterwards destroyed to give place to a powder magazine, while the timber-built mill at *Walton-on-the-Naze* at the head of Walton Channel, was pulled down in 1921 and its place taken by a boat-house. It had a pond of thirty acres and one under-shot water wheel with straight radial floats.<sup>3</sup> The post windmill<sup>4</sup> standing beside it was blown down the day the demolition of the tide mill was completed.<sup>5</sup>

<sup>1</sup> Gregory's *Mechanics*, 4th ed., 1826, pp. 520-530.

<sup>2</sup> per Mr. P. H. Mathews.

<sup>3</sup> *The Engineer*, Feb. 26th, 1909.

<sup>4</sup> There is a picture in oils by Ford Madox Brown in the City of Birmingham Art Gallery, which shows the windmill, the tide mills, a sailing ships, and a martello tower.

<sup>5</sup> *Trans. Essex Archaeological Society*, 1929.

A windmill was built at *Milton* (now Southend-on-Sea) in 1299 to replace a tidal mill which was finally destroyed by the sea in 1327. As there is no mention of profits from it in a survey of the property completed shortly after 1284, it was apparently out of use before that date.<sup>6</sup>

*St. Osyth Mill* at the head of St. Osyth Creek, belonged to St. Osyth's Abbey and is mentioned in an abbey balance sheet of 1491. The present mill, last worked in 1930, is weather-boarded and tiled, and was considered by Mr. A. R. Powys to date from about 1730.<sup>5</sup> It is built on a bridge and has a pond of about thirty acres. The two wheels, 18 ft. 6 in. diam. by 6 ft. wide with wooden floats drove two groups of three and four pairs of stones, one of which has a grain cleaner incorporated in the hopper (see Fig. 2).

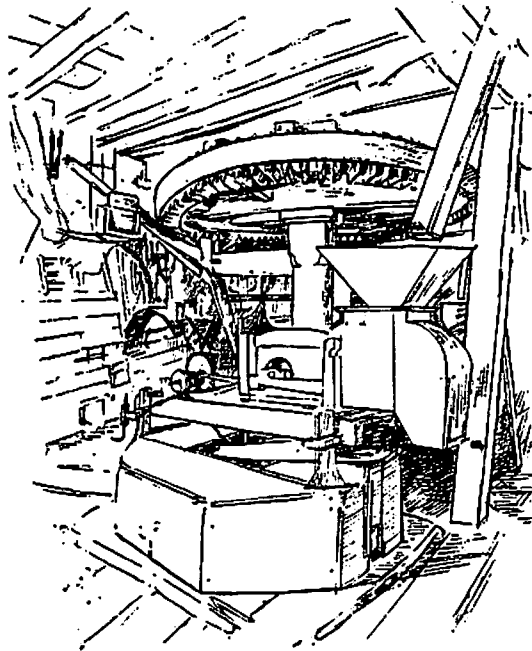


FIG. 2. ST. OSYTH MILL, ESSEX.  
Stones, wheat cleaner and sack hoist.

*Thorrington Mill* at the head of Arlesford Creek is a weather-boarded and slated derelict with an outside breast-shot iron wheel with closed buckets which is 16 ft. diam. by 6 ft. wide. The wheel is mounted on an iron shaft and drove three pairs of stones. Auxiliary power could be used to drive one pair of stones by means of a pulley outside the building and a pair of iron bevel gears. The date 1831 is on a brick on the outside of the mill and this may have been the date of erection or rebuilding. It is said to have been out of use for twelve years.

*Fingringhoe Mill* on Roman River, which is mentioned as early as 1531,<sup>5</sup> is a fine weather-boarded building now used as a store for the adjoining power mill. Although the sluice is now broken, the wheel still remains inside the mill building. It is breast-shot, 16 ft. diam. by 8 ft. wide, with closed buckets and drove two sets of three pairs of stones. With a good head of water it would drive four pairs of stones and the dressing machines together. The iron pit wheel, about 10 ft. diam., was too heavy for the 10 in. square iron shaft and canted it up.

*Stambridge Mill* near Rochford, on the Roach (Pl. I), is still at work with the power mill adjoining it. The mill is weather-boarded, with a red tiled mansard roof and two lucams projecting, and adjoins the red brick mill house which appears to be about 220 years old. The wheel is about 18 ft. diam. by 12 ft. 9 in. wide with wooden floats. It is mounted on a wooden shaft and drives three pairs of stones.

LONDON.—There are references to several mills in London: as to the appearance or construction of these, we know little. The Templars built mills on the Fleet River at Baynard's Castle<sup>7</sup> which were destroyed in 1307. A brick and timber mill, known as the *Old Flood Mill* in 1825, stood on the Ravensbourne at Deptford 200 yards below the bridge carrying the London-Greenwich road. It belonged to Christ's Hospital and was occupied by J. & H. Robinson.<sup>8</sup> It is mentioned as early as 1608 and was at one time used for the manufacture of biscuits.<sup>9</sup> At *Hackney Marsh* a tide mill was erected for boring guns and at *Horsley Down* there were tide mills at the time of Edward I.<sup>10</sup> At *Kings Mill* below the Thames Tunnel and about 1½ miles from Tower Bridge a large additional reservoir burst in 1779 and flooded low-lying gardens around. At *Nine Elms*, Battersea, in 1786, a mill stood on a creek running from the Thames to what is now the Gas Light & Coke Company's premises on the site of the locomotive running sheds. The mill is shown on a map published in 1800 by J. Edwards, Belvedere Place; the bridge is still called Mill Pond Bridge. The Railway first crossed the pond on a viaduct in 1838 and the pond was filled in soon afterwards. The mill building remained until the 1870's.

On the east side of St. Saviour's (then Savory) Dock, Southwark, stood *Savory Mill*, a quarter of a mile below Tower Bridge. It was fed by the Neckinger stream (now gone) and a series of ditches which supplied the tanneries with water. The mill is shown in a map of 1742 and is still commemorated in Mill Stairs.<sup>11</sup> A mill is mentioned at *Rotherhithe*, but there is no information as to its date or construction.<sup>12</sup> *London Bridge Mill* was used for pumping water. In 1580, at the instance of Sir Christopher Hatton, a lease of the most northerly arch was granted to Peter Morice, a Dutchman, for 500 years at ten shillings per annum, and in 1584 the second arch was leased on the same terms.

<sup>6</sup> *Trans. Southend-on-Sea and District Antiquarian and Historical Society*, II (1922), pp. 113-167.

<sup>7</sup> Pat. Roll, I John.

<sup>8</sup> *The Engineer*, July 12th, 1901.

<sup>9</sup> N. Dews, *History of Deptford*, 1884.

<sup>10</sup> *Old and New London*, V, 46.

<sup>11</sup> *The Engineer*, July 12th, 1901.

<sup>12</sup> E. J. Pout, *History of Rotherhithe*, 1907.

The mills continued in the same family until 1701 when they were bought by Richard Soames for £38,000 and a company was formed to take them over. The following description is given by John Bate in 1635,<sup>13</sup> with a diagram (see Fig. 3) which is reproduced here:—

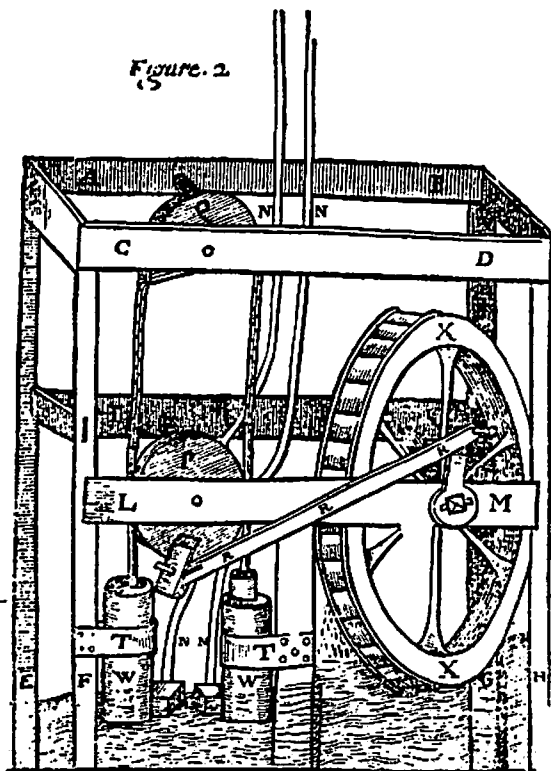


FIG. 3. LONDON BRIDGE WATER WORKS.  
From Bate—*Mysteries of Nature and Art*.  
2nd ed., 1635.

“ Divers Rivers there are, which according unto their propinquity or remotenesse from their mother Sea, run and returne (I meane ebbe and flow) more or lesse; whose force and stream in some is of its own accord, sufficient to mount its proper water as may be seene at the Water mill or Engine neare the North end of London Bridge: which Engine by the ebbing and flowing of the Thames, doth mount the sayd Water unto the top of a Turret, and by that meanes is conveighed above two miles in compasse, for the use and service of that City. Which Engin I circumspectively viewed, as I accidentally passed

<sup>13</sup> *The Mysteries of Nature and Art*, 2nd edition, 1635, p. 53

by, immediately after the late fire that was upon the Bridge Anno 1633, and the device seeming very good, when I came home I drew a modell thereof and have here presented it unto the view.

“ A, B, C, D, E, F, G, H, I, K, L, M, doe signify a frame strongly made of timber, X, X, signifie the water wheele, the Gudgins of this wheele must be set to turne in strong brasse sockets, firmly set in the two middle beames of the frame I, K, L, M. The ends of the said Gudgins, must be made to reach a good way over the beames, and they must be made square towards their ends, and have each a handle pinned fast on. Then in the middle beames I, K, L, M, must likewise be fastened another strong wheele, as P, which must have as it were a spoak, reaching out from it, upon the lower side. There must also be another half or 3 quarter wheele, as Q, placed directly above it whose Diameter must be of one size or proportion: directly under the utmost edges of these wheeles must be firmly set two strong barrels of brasse or iron, which is of more durance at W, W, having each of them a succur cast with the barrels, these barrels must be bound fast unto two posts of the frame, with two strong yron bands, as T, T, to the end they may not stirre: unto, each of these must be fitted a force well leathered, and in the tops of the forces must be set two picces of wood, two foot long and about two inches thicke, and to the tops of them must be linked two chaines of iron: which must be linked straight up to the two ends of an iron band, that must compasse the circumference of the uppermost wheele noted Q: a long and strong wooden barre must come over the handle of the maine wheele, and upon the spoake of the wheele P, this barre is noted with R, R. N, N, N, signifie the Pipes whereinto the water is forced. These pipes carry the water to the top of a Turret neare adjoining unto the Engin, and these being strayned, thorow a close wyer grate, it descendeth into the maine wooden pipe, which is layed along the streets and into it are grafted divers smaller pipes of lead, serving each of them to the use and service of particular persons.”

In the XVIIIth century it comprised four wheels in the first four arches. The first drove 16 pumps, the second 8, the third 12 and the fourth 16. In all there were 20 double and 32 single-acting pumps, having a bore of 7 in. and a stroke of 30 in. The delivery at normal tide was 123,120 gals. per hour, with a loss of 20 per cent. due to leakage. Each wheel was 20 ft. diam. by 14 ft. wide with 26 floats and mounted on a shaft 19 ft. long by 3 ft. diam. Each shaft ran on brasses fitted to levers 16 ft. long, which could be raised up and down by a geared windlass according to the state of the tide.<sup>14</sup>

*East Greenwich Mill*, halfway between Blackwall Tunnel and Woolwich, was a flour mill designed by John Lloyd, an engineer of Brewers Green. In 1803 one of Trevithick's high pressure engines was used for pumping during the excavation of the pond. It had a cast iron boiler 6 ft. diam. by 1 in. to 1½ in. thick in different places according to Trevithick. One September day the boy in charge went off to catch eels, a labourer stopped the engine because it was going too fast and the boiler blew up, killing three men and injuring

<sup>14</sup> W. Maitland, *History of London*, 1782, Vol. I, p. 51. cf. Jenkins, *Collected Papers*, pp. 131-140, for detailed information.

others. In 1901 the Blackheath and Greenwich District Electric Lighting Co. occupied the site. The mill was parallel to the river bank and had a 40 ft. waterway, with a wheel 11 ft. diam. by 26 ft. wide weighing 20 tons; there was a space 7 ft. at each side to allow for the free flow of water into and out of the mill pond. There were 32 floats in four sections breaking joint with each other to lessen the shock of the water. The wheel revolved in a wooden frame, which rose and fell with the tide. Planking was hinged to the floor of the frame and to the base of the beams which served as guides to the frame, and projected towards the mill pond. The tide could not get through the planking, and so forced it up as it rose, maintaining the wheel at working level. At each end of the wheel, a ring of cogs engaged bevels at the lower ends of two upright shafts. There were two bevels on each shaft, and a lever was provided to change from one to the other when the tide changed.<sup>15</sup>

In the Becontree Hundred (i.e., East and West Ham) there were eight mills (formerly nine) in the time of the Domesday Book. The mills north of Stratford Causeway were almost certainly of Roman origin for in the IIIrd century Cormac MacAirt, High King of Ireland, sent over to England for an artificer to build him a mill after the Roman pattern.<sup>16</sup>

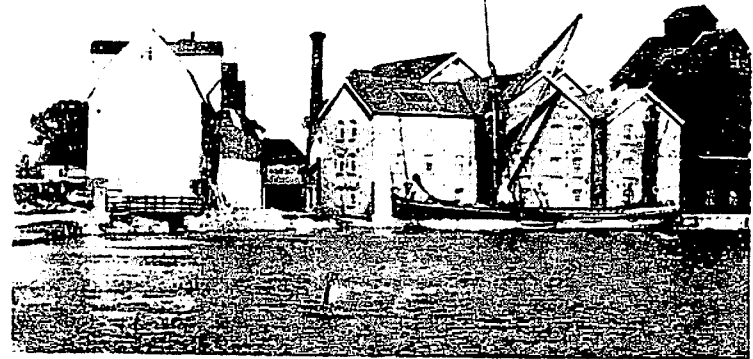
The mills at *Three Mills Distillery, Bromley-by-Bow*, stand on land that may have been embanked at the time of King Alfred. In 1135 at the bequest of Queen Matilda the Monastery of Stratford Langthorne was founded by William de Montfitchet, a Norman Baron, who owned much land on the River Lea, up to and beyond Bishops Stortford. He gave all his lands in Ham to the Monastery, including two mills next to the causeway of Stratford. The three mills were built; the third was removed when, in the reign of Edward VI, an Act was passed to make the river navigable. Compensation was to be paid: the first case of compensation on record. At the dissolution of the monasteries the mills were taken over by the Crown and granted in 1539 to Sir Peter Mewtas, at one time Ambassador at Paris. In 1633 they passed to Sir John Nulls, and in the 1660's to the Astley family. In 1730, Peter Lefevre, a Huguenot who died in 1751, and his partner Grace of St. Thomas Mills, the Stratford distillery house north of the High Street, leased the mills and later acquired the freehold from Lord Bathurst. In due course they descended to Bissons, Metcalfe & Mure. Before 1760 the Nicholsons had been connected with the mills through William Bowman, who was a partner in Three Mills in 1772, and in 1872 the mills were taken over by them.

Of the two mills remaining, the older is the House Mill (No. 1), rebuilt in 1776: the Clock Mill (No. 2) (Pl. II), was rebuilt in 1817 and includes the clock, which is dated 1753 and has a bell cast in 1750. The mills are semi-tidal impounding up to 12.5 ft. O.D. All the levels have risen due to the embanking of the rivers; the original depth of navigation at the locks was 4 ft. 6 in.: it is now 12 ft. 6 in.<sup>17</sup>

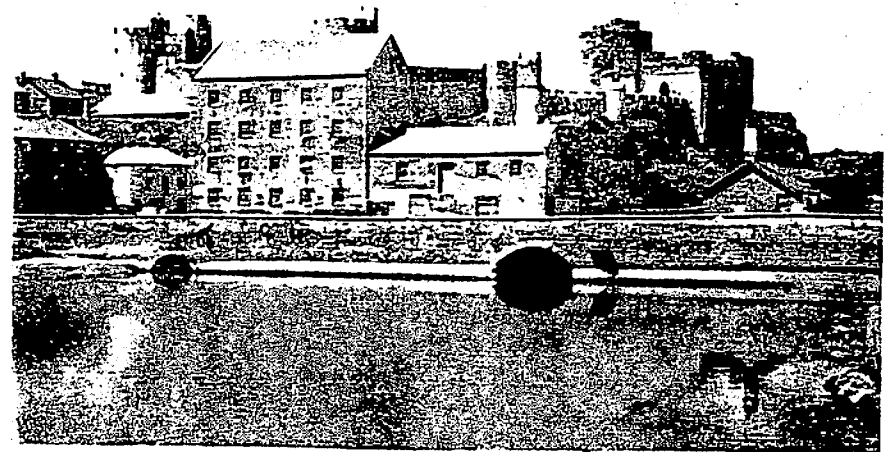
<sup>15</sup> Gregory's *Mechanics*, 4th ed., 1826, pp. 35-37.

<sup>16</sup> Keating, *History of Ireland* (circa 1633).

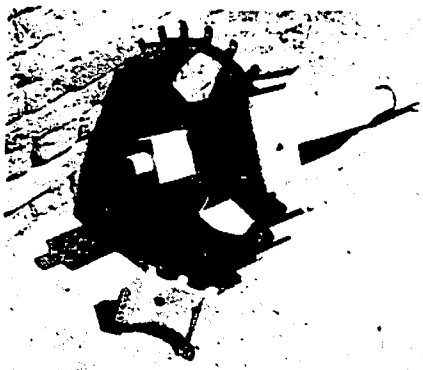
<sup>17</sup> per Mr. R. Nicholson.



STAMBRIDGE MILL. ESSEX.



PEMBROKE MILL.



ELING MILL, HANTS.  
Showing the removable segment.

THREE MILLS DISTILLERY,  
BROMLEY-BY-BOW, LONDON.

*Left* : CLOCK MILL.

*Below* : HOUSE MILL.

Wheels 4 and 5 showing inter-  
mediate gearing for No. 4 wheel.

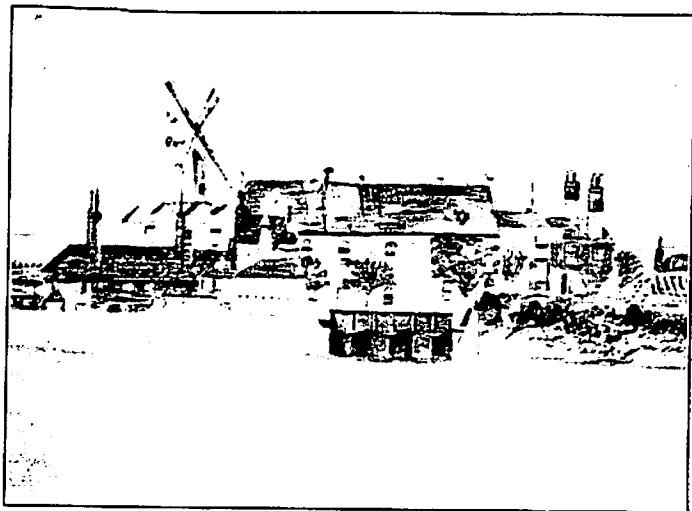
*Opposite* :—

*Top* : CLOCK MILL.  
The three water wheels.

*Below Left* : CLOCK MILL.  
Drive from wheel to stones.

*Below Right* : HOUSE MILL.  
Sack Hoist Drive.





BISHOPSTONE MILL. SUSSEX.



BIRDHAM MILL. SUSSEX. 1868.

The particulars of the mills are best set out in tabular form.<sup>18</sup>

HOUSE MILL (No. 1) (Pl. II)	Wheel No.	Diam. Ft.	Width	Floats	H.P.
	1	20'	3' 1"	2' 11" x 2' 8" Poncelet	20—25
	2	19'	3'	2' 10½" x 1' 7" straight	20—25
	3	20'	3' 5½"	3' 3" x 2' 10" "	20—25
	4	20'	3' 1"	4' 8" x 2' 10" lapped Poncelet	40—45
	Stones		Diameter		
	4 pairs		4' 4"		
	8 pairs		4' 2"		
CLOCK MILL (Pl. III)	Wheel No.	Diam. Ft.	Width	Floats (all Poncelet)	H.P.
	1	20'	3' 10"	3' 8" x 1' 9½"	20—25
	2	19' 6"	2' 7"	2' 5" x 1' 8"	20—25
	3	20'	4'	3' 9" x 2' 10"	20—25
	Stones		Diam.		
	Engine 8 pairs		4' 2"		
	Water 4 pairs		4' 4"		
	" 1 pair		4' 2"		
	" 1 pair		3' 8"		
				R.P.M. of Stones 130	
				H.P. required 12	

The 8 ft. wide wheel replaced a rise-and-fall wheel 10 ft. diam. by 4 ft. 6 in. wide having an inclining wheel shaft with a train of wheels to the pit wheel. It became inoperative because of the increasing head due to the embanking. Intermediate gearing is still used between the wheel shaft and the pit wheel with the 8 ft. wheel to bring it into line with the stones. Most of the stone furnishings are of the usual type with round wooden casings, but in each Mill 8 pairs have metal furnishings of Fairbairn's design with silent feed. A windmill south of the granaries was destroyed when the distillery was rebuilt in 1836.

KENT.—Wyatt's tide mill at *Northfleet* was noted by Goodrich,<sup>19</sup> but apart from this and one other doubtful example, tide mills in Kent appear to have been confined to the Medway estuary.<sup>20</sup> In "*Customale Roffense*" a water mill is mentioned at *Woldham* (Wouldham). Smetham<sup>21</sup> says that there were "two water mills at *Temple Manor*, the house or preceptory of the Knights Templars, these under one roof." At both these places there is no stream and it is possible that the mills were therefore tide mills. Fisher<sup>22</sup> says that in the time of Gundulph, Martin, the Chamberlain of the Priory of St. Andrew, *Rochester*, built a tide mill below the castle.

The *Strood* tide mill of later days stood near the Watermill Tavern, Canal Road. The mill is shown on a plan of the city of Rochester, given in *The History and Antiquities of Rochester and its environs*, 1712. Percy Young<sup>23</sup> says it was "built upon the sloping bank of the river; that part which stood over the slope upon piles of wood, the superstructure being also of wood." The

<sup>18</sup> per Mr. W. M. M. Shepperd.

<sup>19</sup> Vide Mr. Forward's paper on "Simon Goodrich and his work as an Engineer," Part II. *Trans.* XVIII.

<sup>20</sup> The following notes are from Mr. W. Coles Finch.

<sup>21</sup> *History of Strood*, p. 153.

<sup>22</sup> *History of Rochester*, p. 109.

<sup>23</sup> *Tide Mill Secret*.



wheel and machinery were housed in the piled part of the building and were visible from Rochester Bridge. When last worked as a mill in 1858 it was from two to three hundred years old. Two water wheels—on either side of a flap sluice—drove five pairs of stones; one driving two pairs of French and one pair of peak stones and the other driving two pairs of wheat stones, the flour dressers, wheat cleaners and the sack hoist. The output was 50 sacks a week. With a spring tide it would run for 6 hours. With an ordinary tide 3 hours had to elapse after high tide before the mill could work and it would not work at all with a neap tide or if the wind held up the water.

In Domesday Book there is this reference to what appears to have been a tide mill at *Dover* though there is no proof that it was. "At the entrance to the port of Dover is a mill which carries disaster to vessels by the great disturbance of the sea, and so causes the greatest damage to the King and his men; it was not here in the time of King Edward; the nephew of Herbert says that the Bishop of Bayeux (half-brother to William I) granted leave to build the mill to his uncle the said Herbert, son of Ivo.<sup>24</sup>

SUSSEX.—*Bishopstone Mill* (Pl. IV) opposite Newhaven was built by the Duke of Newcastle in 1761. It was worked by a side cut from the Ouse at Newhaven, the waste water escaping into lagoons near the shore. It had originally four pairs of stones: but later these were increased to 16 pairs, worked by three undershot wheels about 15 feet diameter. One was under an extension on the Newhaven side, carried on two low arches; while under the old portion of the mill five smaller arches led to the other two wheels. All these arches had gratings up to the top.<sup>25</sup> On the top of the mill was a windmill added by Mr. Catt and used only for hoisting sacks. At *Pagham Harbour* and *Sildesham*, near Selsey, the foundations of tide mills are to be seen; the latter was erected by Woodroffe Drinkwater in 1755 under the direction of Benjamin Barlow, who invented the machinery.

*Birdham Mill* (Pl. IV), situated at the mouth of Chichester Canal, was until the recent development of the adjacent land situated in the most beautiful surroundings. The timber mill was rebuilt in 1768, and in 1891 the brick store was built on. Fifty years ago<sup>26</sup> there were three pairs of wheat stones and two pairs for grist. Most of the corn came from Southampton by water and vessels of 150 tons then could reach the mill. Latterly only the wheat stones and one grist stone was worked. There were two wheels, an inside one of iron 12 ft. 6 in. diam. by 4 ft. 9 in. wide, and an outside one of wood (Pl. V) 11 ft. 6 in. diam. by 7 ft. wide, each with 24 floats mounted on 18 in. oak shafts. These were served by a 30-acre pond giving a normal head of 12 ft. and a working period of 5½ hours. The mill stopped in 1935 and by 1936 was gutted of all its machinery, leaving only the two wheels and their gearing in place. The mill is now to be used as a motor boat repair shop, and the mill pond as a motor boat dock.

<sup>24</sup> Bennett and Elton, *History of Corn Milling*, Vol. II, p. 128.

<sup>25</sup> *The Engineer*, July 12th, 1901.

<sup>26</sup> per Mr. B. Cribb.      <sup>27</sup> per Mr. F. W. H. Shepherd.

At *New Fishbourne*, at the head of the Chichester Channel, stood *Salt Mill*, a tide mill of which only the foundations now remain. It was built of brick above tide level and had a tiled roof. An undershot water wheel drove a pair of wheat and a pair of barley stones on the first floor, as well as a bolter, a wire dresser, an oat crusher and a wooden lathe. Tom Shepherd, the first V.C., worked for many years in this mill and died about seventy-five years ago. He was at one time pinned in bed by a ship's bowsprit, which drove through the wall of the mill house in a storm. The highest tides were about the level of the floodgate hand rail, about 4 ft. above the causeway and just below the level of the bottom of the mill. Two hundred yards east of this there was Barton's tide mill which was burned down about 1870<sup>27</sup>, while to the north was a post windmill which was moved on a trolley by road from Littlehampton in about 1853: it was pulled down in 1898.<sup>28</sup>

*Slipper Mill, Emsworth*, is just in Sussex. In appearance it has altered considerably in recent years: the new brick and slate store house, which rather dwarfs the mill, replaces an earlier and smaller timber and tile building. The old miller's house has also been removed. This had a water wheel in the tail race of the mill, which drove pumps to fill a bath in the house: the owners of the Stanstead Estate who owned the mill used to come down and take sea water baths there. The present foreman, Mr. Burgess, was born in the thatched round-house of a pug mill close by, which was used for making the bricks for the old Stanstead House and was afterwards turned into two cottages. The earliest date in the mill is 1735, which is presumed to be the date of some extensive alterations. The mill receives water from a small stream as well as using tide water; it has no auxiliary source of power. The single undershot wooden wheel under the floor is 9 ft. diam. by 8 ft. 6 in. wide, with open buckets and is mounted on an oaken shaft 16 in. square and drives two pairs of stones—there were three pairs once—and other machinery on the first floor.

Adjoining this mill is the millpond of another mill of which only some foundations and a brick chimney remain. It was built in 1867 by a Mr. Hatch to spite, it is said, Mr. Bierly, the then owner of Slipper Mill. The tail water ran across the tail water of Slipper Mill almost at right angles and had to be altered. After only about thirty years this mill was burnt to the ground and the mill pond is now a timber pound.

HAMPSHIRE.—On the Hampshire side of the border another tide mill stands at Emsworth. This is *Quay Mill* which has not been worked by the tide for 17 years. It is said to have been built over two hundred years ago for the production of flour for biscuits during the wars with the French. The mill pond has now been bought by the local council. It served an undershot wheel, now removed, which drove four pairs of stones, of which two now remain. The picturesque red roofed mill has not altered much in appearance.

At *Portsmouth* in 1817 most of the grain for the Naval Victualling Office was ground at a tide mill, which stood on piles on the shore,<sup>29</sup> erected there by the Government at a cost of £6,000.

<sup>28</sup> Bennett and Elton, *History of Corn Milling*, 1898, Vol. II.

<sup>29</sup> Bennett and Elton, *History of Corn Milling*.

The King's Mill at Portsmouth was driven by water collected in a great tidal basin situated near the present Sun Wharf and a similar tidal mill existed on the opposite side of the harbour at *Forton*, near Gosport.

Several tide mills were in operation on the Itchen in the Middle Ages in the eastern suburb of *Southampton*, where a street still retains the name of Millbank, from a mill of this description. One of the most interesting of the tidal mills was that which was situated close to the eastern wall of Southampton, the town ditches on the east and north of the walls forming the reservoir for the water, which worked this mill at its outlet into the sea at the south-eastern corner of the fortifications. This mill is described in the old records of the town as the " *Communis molendini aquatici subitus altam crucem extra portam domus dei* " and in the 7th Henry VI, it was farmed out by the mayor, aldermen and burgesses at an annual rent of 20s.<sup>30</sup>

At *Eling* on the River Test a red brick tide mill stands on a toll bridge: both bridge and mill are the property of Winchester College. The automatic

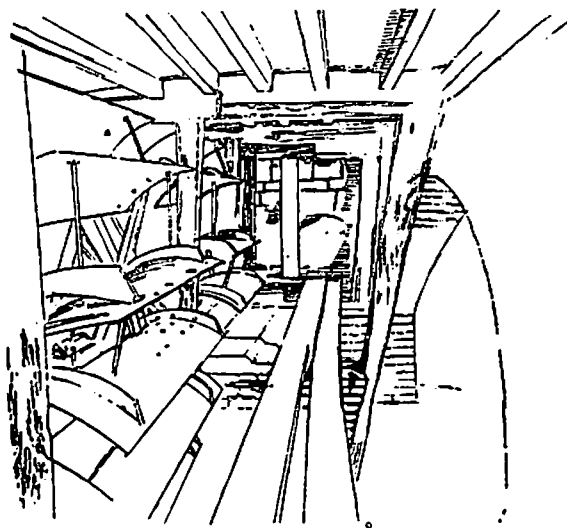


FIG. 4. ELING MILL, HANTS.  
Poncelet water wheels.

tide gates are incorporated in four hand-operated sluices built on to the upstream side of the bridge; the tide is admitted by flap valves instead of by lock type gates which are the usual method. The head is about 12 ft. and at spring tides the river fills up for two miles back. About 35 years ago the mill was considerably altered by Armfields of Ringwood: two iron water-wheels 11 ft. 6 in. diam. by 5 ft. 2 in. wide with 24 curved Poncelet floats replaced the wooden wheels (see Fig. 4) while, with the exception of the great spur wheel, which is of

<sup>30</sup> *Antiquary*, Aug., 1891, pp. 55-56.

iron and cogged, all the shafts and gears are of iron. Only one of the wheels is now used and drives two pairs of French stones aided by a 10 h.p. Blackstone engine and most of the gear from the other wheel has been removed.

*Ashlett Mill*, Fawley, is now the Ashlett Club, a recreation club for the employees of the Agwi Petrol Refining Company. It is built in a particularly beautiful red brick with a tiled mansard roof and bears the date 1816 on a stone on the east side of the building. It was built originally in 1618 and was last worked about 1890 and has since served successively as flats, a yacht stores and lodgings. None of the gearing remains, but there is evidence to be seen which shows that two water-wheels, one at each end of the main building, each drove two pairs of stones. The mill pond takes the cooling water from the refinery and a white " coral " grows on the sluice.

*Beaulieu Mill* is built on the bridge across the Beaulieu river, which separates the Abbey from the village, and uses fresh water as well as the tide. The main building is of red brick, with a weather-boarded extension to the rear, and tiled roofs. At one time there were two wheels under the floor of the mill. One wooden wheel now remains 12 ft. 4 in. diam. by 4 ft. 6 in. wide with 24 buckets, mounted on an 18 in. diam. wooden shaft and drives two pairs of stones mounted on a hurst on the ground floor (Pl. VI). Two further pairs of stones and a sack hoist are driven by an 8 h.p. electric motor.

ISLE OF WIGHT.—The tide mill at *St. Helens* is stone built, with slated roof, but is a windowless skeleton with a general air of desolation. It was at one time worked by Edward Way & Son and in their time a waggon with five horses went as far as Ventnor twice a week. There are two wooden wheels, each of which drove four pairs of stones. The larger wheel is outside and is 20 ft. diam. by 6 ft. wide on a 22 in. diam. wooden shaft; the smaller one inside the mill is 15 ft. 6 in. diam. by 6 ft. 6 in. wide on a 2 ft. diam. shaft. Both have oak floats and are fed by a tidal pond adjoining Brading Harbour.

At *Wootton Bridge* the mill on Wootton Creek seems to have been altered or extended two or three times. At the end is a stone built and slated twin gabled building; the next section is single gabled and tiled; then comes a portion with a slated mansard roof and the ends weather-boarded where they are exposed and finally a substantial slated building of Georgian aspect. There are two wooden wheels cased inside the mill, about 24 ft. diam. by 6 ft. wide; but only one is now used and can drive 3 pairs of stones. An attempt was made to work one set of gears with a gas engine in conjunction with the water-wheel; but the scheme failed on account of the effect of the hit-and-miss governor. The mill pond is fed by the Blackbridge Brook as well as by the tide and has both lockgate type as well as flap valve sluices on the upstream of the bridge: it will work the wheel for four hours each normal tide.

*East Medina Mill*, near Whippingham, was built about 1790 by William Porter, a pastrycook of Newport. At that time it was known as Botany Bay Mill from the fact that the first Botany Bay convicts were waiting at the Northern Bank while the mill was being built. The labourers employed in building the mill went down there from Newport in boats and were taunted by the porters on the quay with being bound for Botany Bay. The mill was leased

by William Roach of East Standen in 1797 and the lease includes "The storehouse and bakehouse adjoining to the South end of the aforesaid mill house, and at present used and occupied as an hospital or barracks for His Majesty's troops." As to the troops themselves, tradition connects them with the tablet on the South wall of Whippingham Church bearing the inscription: "To the honoured memory of eighty-four Hessian soldiers of the regiment Prinz Carl Lossbergh, who died of disease in the Isle of Wight during the campaign in the year 1794, and were buried in Whippingham Churchyard. This Tablet is placed here by the Landgraf A.F. of Hess." The soldiers were probably mercenaries which it was customary to hire at that time. In 1930 the roof of the barrack portion was lifted bodily off the mill in a gale and the main timbers deposited 100 yards away;<sup>31</sup> it has not been repaired and now presents a sad appearance. The mill building is of red brick with a curious flat-topped roof, looking as though the top of the gable had been sliced off. The machinery is confined to the extreme north end of the mill and the wheel (Pl. VI) is contained in a separate boarded wheel house. It is from breast to undershot according to the head of water, is 15 ft. 6 in. diam. by 6 ft. 8 in. wide, with 30 oak floats and is mounted on a 12 in. octagonal shaft; it drives two pairs of composite stones—there were three at one time. The mill which stands on the east bank of the River Medina, has been acquired by the Newport Corporation from Mr. John Roach with a view to utilizing the site in connection with electricity works.

DEVON.—*Pomphlett Mill*, Plymouth, on the river Plym, is a stone-built building with a slate roof. It had one undershot wheel, which has now disappeared, and two pairs of french stones. It has not been worked by water power since 1924, and is now driven by electricity and is the provender mill of the Plymouth Co-operative Society. Another Plymouth mill now gone was *Mill Bridge Mill*, a three or four-storey building on a toll bridge.<sup>32</sup> Of *Budshead Mill*, St. Budeaux, near Devonport, only the foundations remain. The deed relating to its construction was made on 10th October, 1791: in it George Leach leases "six acres of mud and marsh land on the Pondhead Creek or Poundhead Lake, part of the Barton of Buttshead of the river Tamer (*sic*)." The mills were to contain one pair of wheat stones and a flour mill, one pair of barley stones, one pair of oat stones and a fan and barley engine. The materials were bought from William Jeffery; they lay at Mud Lane, Plymouth and cost, with the shed in which they lay, £214. John Gouk, a millwright of Plymouth, built the mill and was lent £213 13s. od. in cash and £50 in cash or timber or both by George Leach, and stones and lime up to £50 worth from his quarry by Christopher Oliver. The security was the mill itself, which was held in trust. The two original wheels were 14 ft. diam. by 8 ft. wide; they were replaced by two water turbines developing a maximum of 50 and 28 h.p. respectively. They were housed in a timber-built mill roofed and hung with slates and were supplied from a six-acre pond with a head of from 9 to 14 ft. giving from 1½ to 4½ hours work per tide.<sup>33</sup> A mill at *Blaxton*, on the river Tavy has now disappeared.

<sup>31</sup> *Isle of Wight County Press*, October 9th, 1937.

<sup>32</sup> per Mr. H. Doney.

CORNWALL.—A mill at *Salter* above Saltash on the Tamar has gone. Below Forder, however, is *Antony Passage Mill* on a creek on the north bank of the Lynher River. It bears the inscription "F.B., R.B., A.B., 1613," over an archway to the first floor of the mill, and "1866" over an archway to the ground floor. The first gives the date of the original building and the initials of Frederick, Richard and Abraham Buller, ancestors of General Buller. The second is the date of rebuilding by the great-grandfather of the present owner, Mr. Pearce, who bought the mill in 1863. Assisted by his son he did all the millwrighting and even felled the apple trees for the cogs. Although the mill has been out of use since the 1880's and most of the gear is submerged at each high tide, an astonishing amount remains. There were two sluices and four wooden wheels about 12 ft. diam. by 3 ft. wide, driven by water from an 8½ acre pond. The wheels were mounted on 12 in. shafts and each drove one pair of stones.

*Delabole Mill* at the head of the creek on the south bank of the Lynher River stopped about 1915. It drove two pairs of stones with an undershot wheel, but only the foundations of the mill remain. Further east at the head of another creek is *Wacker Mill*, Antony. It is a stone building with a slate roof and the sluice is under the main road from Torpoint. There is a single outside undershot wheel 7 ft. 6 in. diam. by 3 ft. wide on an 18 in. diam. wooden shaft which drove two pairs of stones on a hurst on the ground floor. It was closed down in 1915.

The old stone-built *Carbeal Mill* at Torpoint on the Hamoaze, is now, with its pond, a ship-breaking and barge repairing yard, while the outhouses are used as stables.

*Millbrook Mill* on Millbrook Lake ceased working before the war of 1914. It had two wheels each driving two pairs of stones and bears on a stone the date 15 + 18 with a cable moulding surround, and above is another: REBUILT IN L 1801 C. It is now a coal store and its stone walls are roofed with corrugated iron.

On 30th March, 1614, a "parcell or quantity of ground oes (ooze) and wastes" was leased to Thomas Arundell by the Mayor and burgesses of the "Burrough of Portbyham alias West Looe" for 500 years at a rent of "thirteen shillings and four pence of current English Money." A 13-acre pond was enclosed by a clay cored wall over 700 ft. long, from 6 to 8 ft. high, and "broad enough for a coach to pass over it."<sup>34</sup> In 1621 Arundell rented the ruined fresh water *Borough Mill* for £3.6.8 per annum. He made a leat around the hill from Polean Creek to the vicinity of Looe Bridge, with the probable intention of adding an overshot fresh water wheel to the undershot tide water wheel, though there is no proof that this was actually done. Later on a dye-house was built between the mill and the bridge, and later on still the dye-house became a cider mill. The mill was purchased from the Arundells by Bishop Trelawney in 1694 and remained in the Trelawney family until purchased by the late P. A. Pecher, J.P., who used it for grinding bone meal in 1883.<sup>34</sup> The mill pond

<sup>33</sup> Bond's *History of Looe*.

<sup>34</sup> *Devon and Cornwall Notes and Queries*, April, 1936. C. K. C. Andrew.

was at one time used as a timber pound and an attempt was made to drive saw mill machinery from the wheel; this was unsuccessful and a gas engine was installed. The mill is now out of use and belongs to the East Cornwall Electricity Undertaking.<sup>35</sup>

The *Old Bar Mill* at Bar Pool, Falmouth, has disappeared. It was a wooden mill with an exposed undershot wheel at one end. Thomas Banfield held the lease of this mill from Ardwenack Manor in the 1840's as well as some land near the castle with the mill fields. He got into difficulties and the lease of the mill was taken over by a Mr. Bluett: it ceased work in 1862 or 3. An oil painting of it by C. Napier Henry can be seen in Falmouth Museum.<sup>36</sup>

*Hayle Mill* has also disappeared. It was a four-floored stone building with a slated hipped roof, having one exposed iron outside water wheel about 20 ft. diam. by 8 ft. wide and a steam engine in an adjoining building. The foundations remain and are situated by the side of the creek at the east end of the town in the part known as Copperhouse. In mid XVIIIth century a works was established here for smelting copper which was in the first quarter of the XIXth century turned into an engineering works known as Copperhouse Foundry. The mill pond was formed by enclosing a branch of the creek, and advantage appears to have been taken of an island, much of it copper slag and possibly artificial, to form one side of the pool. The wall is revetted with and built of blocks of copper slag cast at the smelting works, which fixes the date of construction, and the pond is controlled by stock gates at the west and sluice gates at the east end. The tide rises here about 16 feet and the available head appears to have been about 5 ft. There is a chamber between the sluice and the wheel race and the water could there have been controlled to a nearly constant level by its use. The mill eventually closed as men could not be got to follow the tides and work round the clock.<sup>37</sup>

At *St. Issey*, on a creek of the River Camel, near Padstow, the old mill has been pulled down and the outbuildings are now used as a dwelling house. It was a stone built mill of five floors and was erected in front of an older mill which had three floors. A 4-acre pond, enclosed from the estuary, fed a wheel 30 ft. diam. by 4 ft. wide and drove six pairs of stones with a Robey steam engine as auxiliary power. An old sack token (Pl. V), issued by Mr. Tregaskis, the last owner, gives a view of the mill showing the chimney stack, a sailing ship and a covered miller's waggon.<sup>38</sup>

Another tide mill on the Camel estuary is said to have existed at *Dinham* but no details are available. Carew's *Survey of Cornwall*, 1602, states under Efford (Bude) p. 118 that "Master Arundel of Trerice . . . hath to his great charges builded a Salt-water Mill, athwart this Bay, whose causey serveth, as a verie convenient bridge, to save the way-farers former trouble, let, and daunger."

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<sup>35</sup> Per Mr. T. C. Pape.

<sup>36</sup> *Cornish Echo*, 18th Oct., 1929.

<sup>37</sup> per Messrs. W. A. Michell and H. W. Dickinson.

<sup>38</sup> per Mr. Prior, the last miller.