BIOGRAPHY

OF

WILLIAM SYMINGTON,

Inventor of Steam Navigation.

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OF

WILLIAM SYMINGTON,

Civil Engineer;

INVENTOR OF STEAM LOCOMOTION BY SEA AND LAND.

ALSO, A

BRIEF HISTORY OF STEAM NAVIGATION,

WITH DRAWINGS.

DEDICATED, BY PERMISSION, TO

DAVID NAPIER, ESQ.,

Engineer, &c.,

By J. & W. H. RANKINE, Engineers.

PUBLISHED BY
A. JOHNSTON, Bookseller, Falkirk.

1862.

DEDICATION.

TO DAVID NAPIER, ESQ.,

ENGINEER, &c.,

WORCESTER, ENGLAND.

Sir,

To have lived abstracted in their pursuits, and to have died in obscurity is, alas! too often the lot of the ardent and enthusiastic sons of science.

In announcing Mr Symington as the father of the Steam Navigation of the present day, we hope at the same time to give just praise to his talents, and due honour to his memory. And, it will be acknowledged as matter of public regret, that whilst neither he nor his family have reaped the advantage of his discovery, that even of the honour of it too many have succeeded in depriving him.

So connected is the application of Steam to Locomotive Engines with the interests of Navigation at large, the extension of commerce, and the increase of happiness to the whole human race, that to you, Sir, as one of the most zealous and active promoters of Steam Navigation in this country, the present Dedication would be due; but beyond this, private esteem induced us to request permission thus to subscribe ourselves,

Your ever grateful,
affectionate, and sincere friends,
J. & W. H. RANKINE.

Pleasance, Falkirk.

PREFACE.

Among the many important inventions and improvements of the present age, none has proved of greater utility than the adaptation of steam to the purposes of navigation. It is, therefore, much to be regretted that he who accomplished so arduous an undertaking, was rewarded, except by a few intelligent and spirited individuals, with treachery, ingratitude, and neglect.

In the prosecution of his plans, the best of his days were spent; lucrative engagements abandoned; and his private means, and even those of his family, expended.

He lived to see that realised which, before he showed its practicability, was generally reckoned chimerical: and to observe others reaping the fruits of his labours, without the honesty to acknowledge to whom they were indebted.

The following narrative is drawn up from a memorial presented to the Lords of His Majesty's Treasury, in behalf of William Symington; and from documents in the possession of his family.

DESCRIPTION OF DRAWINGS.

Fig. I.

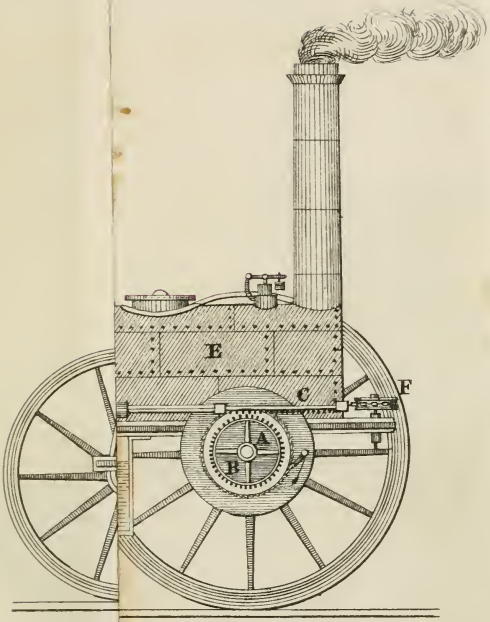
A.—Drum, fixed upon the hind axle.
B.—Tooth and ratchet wheels.
C.—Rack rods, one on each side of the drum; the alternate action of which, upon the tooth and ratchet wheels, produce the rotatory motion.
D.—Cylinder. E.—Boiler.
F F.—Direction Pulleys. G.—Water tank.
H.—Steam pipe.

Fig. II.

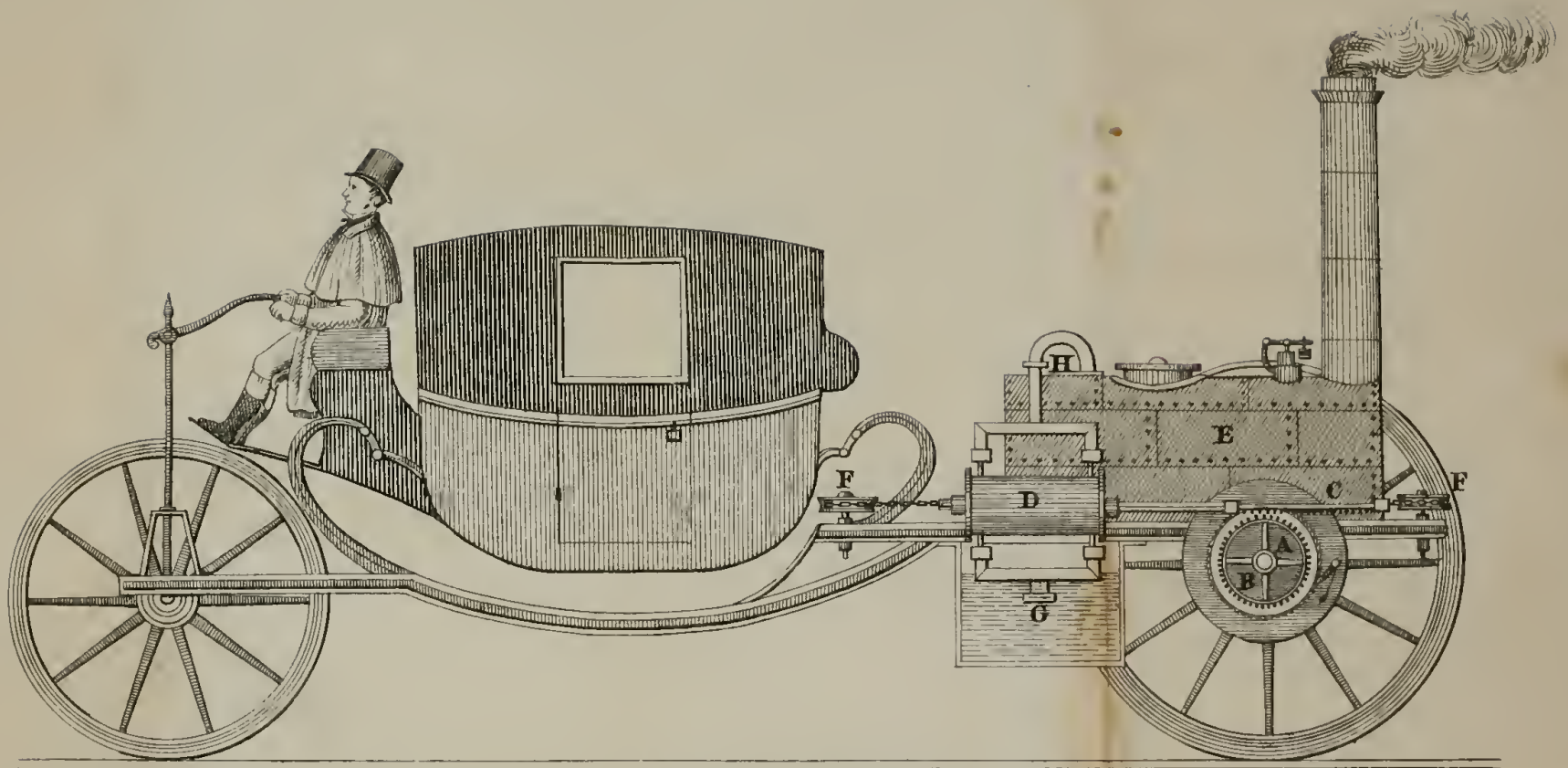
A A.—Cylinders. B.—Boiler. C.—Steam pipe.
D D.—Air pump rods. E E.—Connecting chains.
F F.—Direction pulleys.
G G.—Paddle wheels, situated and wrought in a trough, extending from stem to stern of the boat, and allowing free ingress and egress to the water. I I.—Flotation line.

Fig. III.—(Charlotte Dundas.)

A.—Air pump. B.—Boiler. C.—Condenser. D.—Cylinder. E.—Connecting rod. F.—Steer wheel.

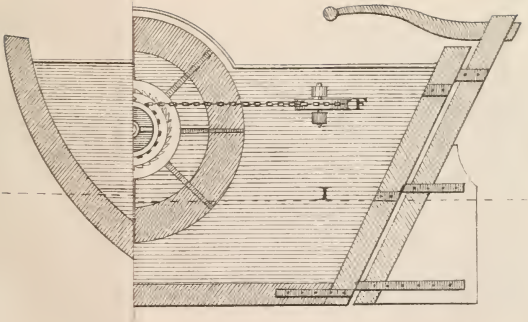


ILT IN 1786.

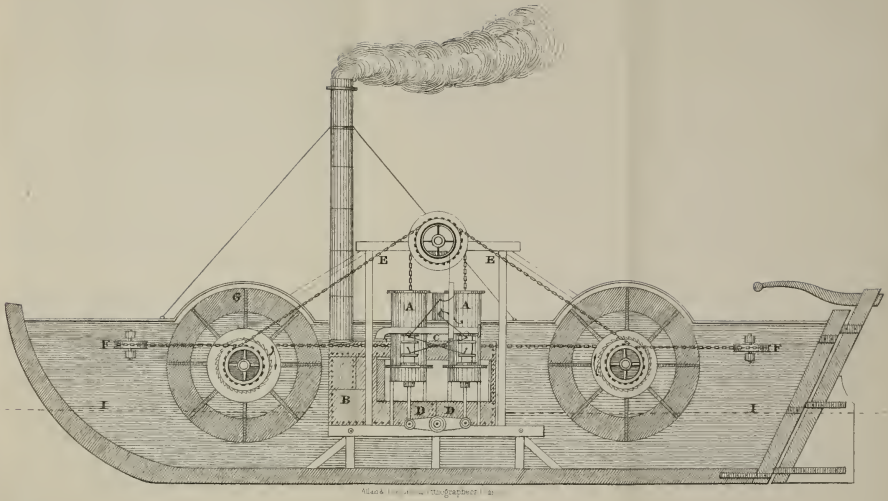


Allan & Ferguson, Lithographers, Glasgow

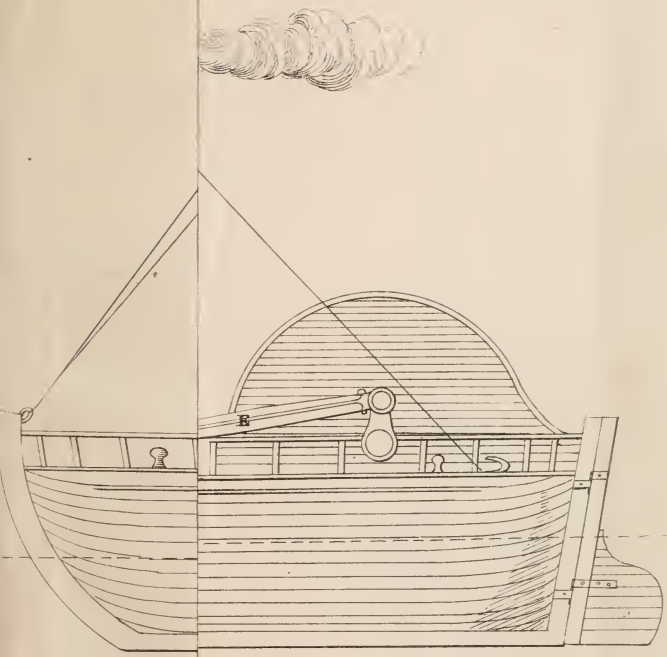
LATERAL SECTION OF STEAM CARRIAGE MODEL, BUILT IN 1786.



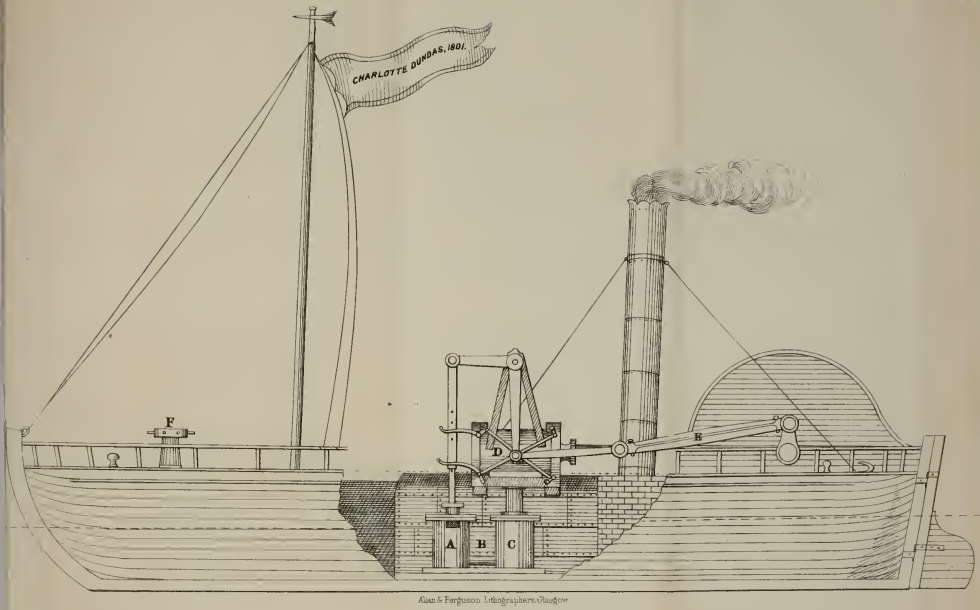
LT IN 1788.



LATERAL SECTION OF THE ORIGINAL STEAM BOAT, BUILT IN 1788.



LT IN 1801.



Allan & Ferguson Lithographers Glasgow

LATERAL SECTION OF THE CHARLOTTE DUNDAS, BUILT IN 1801.

BIOGRAPHY

OF

WILLIAM SYMINGTON.

William Symington, the real inventor of Efficient Steam Navigation, was a native of Leadhills, Lanarkshire, Scotland. Intended for the Church, he received an excellent education, but his predilection for mechanics defeated that intention.

Before completing his twentieth year he conceived the idea that the steam engine could be rendered available for the propulsion of land carriages, an idea he afterwards embodied in a working model, which—by the advice of Mr Meason, manager and part proprietor of the Wanlockhead Lead Mines—he exhibited to the Professors of the University of Edinburgh and other scientific gentlemen in that metropolis, who were so much pleased, both with Symington and his invention, that they strongly recommended Mr Meason not to lose sight of so promising a genius—a recommendation so much in accordance with that gentleman's own inclination, that he sent Symington to the University of Edinburgh the succeeding winter, where, it appears by certificates Nos. 15 and 16, he was matriculated as a student.

Among those who examined the model in Edinburgh was Mr Miller, of Dalswinton, who had spent much time and no little money in experimenting on ordnance and naval architecture. Among his other schemes he attempted to propel double-keeled vessels by turning paddle-wheels with a capstan, but up to the time he saw the steam-carriage model he had used no other propelling power than that of men. After expressing his admiration of the model, he told Symington that he, too, was an inventor, and described his boats, and the disappointment he felt in the power he employed not being sufficiently effective. Symington then said, "Why do you not use the steam-engine?" and proceeded to show how it could be connected with the wheels of the boat, using the model of the steam-carriage to explain his meaning. Convinced by this explanation, Mr Miller expressed a wish that as soon as he could devote attention to the subject, Mr Symington should construct a steam-engine of a similar kind to that which he had invented, and fit it into a double-keeled boat with which Mr Miller was experimenting.

It was not until the autumn of 1788 that he could get everything in readiness, being engaged in constructing and erecting machinery for the Wanlock Lead Mining Company. When the steamboat was tried, it proved most successful, which induced Mr Miller to give orders that one of his larger experimental boats, and a steam-engine of greater magnitude and power, should be got ready. This was done, and in 1789, amidst the cheers of assembled multitudes, she was propelled on the Forth and Clyde Canal, at the speed of nearly six miles an hour; but here, when success had so signally crowned his efforts, Symington had the misfortune of losing the co-operation of Mr Miller, who, most unaccountably, at once and for ever abandoned experi-

ments in steam navigation. From that time, until the year 1800, this invaluable nautical auxiliary was allowed to lie dormant, the state of its inventor's pecuniary resources being such as to prevent his attempting to carry it further unaided. One day, however, while going to examine a field of coal he intended to rent or purchase, he heard some one calling to him, and, on looking round, saw Lord Dundas beckoning to him from the window of his carriage, which had just passed. On going to the carriage, his lordship told him that, having seen his former steamboat experiment, he had come down from London principally for the purpose of seeing him, in order to learn whether steamboats could not be substituted for the horses used in dragging vessels on the Forth and Clyde canal, of which his lordship was a large proprietor and governor. Mr Symington, fortunately for his country and the world, although most unfortunately for himself and family, gave up all thoughts of the colliery, and returned home, elated with the thought of being able to re-embark in his favourite project under such promising auspices. On subsequently waiting on his lordship by appointment, an arrangement was speedily effected, and, in 1801, the first boat, named the "Charlotte Dundas" (in honour of his lordship's daughter, afterwards Lady Milton), was built for the express purpose of being propelled by a steam engine. After making a trip to Glasgow, she was set to work, and towed on various occasions vessels in the canal, besides running down into the river Forth and dragging thence at one time up the river Carron into the canal at Grangemouth, four or five sloops, detained by a contrary wind. Although thus far successful, the proprietors of the canal, with the exception of Lord Dundas, fearing its banks might be injured by the undulations caused by the

paddle-wheels, ordered it to be discontinued. His Lordship, however, who was not so easily prejudiced or discouraged, advised Mr Symington to get a model of his boat constructed, and take it to London—an advice which was followed by Mr Symington himself taking the model to Arlington Street (No. 17), and presenting it to his Lordship, who was so much pleased with it that he introduced him to his Grace the Duke of Bridgewater, who not only expressed his admiration of the plan, but immediately gave orders that eight boats of similar construction should be got ready as speedily as possible for his canal. Soon after his interview with the Duke of Bridgewater, Mr Symington returned to Scotland, and completed his second and largest steamboat, likewise named the Charlotte Dundas, for Lord Dundas. This boat was tried in March 1803, when she towed two laden sloops, the Active and Euphemia, of seventy tons burthen each, from Lock No. 20 to Port Dundas, Glasgow, 19½ miles in six hours, notwithstanding that during the whole time so strong an adverse gale prevailed that no other vessel in the canal could that day move to windward. But even this farther proof of the efficiency of the invention did not remove the objections of the managers of the Canal Company, and they peremptorily ordered all further trials to be discontinued. The boat was therefore laid up in a creek of the canal now occupied by one of the public works at Bainsford, and Mr Symington had to suspend his attempts to introduce steam navigation in that quarter—especially, as on the very day he made his successful experiment in towing the "Active" and "Euphemia," he was informed by Lord Dundas of the decision of the canal manager, and also of the death of the Duke of Bridgewater.

The experiments made under the patronage of Lord

Dundas were far more perfect than those he made under him for Mr Miller, as a direct acting engine and crank, for procuring a rotary motion, were substituted for the engine and ratchet wheels used in the first boats; indeed, it may be said, that here commenced the present system of steam navigation.

For several years from this time, Mr Symington resumed his usual engineering avocations, and would soon have become independent but for the difficulties in which his steamboat experiments had involved him, having cost him not only several thousand pounds of his own money, but also considerable sums belonging to his family. In 1824 he endeavoured to bring his claims under the notice of Government, and through the kind interest of Sir George Clerk and Sir Ronald Ferguson obtained £100 from the privy purse of his late Majesty King George the Fourth, and a further sum of £50 a year or two afterwards. Sir Ronald Ferguson told Mr Symington there was no doubt the £50 would be continued annually; but no additional allowance was ever granted, although the expense incurred in collecting evidence and going to London exceeded all he ever received for his trouble.

For the last two or three years of his life he was, with Mrs Symington, totally dependant for support on the members of his family, resident in London. He went to London for the last time in 1829, labouring under a painful and dangerous disease; but by medical care, and other attentions he received, he so far recovered as to be able to resume his mechanical pursuits, and soon afterwards to endeavour to procure a Parliament investigation of his claims. The latter object, however, he could not attain, a circumstance which preyed so much upon his mind that his malady made rapid progress, and he died on the 22d of March, 1831, wounded in

spirits and broken down by misfortunes. His mortal remains rest in the churchyard of St Botolph, Aldgate, London, so that he owes not even a grave to the land of his nativity.

The merit of having invented steam navigation has been claimed by several individuals, or by their supporters for them. Three of these, Messrs Miller, Fulton, and Bell, certainly aided in its introduction; but the fourth, Mr Taylor, a native of Cumnock, Ayrshire, there is no doubt did more to retard than facilitate its progress. It does not appear that Mr Miller himself ever claimed the honour of invention, but his representatives attempted to do so for him. He certainly contributed to Mr Symington's experiments, supplied him with boats, and, to a considerable extent, with money, but he did nothing more, as double-keeled boats, with paddle wheels, were well known and described long before his day.

Mr Fulton, it is proved beyond the possibility of dispute, was on board of Mr Symington's first "Charlotte Dundas," and in the month of July, 1801, was carried in her eight miles on the Forth & Clyde Canal in an hour and twenty minutes, receiving explanations, and taking sketches both of the boat and her machinery, prior to his being able to succeed in propelling a steam vessel on the Hudson river in America, in 1807.

Mr Bell was also often on board of Mr Symington's boats. He even intruded himself offensively among the patternmakers and constructors of Mr Symington's steamboat machinery in the Carron Ironworks, and had many opportunities—of which he repeatedly availed himself—of examining the steamboat laid up in Bainsford Creek, before he succeeded in producing the "Comet" in August 5, 1812, which was at first a very imperfect boat, and far inferior, both in power

and performance, to any of Mr Symington's boats on the canal.

Mr Taylor contributed nothing whatever to the invention. He was a tutor in the family of Mr Miller when that gentleman was experimenting with his double-keeled vessels (being paddles turned with the hand). He was intimately acquainted with Mr Symington, and on the most friendly terms with him—indeed, they were fellow-students and fellow-lodgers while attending the College classes in Edinburgh during the session of 1756–7, after Mr Symington had exhibited his steam-carriage model the preceding summer. Trusting to the want of suspicion on the part of Mr Symington, and to the secrecy of his own proceedings, he attempted to make it appear that he suggested the idea of steam navigation to Mr Miller, after a certain boat race, which took place at Leith in February 1787, although, as already stated, it was in the summer of 1786 that Mr Miller inspected Mr Symington's steam carriage model. In a cunningly-devised memorial (which he addressed to Sir Henry Parnell, in 1824, then chairman of a select committee on the subject of steam vessels), Mr Taylor advanced his pretensions to the invention, but that enlightened statesman declared that he saw nothing entitling him to remuneration. He afterwards made application to Mr Huskisson, who likewise rejected it; but, after Mr Taylor's death, through misrepresentation, "the grand national mistake" was made of awarding £50 to his widow for his supposed services as the inventor and introducer of steam navigation, although all that he ever did to forward it was the bringing together of Messrs Miller and Symington.

To afford a ready means of judging of the respec-

tive claims of the parties interested, the following summary has been drawn up :—

It was in the year 1786 that Mr Symington patented his working model of a steam carriage in Edinburgh, and suggested steam navigation.

In 1788 he superintended the construction of steam engines of his own invention, and the fitting of them into one of Mr Miller's pleasure boats, which boat was successfully propelled that year on Dalswinton Lake by steam power. The engines are now deposited in the museum at Kensington, alongside the models of the Great Eastern's steam-engines.

In 1789, a larger boat, with more powerful engines of the same kind, was successfully propelled by steam on the Forth & Clyde Canal.

In 1800 he was engaged by Lord Dundas to construct steam tugs on the Forth & Clyde Canal.

In 1801 the "Charlotte Dundas" steam tug, was repeatedly on the canal. She towed vessels there, and up the rivers Forth and Carron into Grangemouth; and it was then that Mr Fulton, the American engineer, was conveyed eight miles on the canal in an hour and twenty minutes. In the same year, he patented his direct-acting steam-engine, already referred to, for propelling vessels.

In 1802 and 1803, the second "Charlotte Dundas," a larger and more powerful boat, towed vessels on the canal; and, on one particular occasion before noticed, dragged two laden sloops of 70 tons burthen each—the Actual and the Euphemia—a distance of 19½ miles in six hours against a strong adverse gale.

His experiments were here ended, through the fear of the managers of the canal that its banks might be injured by the undulation caused by the wheels.

It was not till 1807 Mr Fulton first succeeded in

propelling a vessel by steam on the Hudson. And it was not till 1812 that Mr Bell's first boat, the "Comet," was tried and set to work on the Clyde, Mr Bell, as well as Mr Fulton, having both been on board of Mr Symington's boats, and satisfied themselves of their efficiency.

Those dates show that Symington's boats were working 19 years before Mr Fulton's, and 24 years before Mr Bell's first boat. We will now prove the above, beginning with poetry, who has sent her aid to do justice to Mr Symington.

The subjoined poem is extracted from a volume written by Mr Muir, of Kirkintilloch.

"March, 1802.—The Steam Barge, or Nautical Novelty."

"On seeing the New Steam Boat, invented by William Symington, pass through the Great Canal, dragging two vessels fully loaded :"

Whan first, by labour, Forth and Clyde,
Were taught o'er Scotia's hills to ride
In a canal, deep, lang, and wide ;
Naebody thought
Sic wonners, without win' or tide,
Wad e'er be wrought.

To gar them trow that boats wad sail,
Thro' fields o' corn, or beds o' kail,
An turn o'er glens their rudder tail,
Like weathercocks,
Was doctrin' that wad needed bail
Wi' common folks.

They ca'd it nonsense,—till at last,
They saw boats travel east an' wast,
Wi' sails an' streamers at their mast ;
Syne, without jeerin',

They were convinced, the blust'rin blast
Was worth the hearin'.

For mony a year,—wi' little clatter,
An' naething said about the matter,
The horses harl'd them through' the water,
Frae Forth to Clyde;
Or, the reverse, wi' weary splatter,
An' sweaty hide.

Then we believ'd, puir silly bodies,
Wha naething ken o' learn'd studies,
That horses' hoofs and hempen woodies,
Boot still to draw them;
An' cursin' callants clad in duddies,
To swear and ca' them.

But little think we what's in noddles,
Whar science sits, an' grapes and guddles,
Syne darklins forth frae drumly puddles,
Brings things to view,
That the weak penetration fuddles,
O' me an' you.

For lately we hae seen a lighter,
An' at her end a fanner's flighter,
May bid boat haulers a' gae dight her
Black sooty vent;
Than half a dizzen horse she's wighter,
By ten per cent.

Wi' something that the learned ca' steam,
That drives at heughs the waukin beam
O' huge engines to drain coal seam,
Or carry hutches;
She in her breast swalls sic a feam,
As has few matches.

By it she thro' the water plashes,
An' out the stream ahint her splashes,

At sic a rate, baith frogs an' fishes
Are forced to scud,
Like ducks an' drakes, amang the rashes,
To shun the mud.

When first I saw her in a tether,
Draw twa sloops after ane anither,
Regardless o' the win' an' weather
Athwart her bearin',
I thought frae —— she had come hither,
A privateerin'.

An' that the pair she had in tow
War prizes, struck me sae I vow,
I cry'd, when fixet to their prow,
I saw her cable,
In Satan's furnace now they'll low,
Amang the rabble.

It was sae odd to see her pullin',
An' win' an' wather baith unwillin',
Yet deil ma' care, she, onward swellin',
Defied them baith,
As constant as a mill that's fullin'
Gude English claith.

Can e'er, thought I, a flame o' reek,
Or boilin' water's caudron smeek,
Tho' it war keepit for a week,
Perform sic wunners,
As quite surprise amaist the feck,
O' gazin' hunners.

But facts we canna' weel dispute them,
Altho' we little ken about them,
When prejudice inclines to doubt them,
Wi' a' her might.
Plain demonstration deep can root them,
An' set us right.

Ere lang gae now wi' whirligigs
An' steam engines we'll plough our riggs,
An' gang about on easy legs,
Wi' nought to pain us,
An' fit in tethers useless naigs,
That used to hain us.

Braw news indeed for man and beast,
They'll then hae nought to do but rest,
An' on their former labours feast
Wi' cheerfu' heart,
When thus they see warm steam insist
To play their part.

Of the many subjects upon which there has been almost endless discussion, possibly there has not been one on which there has been so much diversity of opinion and ignorance as on this. Many have claimed the merit of having invented efficient steam navigation, and for equally as many has the merit been demanded, but to William Symington, the subject of this biography, the real merit is alone due. This assertion will be very clearly proved by the following:—

COPIES OF AFFIDAVITS

RESPECTING THE INVENTION OF STEAM NAVIGATION.

We merely premise by saying that Symington's patent was taken in 1786.

1. WILLIAM SYMINGTON, Civil Engineer, now residing at Falkirk, in the county of Stirling, in that part of the United Kingdom called Scotland: produces herewith and refers to a memorial containing a narrative of his connection with the invention of Steam-boat Navigation; each page of which memorial

is subscribed by the deponent as relative hereto; and he maketh oath and sayeth, that the said memorial contains a true narrative of facts, as connected with the said invention. And he further sweareth, that he did not receive any aid or assistance of any kind to enable him to invent and apply a steam engine to the propelling of boats.

Sworn at Woodburn, in the county of Stirling, upon the first day of December, in the year one thousand eight hundred and twenty-four, before me, one of His Majesty's Justices of the Peace for the county of Stirling.

(Signed) WILLIAM SYMINGTON.
JOHN CALLANDER, J.P.

2. Alexander Carlaw, formerly residing at Wanlockhead in the county of Dumfries, now farmer of Powfoulis in the county of Stirling, in that part of the United Kingdom called Scotland, maketh oath, and sayeth: That he knew William Symington, engineer, at present residing in Falkirk in the said county of Stirling. That he has access to know that the said William Symington made certain experiments in the autumn of the year 1788, by applying a small steam engine to propel a boat on a piece of water near the house of Dalswinton in the county of Dumfries. That, in the summer preceding, he was instructed by the said William Symington to forge various pieces of iron-work which were employed in the above-mentioned experiment. He further sweareth that the application of a steam-engine to the propelling of a boat upon water, was generally said and universally believed the invention of the said William Symington, and who was at that time patronised by Patrick Miller, Esq. of Dalswinton, now deceased; and the deponent understands, and it consists with his know-

ledge, that the said experiments were further prosecuted upon a larger scale by the said William Symington in the following year, being 1789, upon the Great Canal, near Carron Iron Works, also under the patronage of the said Patrick Miller, Esq.

Sworn at Falkirk, in the county of Stirling, upon the Fourth Day of November, one thousand eight hundred and twenty-four, before me, one of His Majesty's Justices of the Peace for the county of Stirling.

(Signed) ALEXANDER CARLAW.
WILLIAM COUBROUGH, J.P.

3. Richard Young, residing in Edinburgh, in that part of the United Kingdom called Scotland, grocer, maketh oath, sayeth: That he was gardener to Patrick Miller of Dalswinton, in the county of Dumfries, in Scotland aforesaid, for several years prior and posterior to the year 1788. That some time in the course of the said year, William Symington, engineer, presently residing at Falkirk, then at Wanlockhead, in Dumfriesshire aforesaid, did occupy one of the rooms in the house of the deponent as a workshop, where the said William Symington constructed a piece of machinery worked by steam, which he fitted into a boat then lying on a small lake near Dalswinton House.

That the deponent was present, along with several other persons, when the said boat was propelled by means of the said engine, apparently to the satisfaction of the said Patrick Miller, and the other persons present; and it consists with the knowledge of the deponent that the said Patrick Miller never did propel any boat by means of steam till it was done, as above described, by the said William Symington; and he also knows that several other experiments were

afterwards made by the said William Symington upon the Forth and Clyde Canal, when he understood the said William Symington completely succeeded in applying the power of the steam engine to the propelling of boats. That the deponent does not remember to have seen Mr Miller or Mr Taylor—who was then tutor in Mr Miller's family — aiding or assisting the said William Symington in the construction of the said steam engine, otherwise than under the immediate direction of the said William Symington; and in the construction thereof, and in erecting it on board of the said boat. The deponent believes the whole to have been done by Mr Symington, as engineer, and the workmen under his direction.

Sworn at Edinburgh, the seventh day of September, in the year one thousand eight hundred and twenty-five, before me, one of his Majesty's Justices of the Peace for the City of Edinburgh.

(Signed.) RICHARD YOUNG.
JAMES SPITTAL, J.P.

4. Joseph Stainton, Esq. of Biggarshiels, manager for Carron Company at Carron, in the county of Stirling, in that part of the United Kingdom called Scotland, maketh oath, and sayeth: That he knows William Symington, engineer at Falkirk; that he has access to know that the said William Symington made certain experiments in the year one thousand seven hundred and eighty-nine, by applying a steam-engine to propel a boat along the Forth and Clyde Canal. That the machinery for said experiment was made at Carron, under the direction of the said William Symington, and the expense thereof, amounting to three hundred and sixty-three pounds ten shillings and tenpence, was paid to Carron Company by the now deceased Patrick Miller, Esq. of Dal-

swinton. That the deponent has seen the boat in which the said experiments were made, and has frequently heard the experiments mentioned. That, in the year one thousand eight hundred and one, or about that time, the said William Symington was employed by the now deceased Thomas Lord Dundas, to erect a boat and construct a steam-engine to propel it along the said Canal. That the deponent saw the said boat when completed, and had access to know that it was employed in the way of experiment to drag vessels along the canal. That it consists with the deponent's knowledge, Robert Weir was employed by the said William Symington about the said boat. That he knew the said Robert Weir, who now resides at Kincardine, to be a man of respectable character and of veracity. That the said William Symington afterwards constructed a larger boat, aad the deponent had access to see both the boats, and to know that they were propelled by steam.

Sworn at Carron, in the county of Stirling, upon the 30th day of November, one thousand eight hundred and twenty-four, before me, one of His Majesty's Justices of the Peace for the county of Stirling.

(Signed) J. STAINTON.
JOHN CALLANDER, J.P.

5. Henry Stainton, Esq., formerly residing at Carron Ironworks, in the county of Stirling, in that part of the United Kingdom called Scotland, presently residing at Carron Company's Warehouse, London, maketh oath and sayeth, That he knew William Symington, civil engineer, at Falkirk, in the county of Stirling, aforesaid. That he had access to know that the said William Symington made certain experiments in the year one thousand seven hundred

and eighty nine, by applying a steam-engine to propel a boat along the Forth and Clyde Canal. That the machinery for the said experiment was made at Carron, agreeably to the direction of the said William Symington, then under the patronage of Patrick Miller, Esq. of Dalswinton. That the deponent has seen the boat in which the experiments were made, and has frequently heard the experiments mentioned. That, in the year one thousand eight hundred and one, or about that time, the said William Symington was employed by the now deceased Thomas, Lord Dundas, to build a boat, and construct a steam-engine to propel it along the said canal. That the deponent saw the said boat when complete, and had access to know that it was employed, in the way of experiment, to drag vessels along the said Canal, which, he believes, came fully up to the expectations of all parties concerned.

Sworn at London upon the twenty-seventh day of January, in the year eighteen hundred and twenty-five, before me.

(Signed) HENRY STAINTON.
JOHN GARRET, Mayor.

6. William Blackie, residing at Edinburgh, in that part of the United Kingdom called Scotland, pattern-maker at the Carron Iron Foundry, in Edinburgh, aforesaid, maketh oath and sayeth,—That about the year 1789 he was pattern-maker at the Carron Iron Foundry, in the county of Stirling, in Scotland, aforesaid, when William Symington, Civil Engineer, presently residing at Falkirk, in the county of Stirling, aforesaid, then residing at Carron, aforesaid, gave the deponent directions for the modelling of various pieces of machinery, to be used, as the deponent understood, in a steam engine. That he remembers witnessing the experiment made by the said William Symington

with a boat propelled by the said engine with paddle-wheels, upon the Forth and Clyde Canal, in the year 1789. That he deponent thought at the time, and still has reason to believe, that the experiment which he then witnessed was successful, and produced the experiments made by the said William Symington in the years 1801, 1802, 1803. That some time in the year 1801, the said William Symington gave the deponent directions for modelling various other pieces of machinery, for propelling a boat. That the deponent witnessed the experiments made by the said William Symington with the said boat, upon the Forth and Clyde Canal aforesaid, in the years 1801, 1802, and 1803. That the deponent believed at the time, and still believes, that the motion produced in the said boats, by means of the engine aforesaid, was equal or similar to the motion produced by the engines now in common use in steamboat navigation.

Sworn at Edinburgh, the twenty-ninth day of October one thousand eight hundred and twenty-four, before me, one of his Majesty's Justices of the Peace for the city of Edinburgh.

(Signed) WILLIAM BLACKIE.

ALEXANDER BERWICK, J.P.

7. James Blackie, residing at Edinburgh, in that part of the United Kingdom called Scotland, manager of the Calton Iron Foundry, at Edinburgh, aforesaid, maketh oath and sayeth,—That sometime in the year 1801, he was one of the pattern-makers at the Carron Iron Works, in the county of Stirling, in Scotland, aforesaid, when William Symington, Civil Engineer, presently residing at Falkirk, in the aforesaid county, then residing at Kinnaird, county aforesaid, gave the deponent directions for the modelling of various pieces of machinery. That the deponent, after adapting the said pieces of machinery to a steam engine placed in

a boat then lying in the Forth and Clyde Canal, in the county of Stirling, aforesaid, did witness an experiment made with the said boat, propelled by the said engine, under the direction of the said William Symington. That it consists with the knowledge of the deponent that the said boat was moved upon the canal, by means of the said engine, a considerable number of miles, but the deponent cannot charge his memory with the precise number. That the deponent believes the motion produced in the said boat, by means of the said engine, was equal or similar to that produced by the engines of a like power now in common use in steam navigation. That, some time thereafter, the deponent made a complete model of the said boat and steam engine, all under the direction of the said William Symington. That the deponent thereafter witnessed various experiments made by the said William Symington in the years 1802 and 1803, which the deponent knows to have had an equal or greater success than the preceding experiments.

Sworn at Edinburgh, the twenty-seventh day of October, one thousand eight hundred and twenty-four, before me, one of his Majesty's Justices of the Peace for the city of Edinburgh.

(Signed) JAMES BLACKIE.

ALEXANDER HENDERSON, J.P.

8. David Drysdale, residing in Bainsford, in the county of Stirling, in that part of the United Kingdom called Scotland, mariner, maketh oath and sayeth,—That in the month of October 1789, he acted as helmsman on board of a boat then lying in the Forth and Clyde Canal, in Stirlingshire, aforesaid. That this boat had been built upon a particular construction, and was propelled upon the water by means of a steam engine. That the deponent understood that William Symington, Civil Engineer, now residing at Falkirk,

in the county of Stirling, constructed the said steam engine. That the deponent remembers while he acted as helmsman the said William Symington superintended the whole operations performed in the course of the experiment; and it consists with the knowledge of the deponent that the boat so propelled moved at the rate at which boats are generally dragged on canals, or, as near as the deponent can remember, at the rate of 4½ or 5 miles an hour.

Sworn at Bainsford, the thirteenth day of October, one thousand eight hundred and twenty-four, before me, one of his Majesty's Justices of the Peace for the county of Stirling.

(Signed) DAVID DRYSDALE.
JOHN CALLANDER, J.P.

9. Alexander Hart, residing at Grangemouth, in the county of Stirling, in that part of the United Kingdom called Scotland, ship-builder, maketh oath and sayeth,—That sometime in the year 1801, William Symington, Civil Engineer, now residing at Falkirk, instructed the deponent to build a boat of a peculiar construction, adapted for the reception of a steam engine. That the deponent accordingly did proceed to build such a boat, under the direction of the said William Symington. That he adapted a boat for the reception of a steam engine, and thereafter he assisted to place the steam engine into the boat, previous to its removal to the Forth and Clyde Canal.

Sworn at Grangemouth, the nineteenth day of October, one thousand eight hundred and twenty-four, before me, one of his Majesty's Justices of the Peace for the county of Stirling.

(Signed) ALEXANDER HART.
JOHN MOREHEAD, J.P.

10. Robert Weir, residing at Kincardine, in the

county of Perth, in that part of the United Kingdom called Scotland, maketh oath and sayeth,—That he is acquainted with William Symington, engineer, at Falkirk. That he was employed by him for several years. That, in the year 1801, he remembers of Mr Symington erecting a boat, and fitting a steam engine into it, and dragging two vessels along the Forth and Clyde Canal by means of the said steamboat. That the deponent was employed as engine-fireman on board of the said boat. Depones that the following persons, now living, were also on board—viz., Alex. Hart and John Allen, ship-builders, Grangemouth, and John Esplin and William Gow, shipmasters, there. That, some time after the first experiment, while the boat was lying upon the canal at Lock 16, it was visited by a stranger, who requested to see the boat worked. That the said William Symington desired the deponent to light the furnace, which was done, and the stranger was carried about four miles along the canal, and brought back. That this stranger made inquiries both as to the mode of constructing and of working the boat, and took notes of the information given him by the said William Symington. That the deponent heard the stranger say his name was Fulton, and that he was a native of the United States of America. That the deponent remembers Mr Symington remarking that the progress of the boat was much impeded by the narrowness of the canal, to which Mr Fulton answered that the objection would not apply to the large rivers of North America, where he thought the boat might be used to great advantage.

Sworn at Blair Castle, in the County of Perth, upon the twenty-third day of October, one thousand eight hundred and twenty-four, before me, one of

his Majesty's Justices of the Peace for the county of Perth.

(Signed) ROBERT WEIR.
ROBERT DUNDAS, J.P.

11. John Allan, residing at Grangemouth, in the county of Stirling, in that part of the United Kingdom called Scotland, maketh oath and sayeth, that sometime in the year 1802, William Symington, civil engineer, now residing at Falkirk, instructed the deponent to build a boat of a peculiar construction, adapted to the reception of a steam engine: that the deponent did proceed to build such a boat under the direction of the said William Symington, and that he adapted the boat for the reception of a steam engine, and thereafter he assisted to place the steam engine into the boat, previous to its removal to the Forth and Clyde Canal.

Sworn at Grangemouth, the nineteenth day of October, one thousand eight hundred and twenty-four, before me, one of his Majesty's Justices of the Peace for the county of Stirling.

(Signed) JOHN ALLAN.
JOHN MOREHEAD, J.P.

12. John Espline, residing at Grangemouth, in the county of Stirling, in that part of the United Kingdom called Scotland, shipmaster, maketh oath and sayeth—That sometime in the year 1803, he was master of the sloop Euphemia, of Grangemouth, aforesaid. That he was in the way of proceeding from thence, upon the Forth and Clyde Canal, to Port Dundas with the said vessel, having on board a full cargo. That the vessel, along with the sloop Active, of the said Port, being also deeply loaded, were taken in drag at Lock No. 20 by a steamboat, on board of which William Symington, civil engineer, now residing at Falkirk, superintended all the operations dur-

ing the time the vessels were in drag. That, so far as the deponent remembers, the vessels arrived at Port Dundas in the space of six hours, or thereby, from the time of their being taken in drag at Lock No. 20, a distance of 19½ miles.

Sworn at Grangemouth, in the county of Stirling, the nineteenth day of October, one thousand eight hundred and twenty-four, before me, one of his Majesty's Justices of the Peace for the county of Stirling.

(Signed) JOHN ESPLINE.
JOHN MOREHEAD, J.P.

13. Alexander Sclanders, boat-builder, residing at Lock No. 16 on the Forth and Clyde Canal, in the county of Stirling, in that part of the United Kingdom called Scotland, maketh oath and sayeth—That in the month of March, 1803, he was employed by William Symington, civil engineer, to be helmsman on board the Charlotte Dundas steam-boat, in a trip made from Windford (Lock No. 20), along the summit level of the Canal to Port Dundas, the distance being nineteen miles and a half, and which was performed in six hours, dragging two laden vessels, the Active and Euphemia, of Grangemouth (Messrs Gow and Espline masters, although it blew a strong breeze right ahead while on the passage; so much so, that no other vessels of any description could move to the windward in the Canal that day.

Sworn at Falkirk, in the county of Stirling, upon the twentieth day of October, one thousand eight hundred and twenty-seven, before me, one of his Majesty's Justices of the Peace for the county of Stirling.

(Signed) ALEX. SCLANDERS.
W. COUBROUGH, J.P.

Mr Gow, master of the sloop Active also expressed his willingness to make affidavit as to the experiments in which he was concerned, but died before it could be done.

The following evidence has since been collected :—

1. Mr James Flint, James Watt Steamboat, Edinburgh, 20th April, 1833.

Dear Sir,—I have examined the College Album, and find that William Symington is registered as a student in Dr Black's Class, for the year 1786.—I am, dear Sir, yours truly,

(Signed) COLIN CAMERON.
Edinburgh, 26th Oct., 1833,
10 Hill Square.

2. From Sir James Eyre to Robert Bowie, Esq.

My Dear Sir,—True to my promise, I searched the College Books for the name which you desired me to look for. William Symington I find, in 1786, as a student in anatomy, chemistry, and chirurgery; and James Taylor (the only one there) is entered as a scholar in the above branches also in 1784, 1785, and 1786—the last is the same year as Mr Symington. There is a J. Taylor, also medical, but whether John or James does not appear—in 1786 only. These are all the persons of the name I could see. Mr Snodgrass, an engineer, of York Street, Glasgow, saw your pamphlet in my hands, and, after perusing it, said he was so satisfied of your father-in-law's claim that he should keep the book and take it with him to America, and read it to the people of the country. His remark was, and his judgment is much esteemed—"What a pity but this matter had been brought forward sooner. * * * * * * and believe me to be, my dear Sir, yours very truly,

(Signed) JAMES EYRE.

The portion of the letter uncopied refers altogether to professional matters, and is perfectly unconnected with steam navigation.

Leith & Glasgow Wharf, 25th June, 1833.

3. Mr Robert Bowie, Bishopsgate Street.

Dear Sir,—In answer to your application, I cannot have the least hesitation in stating that I remember perfectly well accompanying the late Mr Wm. Symington when he presented the model of his steam-boat to the Right Hon. Lord Dundas, at his house in Arlington Street. This circumstance took place sometime between the year 1801 and 1803; and during the examination, and Mr Symington's explanation of the application of various parts of the machinery, his Lordship expressed himself highly satisfied, and convinced that steam would speedily be brought into use afloat. At the same time stated to Mr Symington that he had a conversation with his Grace, alluding to the Duke of Bridgewater, and that if he (Mr S.) would wait upon his Grace he would get an order for two or more boats immediately.—I am, dear Sir, yours truly, (Signed) JOSEPH ADAMS.

4. I remember having seen Mr William Symington's steam-boat, built for Lord Dundas in the year 1801 or 1802, and called the Charlotte Dundas, tow into the harbour of Grangemouth, from the Watermouth, a distance of at least three miles, four or five sloops attached to each other; and also drag from Grangemouth to No. 16, three sloops, a distance of four miles—both of which operations were performed with the greatest ease.

At any time I am willing to make oath to the truth of this statement.

(Signed) ALEXANDER FRASER.

London, 15th May, 1833.

Carron Warehouse, London, 13th May, 1833.

5. Mr Bowie.

Sir,—I here certify, and, if it be necessary, am willing to declare, upon oath, that I remember Messrs William Symington and James Taylor being at Carron Works during the construction of machinery for a steam-boat, in the year 1789. That all instructions and drawings given, respecting the said machinery, were by Mr Symington; and that I considered Mr Taylor as a spy placed upon Mr Symington's conduct by Mr Miller—an opinion which was very generally entertained. (Signed) HENRY STAINTON.

15 Upper Thames Street.

50 Broad Street, 31st Jan., 1834.

6. Dear Sir,—I have perused, with great interest and attention, the statement and affidavits left with me, and have great pleasure in saying that my view of the question corresponds fully with your own. The purity of Mr Symington's attention to the subject is firmly established; and the claims of Bell, Miller, Fulton, and Taylor, are completely set at rest by the clear and decisive affidavits which you have produced. That steam navigation was attempted by Jonathan Hulls, cannot be denied; but that it was first brought into effectual application by the excellent experiments of Mr Symington, appears to me to be indisputable. That he has consequently large claims upon the substantial gratification of his country will be readily admitted by every one who casts his eyes over all the rivers and seas which have ever yet been navigated.

With every good wish for the success of your efforts in behalf of the family of this very ingenious mechanic, I remain, very faithfully yours,

(Signed) GEORGE BIRKBECK.

Robert Bowie, Esq.

21 Great Corum Street, 15th Feb., 1834.

7. Dear Sir,—In answer to yours of the 5th inst., I can only say that so much time has elapsed since any conversation passed between Mr Fulton and myself on the subject to which you allude, that I have but an indistinct recollection of what occurred between that gentleman and myself respecting his first idea as to the practicability of steam navigation. The impression, however, is on my mind, that he received his first hints from some experiments that he had witnessed in Scotland. I do not remember of his ever having mentioned any one being concerned in making these experiments in that country but Mr Symington. —I remain yours, very truly,

(Signed) JACOB PARKINS.

The following letters were only lately discovered, and they prove that neither Mr Miller nor Lord Dundas considered Mr Taylor the proper party to whom to apply for information concerning the origin of steam navigation :—

8. EDINBURGH, 3d February, 1824.

Letter from Mr P. Miller to Mr W. Symington.

SIR,—As I was not at home when you were employed by my father to erect a small steam-engine for him in a pleasure boat of his, at Dalswinton, with which the first steam experiment now on record was made, in the year 1788 ; nor had I an opportunity of being present at the second experiment made the subsequent year on the Forth and Clyde Canal, likewise under your management, may I, therefore ask you to inform me if you were acquainted with any practical system of steam navigation that existed prior to that period, from which you could have derived any assistance in carryiug my father's project

into effect; or, if you considered the speculations you were then engaged in as original in themselves at the time, for I never heard of any of the individuals who were engaged in the matter that had either ever seen or ever heard of Mr Jonathan Hull's pamphlet.

Being credibly informed that a Mr Henry Bell, of Helensburgh, near Glasgow, has publicly stated that my father's experiments failed, might I also request you to be so obliging as mention what could have given him a handle for so groundless and unfounded a mistake, for at least such did not happen at Dalswinton, as I can show by abundance of living testimony at this very day. I also know that there are many still alive who witnessed the experiment both days, after the wheels were repaired, who are ready to bear evidence that everything the reverse of failure took place on that occasion, and that these two days' experiments were as complete in success as any that have hitherto been made; and I would, at the same time, thank you to say, if you know whether this Mr Bell was ever amongst the spectators upon that occasion.

I have learned, however, that some years thereafter he applied to you to see the vessel you constructed for the Canal Company, and that you showed and explained everything particularly to him, from whence he derived the skill he possesses in this matter; and likewise understood that Mr Fulton, the American engineer, was also at Carron, and had the benefit of seeing the vessel, and receiving instructions from you on the steam system, which he so promptly and successfully carried into effect.

I hope it will be convenient for you, on receipt of this, to give me the information of which I, at present, request the favour; and be so good as to ad-

dress to me at the Albyn Club, Princes Street, where I shall be for a few days, previous to my return to Dalswinton.—I am, Sir, your most obedient servant,

(Signed) PATRICK MILLER.

To Mr William Symington.

9. From the Right Honourable Thomas Dundas to Mr Symington, Civil Engineer.

DEAR SIR,—I was extremely sorry to hear that you had been at the house while I was from home ; I beg to explain the cause of my absence, and the step I had taken to meet the chance of your arrival; and I must first state that, not having heard from you, I hardly thought you were able to accept the appointment I had made. Having accepted an invitation to sleep at Dunmore, on Friday, I came over here during that day, and requested my son's tutor to receive you in the event of your coming to breakfast. Mr Simpson, however, was not aware that you had been at Carsehall, or he would have done all in his power to make up for my absence, and, if possible, would have induced you to remain till my return.

It was well known to me that you were the first person who propelled boats by steam ; and I well recollect the trial-boat lying near the Drawbridge ; the present model is a different one from that possessed by you ; but I do not know if Mr Bell used at first the "eccentric" now in common use.

The "Auletic Wheel" I do not understand, but I will have the pleasure of calling upon you on Wednesday, when I shall be happy to receive your lecture, how much or how little of it may be within my sphere of comprehension.—I am, dear Sir, your obedient servant,

(Signed) THOMAS DUNDAS.

EXTRACTS FROM SCIENTIFIC WORKS, MAGAZINES, LETTERS, &c.

1. "Several attempts have been made to apply the force of steam to the purpose of propelling boats in canals; and there seems to be no reason to think the undertaking by any means liable to insuperable difficulties. Mr Symington appears to have had considerable success; and the method that he has employed for making a communication between the piston and the water wheel is attended with many advantages."—*Journal of the Royal Institution of Great Britain.* Vol. I., 1802: p. 195.

2. "It is indisputable, therefore, that Mr Symington was the first person who had the merit of successfully applying the power of the steam engine to the propulsion of vessels. The boat which he constructed was like that proposed by Hulls, really a tug.*

"It is much to be regretted that there existed not enterprise enough at that time, in Scotland, to encourage the ingenious artizan to repeat his experiments on the Clyde. All the subsequent improvements, however, in steam navigation, may be fairly traced to Mr Symington's attempt; and we cannot help thinking that he has a strong claim on the national gratitude. He is still alive, and we fear not in the most flourishing circumstances. Should the State decline rewarding such meritorious services, the

* It may be noticed that Hull's proposition never reached the shape of an experiment. It was only a theoretical idea, which, like many others of its tribe, might never have been capable of a practical realisation, from more causes than inability to form component parts, so that each would fit the place and suit the purpose proposed. And that there was some doubt as to this in the mind of Hull himself, is evident from the fact that *he never even made a model.*

opulent proprietors of steamboats might well evince their liberality and discernment by bestowing on him some recompense."—Article on "Steam Navigation." *Supplement to the Encyclopædia Britannica.*

3. "It is remarkable also that the unfortunate Symington, who has such claims to the original invention of the steamboat, had previously contrived a similar application for the propelling of carriages; and actually exhibited, in the year 1786–7, in the house of Mr Gilbert Meason, in Edinburgh—the first model of a steam-carriage that was, perhaps, ever seen."—Article on "Locomotive Carriages," in the *Quarterly Review.* March, 1830; p. 380.

4. "Mr Symington took out a patent for steamboats in the same year, 1801, and he has the undoubted merit of being the first person who applied the power of the steam-engine to produce motion in vessels."—Captain Basil Hall's *Travels in North America.* Vol. 2; p. 387.

5. "The earliest successful application of steam appears to have been made on the Forth and Clyde Inland Navigation."—Elijah Galloway on "The Steam-Engine."

6. "This was the first public trial (1802), of steam for a useful purpose in navigation."—Report of the Proceedings of the Managers of the Forth and Clyde Canal Company, with respect to Steam Navigation. *Mechanics' Magazine,* July 9, 1831.

7. "Mr Taylor (who is now also dead) has left the grounds for his pretensions on record in a letter which he addressed to Sir Henry Parnell, the chairman of the House of Commons' Committee. He there states that it was he who suggested to Mr Miller the application of steam power to the working of his paddle-wheels, a considerable time before he introduced Mr Syming-

ton to Mr Miller; that being acquainted with Mr Symington, and knowing he had invented a new construction of the steam-engine, a model of which he had seen at work, he asked him if he could undertake to apply his engine to Mr Miller's vessels; that Mr Symington answered in the affirmative; and, from friendship, he recommended both himself and engine, and afterwards introduced him to Mr Miller; that "after the classes of the College broke up," he (Taylor) superintended the castings of the engine with which the first experiment on Dalswinton Lake was made, and took Symington with him "to put the parts together;" that in 1789 he "repaired to Carron with Mr Symington," and constructed (that is he, Taylor, constructed) the engine employed in the second experiment, and that on returning to Dalswinton and "producing the account of the expense at Carron," Mr Miller became irritated and disgusted at the conduct of the engineer, who had more than doubled both the time and expense—"swore he was a vain, extravagant fool, and did not care how much of his money he wasted, but he should never have that in his power again, for he would have nothing more to do with him or his engine." All which is, according to Mr Taylor, 'a true, faithful, and correct account of the origin and rise of the present system of steam-boats.'

"The whole of this statement, it is important to observe, rests on Mr Taylor's own bare assertion. He was constantly contradicted on all the material points by Symington, and had not the scrape of a pen to show in corroboration of his pretensions from Mr Miller, though he continued on intimate terms with that gentleman to the period of death, which was long after Symington had been publicly taken by the hand by Lord Dundas as the real author of steam navigation. We have, therefore, to inquire what there is about

the statement itself to entitle it to credit? Does it bear the impress of truth or of fiction? Let us see. Mr Taylor says he was 'acquainted' with Mr Symington; knew he had 'invented a new construction of the steam-engine,' and had seen a model of it at work. That he was acquainted with Symington is admitted —they came from the same part of the country, and were fellow-students at college; we have heard that they even lodged together in the same house while in Edinburgh. Being so well acquainted with Symington, he must, of course, have heard of the steam-carriage which Symington exhibited at the College* full two years before his introduction to Mr Miller. So surprising a thing (at that time of day) must have been talked of by everybody, and not least frequently, we may be sure, by the inventor himself. But, strange to say, Mr Taylor makes no allusion to his steam-carriage whatever in his narrative; unless 'the model,' which he says he saw at work, was the model of that carriage, which we think most likely. How is this studious suppression of so important a fact to be explained? Was Mr Taylor apprehensive that if he made mention of Symington's steam-carriage, people would have said at once—'Oh, then, there could be but little merit in your suggesting to Mr Miller that the same power which turned the wheel of a carriage on land would turn the wheel of a vessel on water.' Can there, indeed, be any reasonable doubt that it must have been something of this sort which passed between Taylor and Miller? We are the more inclined to adopt this conclusion from the palpable want of fairness which distinguishes the remainder of Mr Tay-

* It was during the same summer, 1786, when Mr Symington was exhibiting his steam-carriage model, that he was introduced to Mr Miller.

lor's statement. Wherever there is any merit to be gleaned, in regard to the construction of machinery, Taylor arrogates the whole to himself; wherever any blame is incurred, it is thrown on poor Symington. It was Taylor who superintended the castings of the first engine; Symington was merely employed to 'put them together.' It was Taylor who 'constructed' the second and larger engine; Symington was merely 'with' Taylor on the occasion, and, for anything that appears on the face of Taylor's narrative, might as well have stayed at home. It was Taylor, in short, who, according to Taylor, was the actual 'engineer'—the person who directed and superintended everything. But when some person is wanted to bear the burden of Mr Miller's reproaches, on account of the 'time and expense' incurred, it is again poor Symington who is made the scapegoat; he who had never been dignified by Taylor with the name of 'engineer' before, is created for the nonce 'the engineer,' and has a great deal of abuse heaped upon him in that character, which, if there had been any truth in Taylor's previous narrative, ought to have been borne by him alone. Observe, further, the respective qualifications of Taylor and Symington for the parts thus assigned to them. Taylor, who was a student of divinity,* and confessedly no mechanic or engineer, superintends castings and constructs engines; and Symington, who was really a practical mechanic and engineer, and particularly acquainted with steam machinery, is merely a passive instrument in the hands of this inspired son of the Church! What likelihood is there in all this? Clearly none whatever. Besides, if Mr Taylor really played the part he pretends to have done in the construction

* He was a medical student, and does not appear ever to have attended a divinity class.

of the machinery in question—if specially, he 'constructed,' as he says he did, the second and largest engine, he must have been known in the capacity of constructor at the Carron works, where it was built, and there could have been no lack of testimonials of his having been so regarded. Mr Stainton, who was then manager of these works, is still alive. As usual, however, the only authority for Mr Taylor's engineering pretensions is Mr Taylor himself. Many other objections suggest themselves to the claim set up by this person; but it seems to us it would be a waste of words to dwell further on pretensions wholly unsupported and so void of probability."—*Mechanics' Magazine*, May 25th, 1833.

17. The late William Symington and the Invention of Steam-boats and Steam-carriages.—"Sir,—I have noticed, with pleasure, the assistance you have given, from time to time, in your valuable publication, to the friends of Mr Symington in their laudable endeavours to show that he was not only the inventor of steam locomotion, but the first person who applied steam to move a carriage as well as to propel a boat. Whatever other persons may have talked about it, or pretended to do, I know not; but I knew Mr Symington for more than thirty years successively; and I am sure, if a James Taylor, or any other person, had had any pretension to the invention, I must have heard of it. I also knew Messrs Stainton, Carlaw, Weir, and others mentioned in the business, and I never heard them speak of Taylor as the inventor. Mr Symington was very clever and intelligent, and fully capable of doing what has been said of him. His father was a practical mechanic, and superintendent of the Mining Company at Leadhills, where Mr Watt erected a pumping-engine. Here was an excellent opportunity for an ingenious youth from college to improve his

ideas; and certain it is young Symington was not slow in availing himself of it. It is well established that, almost before he was a man, he produced one of the greatest improvements on the steam-engine which had at that time been proposed, and which placed him the very next to Watt. Had he only met with a Boulton, &c., he might probably have numbered engines with this great rival. It appears that his genius was not only displayed in inventing an useful engine, but that that engine was totally different from Mr Watt's; that no infringement could be proved, 'wide as the circle was that Mr Watt, in his specification, had drawn round his invention.' The 'sketch,' however, which you have given of Mr Symington's engine, in your Journal of the 24th of July last, is rather imperfect, as there is one valve awanting, and other things reversed. It, nevertheless, exhibits sufficiently that beautiful idea of a medium piston with which Mr Symington could produce a finer vacuum in the cylinder than Mr Watt could do by his separate condenser and air-pump, and also without cooling the cylinder at every stroke by the injection water, as the common engine at that time did; and I can assure you that Mr Symington's engine could do any given quantity of labour with as little fuel as Mr Watt's; and that Mr Symington's could lift more on each square in the area of the piston than Mr Watt's engine. I have also to inform you, that Mr Symington's engine was not confined to pumping only, but that it was successfully applied to drive machinery in different parts of the United Kingdom; some were also sent to the Indies, and several were erected about London. After Mr Symington's first patent, as well as that of Mr Watt, had expired (for they both ended about the same time), Mr Symington was amongst the first (1801) to alter the shape of steam-engines, so that they should

occupy less room, and be applicable to vessels in general. This may justly be called the real commencement of steam navigation. Here I must observe that Mr Symington was then called almost a madman, because he employed about a ten-horse power engine to propel a boat—viz,, the Charlotte Dundas, although now it is common to have more than ten times that power on board. I can also assure you that Mr Fulton got his first knowledge about steam-boats from Mr Symington, and this I had occasion to assert publicly sometimes. Mr Bell, and all the others about Glasgow, had also their first steam-boat knowledge from the same source. May I add that I also learnt myself the rudiments of mechanism under Mr Symington; and I believe you know that I have added a few items to the useful art.—I remain, Sir,

"J. Dickson, Engineer.

"60 Holland Street, Southwark,
Sept. 14, 1833."

18. The late Wm. Symington's claim to the invention of steam navigation:—"When noticing in our nineteenth volume, p. 121, the Memoir of the late Mr Symington, by his son-in-law, Mr Bowie, we investigated very fully his claims to the invention of steam navigation; and the result of this investigation was a perfect conviction that to him and no other this great honour belongs. We have reason to know that the view which we took of the evidence on the subject—of that part of it more particularly which concerns the rival claims of James Taylor—has made converts of many who had previously a very different impression of Mr Symington's merits. We are entitled also to conclude that we made out a case in favour of this ill-requited individual, which, if not unanswerable, it is at least not very easy to answer—since up to this time no answer to it has appeared. But there are those who,

though they cannot refute a claim, will persist in refusing to acknowledge its validity; some from unwillingness to confess a previous delusion; others from an imperfect perception of what is due to truth; and a few, perhaps, because some interest which they prefer to truth forbids. Among this class—though not certainly in the last section of it—we regret to have to rank, on this occasion, the editors of journals, in general so well and uprightly conducted, as "Chambers's Edinburgh Journal," and "Chambers's Information for the People." In an early number of the former periodical, a memoir of Taylor was given, in which the whole merit of originating steam navigation was assigned to him, and the claims of the real originator, Mr Symington, treated with singular levity; but though the evidence which disproves Taylor's pretensions has been since (as we are informed) communicated to Messrs Chambers, they have never thought fit to amend their award, and in giving, more recently in the "Information for the People," a history of the "Steam Engine and Locomotive Machines," they have omitted all reference to the matter in dispute. They have not, it is true, renewed the claim on the behalf of Taylor, and that is something; but they have failed to do that full justice to Symington which, we think, truth and candour require at their hands.

"The document chiefly relied upon in the memoir of Taylor, as establishing his claims to the invention of steam navigation, was a letter addressed to him by Mr Symington in the following terms:—

"'Glasgow, Feb. 9, 1821.

"'Sir,—In terms of my former agreement, when making experiments of sailing by the steam engine, I hereby bind and oblige myself to convey to you, by a regular assignation, the one-half of the interest and proceeds of the patent taken by me upon that invention,

when an opportunity occurs of executing the deed, and when required.—I am, sir, your obedient servant,

(Signed) "'WM. SYMINGTON.

"'To Mr James Taylor, Cumnock.'

"We were not aware of the existence of this letter at the time we penned our former remarks. We think it right, therefore, to take the present opportunity of stating that it does not alter our view of the case in the least, but, on the contrary, confirms it in the strongest possible manner. Why should Mr Symington bind himself to assign a share in the patent for the invention to Taylor if the whole right to it rested with Taylor—which is what Taylor's friends maintain? It could not have been because Symington acquired, by any pecuniary means, an interest in the invention that the patent for it was taken out in his name; for Symington was notoriously and confessedly a person without money. It must have been the invention of the thing, and that alone, which constituted Symington's title. The monied person in the business—or at least the person who procured from others the money to take out the patent—was Taylor; he also was the person who introduced Symington to the influential patronage of Mr Miller of Dalswinton; and it seems to have been on these grounds—partly pecuniary considerations and partly gratitude—that Symington covenanted to assign to Taylor one-half of the fruits of his invention. If Taylor had been the principal in the affair he would have been the assigning party, and Symington the party to receive the assignment. As it is, Symington appears as the principal, and Taylor as a mere auxiliary—which, no doubt, was the relation in which the parties actually stood towards each other."—*Mechanics' Magazine*, April 26th, 1834.

"The truth that when Mr Symington took out the patent for his steam engine—the same which he used

in his steamboat experiments in 1788—Mr Gilbert Meason, the manager of the Wanlockhead Mining Company, in whose employment Symington was, supplied the necessary funds. Mr Symington afterwards constructed an engine for that gentleman; for which engine, through motives of gratitude, he neither would nor did receive any premium during the whole term of years for which his invention was protected. So far, too, from Mr Symington being 'notoriously,' 'confessedly,' a person without money, he was, as may be seen by the following extract of a letter which he addressed to the Editor of the *Caledonian Mercury* in September 1827, a person in easy circumstances—comparatively with Taylor, at least:—'It is not true,' he says, 'that I had pecuniary difficulties to struggle with while making the experiments on Mr Miller's boat; for during all that time I was in service of the opulent Wanlockhead Mining Company.' In another passage of the same letter he says:—'I admit that Mr Miller furnished the boat and defrayed the price of the machinery at this time, 1788, and also of the second experiment at Carron in 1789; but I decidedly and pointedly refuse that Mr Miller ever remunerated me in any way for my personal trouble and expense; in fact, the experiments cost me more expense than they did Mr Millar, to say nothing of my anxiety and devotion to carry them into full effect.'

"Instead of Taylor being a monied person, he was notoriously and confessedly poor. It is allowed, even by the accurate Chambers, as Mr Allan Cunningham calls him, that he accepted the humble situation of preceptor in the family of the late Patrick Miller, Esq. of Dalswinton, 'because he had made the important discovery that the ardour of enthusiasm, however it may sustain the mind, will not support the body.' Neither did Taylor procure any other person who had

money to take out the patent; for, as already stated, the gentleman who actually advanced the money was Mr Meason, Symington's employer and patron."—*Mechanics' Magazine*, May 10th, 1834.

Remarks on the rival claims to the introduction of steam navigation:—"Sir,—It must be evident to every one that not only England, but the whole civilised world, is under immense obligation to the individual who first rendered steam available to the purposes of navigation. Public opinion, however, seems still to vibrate between the conflicting claims to this honour put forward by the late William Symington, Mr Miller of Dalswinton (or rather by his representatives), and Mr James Taylor. As to those of Fulton and Bell, they seem, according to common consent, to be wholly untenable.

"We will, if you please, begin 'wi' the laird' first. Mr Miller was a man of property, possessed of an active mind, which was constantly requiring excitement. He was, therefore, always ready to enter into any experiments which promised to afford him that mental stimulus congenial to his feelings. He was consequently very ready to assist with his patronage young men who possessed inventive genius, or supposed that they were so blessed, and, of course, was very commonly disappointed. As he was easily induced to begin experimentalising, he was just as apt to quit it without carrying it on to a successful result; for, although not deficient in wealth, he lacked that spirit of perseverance from which alone success can emanate.

"Taylor was a tutor in this Mr Miller's family. He had been on terms of intimacy with William Symington when at the University of Edinburgh, and had seen a model of an improvement which Symington (though then still a very young man) had just perfected in the steam engine. In consequence, it would seem,

of some mention made to Mr Miller of Symington (very probably by Taylor), Mr Miller, early in 1786, called upon Symington, who was then in the employment of, and residing with, Mr Gilbert Meason, the manager of the Wanlockhead Mining Company, and after conversing with him for some time, engaged him to make some experiments, for the purpose of ascertaining the practicability of propelling boats by steam. Miller himself had, previously to this, attempted to move boats by means of wheels set in action by treddles—a plan which he was compelled to abandon from the excessive fatigue it occasioned to the men employed. This scheme, by the way, had not even the charm of novelty to recommend it, for it had been practised by the Romans, who used oxen to work machinery, and also by Savary, who had, like Mr Miller, exerted human force for that purpose."*

The biographer of Taylor, in *Chambers's Journal*, states that he "attended the University of Edinburgh for several years; that the classes selected by him were anatomy, surgery, and chemistry; and that he prosecuted his studies with much assiduity and success; for at the end of his course he was prepared to enter either upon the profession of medicine or divinity." Now, if the College Album be an authority to be confided in, Taylor matriculated for one season only, and attended the classes above mentioned for one course each. "One swallow," says the adage,

* Mr Miller seems to have had a predilection for appropriating other persons' inventions to himself—or, if he had not, his friends have endeavoured to do so for him; as they would willingly have us believe that the piece of sea ordinance known as the "carronade" was the fruit of Mr Miller's genius, when, in truth, it was invented by Mr Gascoigne, one of the proprietors and managers of the Car on Iron Works, from which circumstances it derived its name.

"does not make a summer;" but, according to Taylor's biographer, one course of lectures fully qualified him to be either a physician or divine! I make no doubt that he was just as well qualified for the one as the other—that is, not at all. I agree with the writer in *Chambers's Journal* that his genius was excursive, and that to a very considerable extent, but I have yet to learn that its excursions were ever attended by any beneficial result. He is said to have had a predilection for mineralogy, geology, and mechanics; but if this were true, how comes it that Taylor, being at the University where those subjects were treated upon scientifically, never availed himself of so excellent an opportunity of attending the classes in which they were taught.

"The improvement in the steam-engine, devised by Mr Symington, was accomplished in 1785–1786; and it was in the spring of 1786 that Mr Miller, as already mentioned, engaged him to carry on some experiments upon steam navigation. These were made upon the lake at Dalswinton, Mr Miller's property, in 1788. It is asserted that Mr Taylor remained in Edinburgh, after Mr Miller had left to superintend castings of the parts of the engine intended to be employed in moving the boat. But if this were necessary, why did not Taylor afterwards put the engine together? If he were capable of furnishing the drawings and models by which the various parts were to be constructed, surely there could be no necessity for sending for Mr Symington from the Leadhills, to put the different pieces properly 'in setee.' Mr Miller would have been little less than mad to employ Symington in these experiments, when he had such a brilliant and inventive genius as Taylor residing under his own roof. If (as has been asserted) Taylor was the author of these ex-

periments, where are the drawings and documents to substantiate his claims? Have they ever been seen by any person? or, indeed, have they ever existed, except in the imagination of his partisans?

"There is an account of these experiments to be found in the *Scots Magazine* for 1788, which, it has been allowed, was drawn up by Taylor himself. He acknowledges, in this statement, that the merit of the expense of trying the experiment was due to Mr Miller, but that the engine used upon the occasion was the sole invention of Mr Symington; and throughout the whole account he never introduces his own name, either directly or by implication. The notice alluded to was as follows:—

"'On October 14, a boat was put in motion by a steam-engine, upon Mr Miller's, of Dalswinton, piece of water at that place. That gentleman's improvements in naval affairs are well known to the public. For some time past his attention has been turned to the application of the steam-engine to the purposes of navigation. He has now accomplished, and evidently shown to the world, the practicability of this by executing it upon a small scale. A vessel, twenty-five feet long and seven broad, was, on the above date, driven with two wheels by a small engine. It answered Mr Miller's expectations fully, and afforded great pleasure to the spectators. The success of this experiment is no small accession to the public. Its utility in canals, and all inland navigation, points it out to be of the greatest advantage, not only to this island, but to many other nations of the world. The engine used is Mr Symington's new patent engine.'—*Scots Magazine*, Nov. 1788, p. 566.

"In 1789, Taylor is represented as being located at the Carron Ironworks, for the purpose of superin-

tending the castings of an engine of increased size, the cylinders being 18 inches in diameter. But, in opposition to this, we have the affidavit of Mr Stainton, one of the managers of these works, who states that—(See affidavits Nos. 4 and 5.)

"'He (Taylor) was never considered capable of superintending the work; that he never furnished a single drawing or model by which the work might be forwarded; but that, on the contrary, Mr Symington was looked up to as being the person to whom all the necessary inquiries, for the completion of the engine, were to be addressed; and that so far from considering Taylor as a principal, he was rather looked upon as a spy appointed by Miller to watch Symington's conduct, that he did not waste too much of his time upon some experiments he was conducting at the same moment for the Wanlockhead Company.'

"The experiments with the new engine succeeded entirely; but when it had arrived at that point, that by a little more exertion it might have been perfected, Mr Miller's excitement was over. He had been bitten by an agricultural mania, dismantled the steamboat, and left steam navigation to be promoted by other hands.

We will now close this part of our history of steam navigation, by informing our readers where they may see the first steam engine that moved a boat on the 14th Oct., 1788:—

"The maker of the engine was William Symington, a name well known and much respected to this day. He had just invented a new kind of steam engine, for which he had taken letters patent, as "his new invented steam-engine on principles entirely new." Of this Mr Taylor saw a model, with which he was much

pleased, and he accordingly introduced both Symington and his model to Mr Miller, who at once engaged him to plan an engine for his double boat. This he shortly accomplished, and an engine was constructed (the castings being made by George Watt, founder, Edinburgh), and was mounted in a frame and placed on the deck of the boat. And now, after months of anxiety, the moment of triumph had arrived. The vessel moved delightfully, and although the cylinders were but four inches in diameter (those of the paddle-engines of the Great Eastern are 74), it was propelled at the rate of five miles an hour. That engine is the one now in the Museum of Patents. Its identity has been proved beyond the shadow of a doubt. It has been traced from the possession of Mr Miller to that of his eldest son, who received it at his father's death. In 1828 it was packed by him in a deal case, and sent to Messrs Coutts & Co., bankers. Here it was kept till 1837, when it was removed to the warehouse of Messrs Tilbury, High Street, Marylebone. Thence it was sent to Mr Kenneth Mackenzie, of Queen Street, Edinburgh, who kept it for some time, and finally instructed his agent, Mr Fraser, to sell it, It was accordingly sold by Mr Fraser to the late Mr William Kirkwood, of Edinburgh, who removed it from its framing, and threw it on one side, intending to melt it up for the sake of the metal. The death of Mr Kirkwood, however, rescued this most interesting relic from its untimely fate, and it came into possession of the succeeding firm, Messrs Kirkwood & Sons, from whom it was purchased for a small sum, and transferred to the Great Seal Patent Office in 1853. Being, however, in a somewhat dilapidated state, it was reinstated in a frame by Messrs John Penn & Sons, and in January 1857 was finally removed to its present

home in the South Kensington Museum There it stands in its integrity, a monument of anxiety rewarded and difficulties overcome. It has found a resting-place worthy of its great origin, and will doubtless prove an object of even greater interest to the generations which succeed us than it does to ourselves. All honour to those who have preserved it to the nation. — *Once a-Week.*"

RECENT DISCOVERY OF MORE ORIGINAL DOCUMENTS, ESTABLISHING THE CLAIM OF THE LATE WILLIAM SYMINGTON.

" There have been many claimants to the honour of the invention of steam navigation ; but that the late William Symington was the first person who applied the power of the steam-engine to the propulsion of vessels, we think there can now be no reasonable doubt. Blasco de Garay in 1543, the Marquis of Worcester in 1663, and Jonathan Halls in 1737, may all have thought of applying steam to navigation, but their ideas led to nothing. In 1786, however, Mr Symington, then residing at Wanlockhead, Dumfriesshire, conceived the bold idea that the steam-engine might be rendered available for the propulsion of land carriages, as also that vessels might be propelled by the same power. He and his brother George were at that time joint-engineers to the Wanlockhead Mining Company, and Mr John Taylor was manager of the mines, to whom they were much indebted for the facilities afforded them in having the idea soon embodied in a working model, which an old man, named John Black, still living there, remembers hav-

ing seen. It was constructed on four wheels, moved in any direction by the power of a small steam-engine (patented by Mr Symington), and designed so as to carry 16 cwt., besides coals, water, &c."

In the *Edinburgh Evening Courant* of July 12, 1786, it is described as being "one of the most capital discoveries of the age."

It was shortly afterwards taken to Edinburgh, and exhibited by Mr Meason (one of the Mining Company) to the professors of the University, and other gentlemen there, who were all highly pleased with the invention. Amongst others, Mr Miller of Dalswinton, who had been experimenting a good deal amongst vessels, examined the model, and expressed his high admiration of it. Speaking of the disappointment he had felt in endeavouring to propel vessels by turning paddle-wheels by manual power, Mr Symington suggested the application of the steam-engine, and explained how it could be connected with the wheels of the boat, showing its practicability by reference to the model. Mr Miller accordingly desired Mr S. to construct a steam-engine similar to his own, and have it fitted into a boat with which he had been experimenting at Dalswinton. Mr Symington did so, and, as is known to the world, the experiment was crowned with success on Dalswinton Loch in 1788. We have thus glanced at the preliminaries to the first successful application of steam to navigation, and now submit to the public the important documents lately discovered by Mr Stewart, present manager of the Wanlockhead mines. Unfortunately, two of the letters are incomplete—(they seem to have been torn from some old letter book)—but we give them all as they appear to

us, and it is our opinion that they are sufficient to establish Symington's claim. They prove that the idea of propelling both vessels and land carriages had been suggested to other parties than Mr Miller in 1786, and show the hollowness of the claim to the honour of the invention by Mr James Taylor. He and his friends have tried to make it appear that after a certain boat race which took place at Leith in February, 1787, he suggested the idea of steam navigation to Mr Miller, but, after a careful perusal of the following letters by any impartial reader, such a suggestion must go for nothing, more especially as the documents can be proved to be the handwriting of Mr John Taylor, the then manager at Wanlockhead, and brother of the said James, whose name is not so much as once mentioned relative to the matter; besides, James knew very well what was done at Wanlockhead in 1786, and hence, no doubt, the suggestion in 1787, some eight or ten months too late; but he did not expect that such manuscripts would ever come to light, viz.:—

"Mr John Henry Pottgaisser, of Coblentz,
Holland.

"And, if a less burden is laid upon it, the motion may be increased in proportion. The consumpt of coals is very inconsiderable. The carriage runs on four wheels; it is easily turned or stopped; it will not run back on ascending roads, as other carriages do. These are, in general terms, the properties of it. With regard to the freight, you will probably be a better judge of that than we are. The machine will weigh about 1 ton. If you have any thoughts of having one, you will be so good as advise us what sort of country it is—where you would use it—whether water is scarce in it, and what sort of roads. We have

above given you an account of part of its properties, and now it is but right to inform you of the only inconveniency attending it, which is—it requires a quantity of water at certain distances; and, therefore, it will be necessary you mention, if you write, at how many miles' distance water can be got. A small quantity will do, and the machine will take it in itself in a very short space. We would likewise be happy to know what encouragement you think we might meet with if one of us came over to Holland and erected some of them there—whether the States would give us any security that we might for a time reap the benefit of our invention in a moderate way. If you would take the trouble to inform us what encouragement you think we might expect, it will be very obliging. Where roads are so situated that a little water can be got at the end of every few miles' travel, there is not a doubt of the carriage answering to very great purpose, and will be an immense saving; but, from what I have informed you of its properties, you will be able to judge partly of its utility in your country, so that we need not say anything in recommendation of it. We are just about beginning to build one, as the model has got the approbation of the best mathematicians in Scotland, and, from repeated experiments we have made, there is not the smallest ground to doubt of its succeeding. There are three of us in company—viz., George and William Symington, and John Taylor. If you write us, direct to Messrs Symington and Taylor, engineers, at Wanlockhead Mines, county of Dumfries, North Britain.

"Wanlockhead, 8th Sept., 1786."

"Mr Beaumont—Sir,—We received your favour of the 4th Sept., and are very much obliged for the

trouble you have taken of writing us concerning our steam carriage. We see by your letter that Mr Douglas is of opinion it will not answer when going up hill. We do not at present imagine his objection will turn out any hindrance to our carriage travelling on roads such as other carriages travel, though there is no doubt some pieces of road where carts may be taken up that it would not answer for our carriages to go, but these are places where any loading of consequence could not be taken. However, if any objection should arise from that circumstance, your advice upon it will be very acceptable, and thankfully received, being sensible, from your knowledge of machinery, your advice must be very serviceable to us; and we are inexpressibly obliged to you for the kind offer of your assistance. We shall be very happy to see you here when convenient for you to come.—We are, sir, yours, &c.

"To John Beaumont, Esq., Boghall, near Ayr."

This was copied, in the singular, from George Symington.

"Wanlockhead, 24th Sept., 1786.

"Mr Gilbert—Sir,—In consequence of my promise of writing you concerning our steam carriage, I have taken the first opportunity to do it. When I had the pleasure of seeing you, I described the manner of its working, I hope, to your satisfaction. With regard to the weight of the carriage, it must depend greatly on the size of the engine. A carriage proportioned to an engine whose cylinder is in length four feet and diameter twenty inches, and calculated to run at the rate of ten miles in one hour, and carry 100 stones burden, upon any road on which there is no ascent exceeding one foot in twelve, including coals to serve 12 hours—which will be 30 stones weight—and

water to serve 3 [30 ?] miles, the weight of the two managers, and every other apparatus, will weigh nearly 170 stones. If a road in any place exceeds one foot in twelve of ascent, the managers, by slowing the motion of the carriage—which they can easily do in a short time—will increase the power in proportion, and by that means enable it to ascend any piece of road accessible by other carriages; and when the increased ascent is got over, the former motion of the carriage can easily be restored. The carriage runs on four wheels and can turn a circle of 30 feet diameter. When the carriage comes down a hill of any considerable descent, the motion will not be increased by its own gravity, and it can easily be stopped when the manager thinks proper. On descending roads, the engine will use but little water, as a few strokes of it will be necessary to carry the carriage on for a considerable way. On ascending roads there will be no danger of the carriage running back. Allowing an accident to happen the engine, as the wheels at the back end of the carriage can only move in one direction; and, as near as we can estimate, the expense of the carriage and engine will amount to about seventy pounds. But an engine of the same power and apparatus for working boats on canals will only cost about fifty pounds sterling, and will only weigh 110 stones; each stroke of the engine will have a force equal to 160 stones weight when applied, which undoubtedly will be able to drag a great weight upon water, when we view the proportion between it and what a man can do in a boat with common oars, whose exertion does not exceed 7 stones; but this you will be a better judge than we. The engine we propose for working the land carriage is Mr Watt's, with

some very material alterations ; and, before we can use it, we must make an agreement with him, which we intend to propose immediately. But the engine we propose to work boats or ships with is an engine entirely of our invention, and more powerful and better adapted for the purpose than Mr Watt's engine. This engine of our own we have presently at work here in a large model, by which we have properly ascertained its power, and found it to exceed Mr Watt's engine nearly two pounds upon each square inch on the piston, without any greater consumpt of coals ; another advantage attending our engine is its being little more complicated than the old engine, which works with an atmospheric pressure. We are to use our endeavours immediately for a patent for this engine, as well as our carriage. Your assistance when we get application made, will be of great service to us, and thankfully received by, yours, &c.

" P.S.—If there is anything further you would wish to be informed of, please let us know, and we will be happy to communicate every information in our power.

" To Thomas Gilbert, Esq., M.P.,

" To be left at the Post Office, Manchester."

" Mr Meason,—Sir,—In your letter to us you observe there is an engine in the neighbourhood of Edinburgh, which you think very like William Symington's engine ; but since it is not equal to Mr Watt's, it cannot be the same with ours. William Symington completed the model on Friday last, and set it to work, and found it far surpass his greatest expectations. It not only equalled Mr Watt's engine, but exceeds it nearly two pounds on each square inch on the piston, which is a very material difference ; and, when it exceeds so much in

a model, we have reason to expect it will do a great deal more in a large engine, as no model of a fire engine can be made to work so much to the purpose as a large engine of the same construction can do. You are so good as promise to come out and see it as soon as William had it finished, and we will be very glad if you can find it convenient, about eight or ten days after this. At present William is making a new set of working hands, as its power so much exceeded his expectations. He had made the arms too weak, which obliges him to make a new set considerably stronger, which he thinks he will be able to finish in about a week; but I will write you when he gets his engine into motion again, when we will be glad to see you out to see it work, that you may have an opportunity of calculating its power yourself, and seeing the simplicity of the machinery, which I am certain will give you satisfaction. At Lady Dumfries's desire, I met a Mr Gilbert as he passed to England. He is a member of Parliament. He comes from a mining county, and was desirous to have a few specimens of the different kinds of white ore, which I carried down. He gave me some account of the mines in his county, and made inquiry concerning the nature of the mines here. He likewise wanted much to be informed concerning the steam carriage, and from what I told him of its power, he said it would be a great affair for the Duke of Bridgewater on his canals, and desired me to inform you that if he could" ——

It is to be regretted that the manuscripts extend no further; but, incomplete as they are, we do not think that we misinterpret them, when we say that they completely establish the claim of William Symington, and set aside that of James Taylor. John

Taylor and George Symington were at the time admitted into partnership with William, but they never claimed any share of the honour—to the latter alone is the world indebted for the invention. (See affidavits, Nos. 1, 2, 3, and 4.)

In conclusion, we would simply remark that it is hoped the country will yet do justice to the family of one of its greatest benefactors. Steam navigation forms part of the prosperity of the kingdom—of the world. Lord Liverpool, when Prime Minister, said, "I have lived in times when the success of a campaign, or even of a war, has depended upon the possibility of despatching our squadrons from port, and when contrary winds prevailed for whole months and completely disappointed the anxious wishes of Government; but, thanks to the steam-engine, such vexatious difficulties are now for ever at an end." Let the nation, then, though late, act justly and show its gratitude for such benefits. Mr Symington has two sons alive—one in Australia, and the other in Kettle, Fife—both well known for their mechanical genius, and who are well entitled to some national recompense. Their father spent his all in benefitting his country; he devoted the best of his life in proving the practicability of his scheme, even injured his family in bringing it to maturity, and died unrewarded.

In 1801, after steam-boat experiments had been asleep, at least to the world, from 1788 to 1800, although not in Symington's mind; for it will be seen, from the great improvements he had made in the machinery used in the boats built in the years 1801-2—(*See* DRAWING)—for the Right Hon. Lord Dundas,* which plied between Grangemouth and Glasgow.

* To that nobleman we are indebted for his liberality in advancing funds to Symington to carry out the great invention of steam navigation.

DESCRIPTION OF THE CHARLOTTE DUNDAS.

The Charlotte Dundas was built at Grangemouth, in 1801, by Alexander Hart. She was 56 feet long, 18 feet beam, and 8 feet deep. There was a cavity in the stern and in the middle of the breadth of the boat, open behind and below, measuring 4 feet wide and 12 feet long, for the paddle-wheel. She was steered by two rudders connected by iron rods, and wrought in the prow by the steering wheel. The engine was 10 horse-power condensing. The cylinder lay horizontal on deck, with connecting-rod from piston-rod to crank on paddle-wheel shaft. The air-pump was vertical, worked by a bell-crank. It was made at Carron Ironworks, and was Symington's New Patent. (*See* DRAWING.)

In the spring of the year 1802 a small party of gentlemen, among whom was Lord Dundas, the Hon. George Dundas, R.N., and Archibald Spiers, Esq. of Elderslea, met together at Lock No. 20 on the Forth and Clyde Canal, to witness some experiments to be made by a small vessel, which was to be propelled by means of a steam-engine. This vessel had been constructed at the expense of Lord Dundas of Kerse, and had been fitted with a steam-engine designed and constructed by an ingenious young mechanician named William Symington, who was now ready with his vessel and novel machinery to show his patron what great things he could accomplish by the aid of the recently introduced power of steam. . . . . The day was rough and boisterous, a violent March wind blew in direct opposition to the vessel's course, and many and grave were the doubts expressed as to the possibility of Mr Symington's little vessel making head against the gale, when all other vessels were quietly laid by windbound. But such was the con-

fidence Mr Symington had in his machinery, that not only could he make a passage to Glasgow in his own vessel, but (to the surprise of the lookers on) he attached two vessels of seventy tons burden to the stern of his own, and all being ready started his machinery. Away dashed the little steamer tugging after her the two heavy vessels, and in spite of a gale of wind dead ahead, and all sorts of unfavourable prognostications, she reached Port Dundas, Glasgow, in six hours from the time of starting, the distance being nineteen miles and a half, her speed being at the rate of three miles and a quarter per hour.

The little vessel that made this splendid trip was named by Symington the Charlotte Dundas, in honour of his patron's daughter, afterwards Lady Milton. This vessel was the first practical steamer in the world, and made this first useful voyage only sixty years ago.

Lord Dundas was induced, from the success of this trial, to propose to the Duke of Bridgewater the adoption of steam-vessels to tow the barges on his canals. The Duke saw at a glance the advantages this system offered, and at once commissioned Symington to construct eight vessels for him, on the same plan as the Charlotte Dundas. Symington returned to Scotland elated with the splendid prospect before him; but, on arriving there, he met with bitter disappointment—the committee for managing the canal had decided not to employ steam-vessels, and the Duke of Bridgewater was dead.

Unable to struggle against his misfortunes, Symington laid up his boat in a creek of the canal; and for some years after, as people passed to and fro over Bainsford drawbridge, they stopped to look at the Charlotte Dundas, and admire her as an interesting

and ingenious contrivance—this, the first practical steam-boat, and the parent of all those splendid vessels that now continually navigate every river, lake, and ocean, in the world, and which has increased our commerce in the time of peace, and our strength in war. But Britain, with her boasted liberality to genius, allows her son, the inventor, to lie buried without a stone to mark his grave.

It has been stated, at various times, in the newspapers and otherwise, that the Charlotte Dundas steamer (by Symington, in 1801), had a brick funnel. This is a mistake, as will be seen by the following letters. It is ridiculous to think so; for Symington used an iron funnel in 1786 (fifteen years previously), in his steam carriage:—

THE FIRST STEAM-BOAT.

(*To the Editor of the Glasgow Herald.*)

Worcester, July 1, 1860.

Sir,—I was pleased reading a letter in your Thursday's paper about the "Remains of the First Steamboat." Mr Miller of Dalswinton did make some experiments previous to the Charlotte Dundas, but the Charlotte Dundas was certainly the first steam-boat (ten years before the Comet on the Clyde) that was applied to anything like practical purposes in this or any other country. I have not seen the letter your correspondent refers to about the brick funnel, but I think there must be some misunderstanding on that point, as a brick funnel would topple over when the vessel listed. I think that mistake has arisen from the boiler that was on board of the Charlotte Dundas having been a common land boiler, built round with brickwork, as is usually done on land. Although I believe that both Fulton and Bell saw the Charlotte Dundas, I cannot help thinking that it is altogether

a stretch of the imagination about their taking sketches of the machinery, as that appeared to me quite unnecessary—the machinery being of the simplest kind (superior in construction to many steamers of the present day); that any person, though not an engineer, had only to open his eyes, when he could not but see and comprehend the whole at a glance, and retain it in his mind without the aid of pencil or paper. The cylinder lay in a horizontal position on deck, fore and aft the vessel, and the piston was connected to a crank on the paddle-wheel in the stern of the ship; that, with the boiler, constituted the whole machinery of the Charlotte Dundas. Although it is fifty-seven years since I saw the Charlotte Dundas, and although I did not take a sketch of her machinery, this description will be found correct. Poor Symington, the inventor and constructor of the Charlotte Dundas, whom I knew—like many other geniuses who have not the means of carrying out their own inventions, having got disgusted with the world for not appreciating his talents, took to that worst of all remedies for drowning care, and, like many other benefactors of their race, died poor.—Yours truly,

DAVID NAPIER.

REMAINS OF THE FIRST STEAM-BOAT.

(To the Editor of the Glasgow Herald.)

SIR,—Some time ago, I observed an article in your paper entitled "Remains of the First Steam-boat." I beg to correct a mistake in it regarding the construction of the vessel alluded to. It is stated that it had a brick funnel, which was not the case. The funnel was constructed of sheet-iron, in the same manner as those now in use; in fact, the whole machinery of the boat was so complete that it is the opinion of eminent engineers that the Charlotte Dundas steam-

boat was as perfect in principle and practicability as many of the steam vessels now in use; and it was the identical boat which Robert Fulton and Henry Bell minutely inspected, and took sketches of the machinery while it was steaming on the Forth and Clyde Canal in the year 1802—a circumstance which enabled Fulton, shortly afterwards, to introduce steam navigation in America, and Bell to carry the invention to the Clyde.

The late William Symington, of Falkirk, not only invented the Charlotte Dundas steamboat, but he also, so early as the year 1786, made several successful experiments on steam carriages and steamboats with an engine of his own invention, for which he obtained a patent, but it was not until he constructed the above-named vessel, under the patronage of Lord Dundas, that the steam-engine was rendered available for the purposes of navigation. It, therefore, may well be termed the first steamboat, and that from which the present system of steam navigation emanated. I quite concur with the writer of the article in question, that it is a pity that such an interesting record of an important invention should be left to neglect and decay.

It appears that the hull of the boat is still lying in a creek of the canal, near Falkirk. It would surely not be uninteresting for some antiquarian society to preserve, at least, part of the boat, in honour of the country that produced the invention. —Yours, &c., A. S.

In 1802, Fulton, who had been some time in England, hearing of Symington's attempts, went to Scotland, visited him on board his boat, and requested to see it tried. Symington accordingly got up the steam,

made several trips up and down the canal, and fully explained every part of the boat, steam-engine, and apparatus. Fulton made notes of everything, observing at the same time, that the objection of injuring the banks of the canals and small rivers might apply in England, but that in America, where they were upon a much larger scale, this inconvenience could not be felt, and he thought the application of steam-boats in that country, would be of immense public and private advantage, and stated his intention of introducing them there. After this visit to Symington, Fulton proceeded to France, where he constructed his first steamboat, and tried it on the Seine, at Paris, in 1803, and proceeded to America soon afterwards. It is rather singular that Napoleon, who was then First Consul, and who usually was alive to all great improvements, and carried them through with a degree of energy and talent which overcame all opposition, should not have appreciated the merits of the steamboat, and should have allowed such a fine opportunity of benefiting France to have slipped through his hands; but perhaps the same may be said of England, as being still more extraordinary, for the advantages of the steam-engine and machinery had then become universally acknowledged. Fulton, however, impressed with the importance of the invention, being thoroughly convinced of its ultimate success, pursued it with unremitting perseverance and energy, and in 1805 he applied to Messrs Bolton and Watt to make a steam-engine for a boat which he was about to construct in America: this boat was accordingly built in 1807. Watt's steam-engine reached America in 1806. The vessel was named "The Clermont," from his friend Livingstone's residence; the wheels and machinery were on Symington's plan, propelled by Watt's engine; the boat was tried on

the Hudson River, and only attained the speed of 5 miles per hour. This was the first steamboat used in America, and Fulton and Livingstone then took out patents for introducing steamboats in various places of America, and built several others, upon a larger scale, for carrying goods and passengers, employing Messrs Bolton and Watt to make the steam-engines. which were sent from England, each succeeding engine being larger than its predecessor. Although it was generally known that the steamboats had succeeded perfectly in America, and that their employment was daily increasing, yet little or no attention was paid to the subject in England. The idea of employing steamboats on the ocean, had never been conceived, and the objections raised to the agitation of the water by the paddle wheels on the Forth and Clyde canal, were considered so strong, that doubts were generally entertained as to the success of the system anywhere but in large rivers, such as those of America.

In 1812, however, Henry Bell, of Glasgow, who was well acquainted with, and had deeply considered all that had been done by Symington, determined to try once more whether the invention could not be applied on the Clyde; he accordingly caused a small boat of 25 tons burthen to be built at Port-Glasgow, by John Wood, who has since become so well known as a ship-builder; it was 40 feet long, with 10 feet beam, and in it was placed a steam-engine of 4 H. P., on what was termed the bell-crank principle, introduced by Watt; the boiler was placed on one side of the vessel and the engine on the other, with four-paddle-wheels worked by the intervention of spur gear; the wheels consisted of detached arms, with paddles or floats at the end, which, however, did not answer, and the complete wheel, according to Mr Symington's plan, was subsequently adopted. This

boat, which was called the "Comet," began to ply for goods and passengers on the Clyde, between Glasgow and Helensburgh (Bell's native place), in Jan., 1812, and attained the speed of 5 miles an hour.* The "Comet" succeeded so well, that Bell determined to build another vessel of larger dimensions and power. Numerous other parties, seeing the success which had attended Bell's exertions, determined to follow his example, and several other boats were built during the succeeding years of 1813 and 1814; they were, however, still very imperfect, until Cook, of Glasgow,

* In the collection of the Institution of Civil Engineers is the following handbill:—

"STEAM PASSAGE BOAT, THE 'COMET,'"

BETWEEN GLASGOW, GREENOCK, & HELENSBURGH, FOR PASSENGERS ONLY.

The subscriber, having at much expense fitted up a handsome vessel to ply upon the River Clyde, between Glasgow and Greenock—to sail by the power of wind, air, and steam, he intends that the vessel shall leave the Broomielaw on Tuesdays, Thursdays, and Saturdays, about mid-day, or at such hour thereafter as may answer from the state of the tide; and to leave Greenock on Mondays, Wednesdays, and Fridays, in the morning to suit the tide.

The elegance, comfort, safety, and speed of this vessel require only to be proved to meet the approbation of the public; and the proprietor is determined to do everything in his power to merit public encouragement.

The terms are, for the present, fixed at 4s for the best cabin, and 3s the second; but beyond these rates, nothing is to be allowed to servants, or any other person employed about the vessel.

The subscriber continues his establishment at Helensburgh Baths the same as for years past, and a vessel will be in readiness to convey passengers in the "Comet" from Greenock to Helensburgh.

Passengers by the "Comet" will receive information of the hours of sailing by applying at Mr Housten's office, Broomielaw; or Mr Thomas Blackney's, East Quay Head, Greenock. HENRY BELL.

Helensburgh Baths, August 5, 1812.

in 1814, constructed the fourth vessel, the "Glasgow," with an engine of 16 H. P. The machinery of this vessel was so much more perfect and powerful than any which had been previously constructed, that it served as a model for many others; and from this period steam-boats for river navigation were completely established.

Many of the engines employed for the above-mentioned vessels were upon the bell-crank principle, which, from their simplicity and portability, standing upon an independent frame, with the condenser forming part of it, were well adapted for steamboats, and were consequently generally used. The bell-crank levers, receiving the motion direct from the piston, communicated it by means of a connecting-rod and crank to the main shaft, turning the paddle-wheels on

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Mr Bell presented this new method of navigation to the British Government at three different times—viz., in 1802, 1803, and 1813, when, after all his exertions, it was thought to be of no utility to Government. After it was denied him in 1803, he thought it very hard that such a discovery should lie dormant; and, on that account, he sent a description of the method of applying steam in propelling vessels against wind and tide, to all the emperors and crowned heads in Europe, and also to America, which last government put it in practice in the year 1806.

[The above note is taken from a Glasgow Magazine apparently written on Mr Bell's behalf as to his claim to Steam Navigation as the inventor. It is rather amusing to find Bell writing, at the above dates, to all the crowned heads in Europe asking them to adopt his discovery of the Steam-boat, endeavouring to gull them that it was his own, as he had done some of the generous bodies in the West, to the extent of their erecting a monument to him. It shows Bell was not slow to do the FLY people in the West. At that time he could not but know it was another man's invention, secured by patent, and was at work on the Forth and Clyde Canal. There is living witnesses, and numerous affidavits, to prove he inspected Symington's Steam-boat at work.—J.R.]

each side of the vessel; the engine was placed on one side of the vessel and the boiler on the other. The boilers generally used, were upon the principle proposed by Allen in 1730, and Smeaton in 1765, having an internal furnace and flue, surrounded by the water. This form of boiler was first brought into use by Trevithick in 1803, for high-pressure engines, and for low-pressure engines, also, in one of the earliest steam-dredging boats, employed at Portsmouth Dockyard, under Bentham; but the exterior shell of the boiler was of wood, as proposed by Brindley in 1758; in steam-vessels the external shell of the boiler was made of wrought iron. All the steam-vessels above mentioned were worked by one engine only. In 1814, Boulton and Watt first applied two engines, connected together, for working a small boat on the Clyde.

In 1815, a small vessel, with a side-lever engine of 14 H.P., by Cook of Glasgow, made a voyage from Glasgow to Dublin, and round the Land's End to London; it then ran between London and Margate with passengers with considerable success, and this led to others being established in various places: the Scotch boat serving as a model.

In 1816, Maudslay made a pair of combined engines, each 14 H.P., applying the power to the paddle-wheel shaft by the crank, instead of by cog-wheels, according to the previous mode.

In the same year, the late Mr Baird constructed a steamboat at St Petersburgh, with a boiler set in brickwork; this boat worked for some time on the Neva. A drawing of it exists in the archives of our Institution.

In 1817, Boulton and Watt purchased a small steamboat called the "Caledonia," which had been

built in the Clyde, with very defective engines. James Watt, jun., having constructed a new pair of combined engines on the side-lever principle, of 14 H.P. each, made a great number of experiments with the "Caledonia," and went with it to the Scheldt and other places. The arrangement of the engines, as improved by Watt, served as a model for several other vessels.

In 1818, David Napier caused the "Rob Roy," of 90 tons burthen, to be built by Denny at Dumbarton, with an engine of 30 H.P., with which he successfully established a regular communication between Greenock and Belfast. This may be said to be the first time that a regular communication by steamboats, between two distant sea-ports, was established, and it set the example to every other place. Boulton and Watt, after the success of the "Caledonia," made a great number of marine engines of increased power, and with various new improvements, such as introducing wrought iron instead of cast iron for several of the moving parts; and in 1821, a great step was made, by establishing steamboats between London and Leith. Two of these vessels, the "James Watt" and the "Soho," with engines of 120 H.P., by Boulton and Watt, were the largest which had been made, and answered very well.

In 1819, the "Rob Roy" left the Belfast station, and was transferred to the English Channel, to run between Dover and Calais. About this time, Napier built the "Talbot" of 150 tons, with two engines of 30 H.P. each, which ran regularly between Dublin and Holyhead. In this year also, the late Mr Rennie, who had for some time previous watched the progress of this great invention with considerable interest, foreseeing that it would ultimately supersede all others, proposed to the Admiralty to use steam-vessels for

towing vessels of war into and out of harbour against wind and tide; being perfectly satisfied, that if once introduced into the navy, it could not be long before steam-vessels of war would follow; great doubts, however, as to its success were entertained by many of the official subordinates. Lord Melville and Sir George Cockburn, however, overruled all objections, and, as a first experiment, they consented to allow the "Hastings," a 74 line-of-battle ship, to be towed from Woolwich by the "Eclipse," a Margate steam-boat of 60 H.P. The "Eclipse," however, proved too weak, and after towing the "Hastings" a few miles, it returned, and the "Hastings" went to Chatham with her sails alone; the experiment was thus not quite so successful as could have been desired; nevertheless Rennie still determined to persevere. Oliver Lang, the master-shipwright of Woolwich Dockyard, entered fully into Rennie's views, and warmly assisted by every means in his power the introduction of steam-vessels into the navy, contrary to the opinions of many of his superiors. At length the Admiralty, at their recommendation, ordered the "Comet" to be built according to the draft and plan, and under the superintendence of Mr Lang; she was 115 feet long and 21 feet wide, drawing 9 feet of water, and a pair of engines, of 40 H.P. each, were ordered for her from Messrs Boulton and Watt: this was the first steam-vessel in the navy, and it is still in use. By degrees several others were built.

In 1820, a steam-tug was built by Manby, for Messrs Smith, for the purpose of towing their barges upon the Humber; and, in the same year, Maudslay and Field applied the expansive action of steam in the cylinder, which was a great improvement; also escape valves for the water, which might boil over into the cylinders. In that year also, steam-packets were in-

troduced on the post-office station between Holyhead and Howth; and the "Britannia," with oscillating engines, and several other steam-packets, were built by Manby for the Dover and Calais station.

In 1825, the general Steam Navigation Company was established by William Jolliffe, who built two of the largest vessels which had yet been tried, called the "George the Fourth" and the "Duke of York;" they were between 500 and 600 tons burthen, and had engines 130 H.P., furnished by Messrs Jessop of the Butterley Iron Works; these two vessels were intended to establish a regular communication between London and Cadiz, and London and St Petersburg; they accordingly started in September, 1827, and answered extremely well, notwithstanding the heavy storms which they encountered in the Bay of Biscay, and in the Baltic. The General Steam Navigation Company, considering the ideas of Jolliffe too extended, parted with the two vessels (which were afterwards purchased by the Government), and limited their views to the British Channel and the German Ocean. About this period, the "Enterprise," of 500 tons burthen, which was built by Gordon, and had a pair of combined engines of 120 H.P. constructed by Maudslay and Field, made the voyage from London to Calcutta, by the Cape of Good Hope. The advantage and superiority of steam vessels, in every respect, for both river and sea navigation, having been now thoroughly established, their employment became universal; and the size, power, and number of the vessels increased daily in every part of the empire.

From this period nothing remarkable appears to have occurred, until the construction of the "United Kingdom," which was by far the largest in size, and the most powerful that had been made. She was 160 feet long, 26½ beam, and 200 H.P.; the vessel

was built by Steele, of Greenock, and the engines by David Napier. As deep sea navigation by steam advanced, it became an object of considerable importance to save fuel; and to obviate the inconvenience of the incrustation of the boilers by the deposit of salt and other sediments occasioned by the use of sea water, David Napier therefore introduced the system of surface condensation, the condenser being made of a series of small copper tubes, through which the steam, after being used, passed from the cylinder to the air-pumps, the pipes being surrounded by a constant supply of cold water, so that the steam was condensed, and the water was returned directly back into the boiler, to be again converted into steam, without the admixture of salt water according to the usual plan, thus employing the same fresh water over again, whereby the above-mentioned incrustation of the boilers was in a great measure avoided. Hall afterwards tried the same system with certain modifications, and it was employed in several vessels; but like Watt, Cartwright, and others who had tried it, he found the condensation was not so complete, and the weight, and cost, and the difficulty of keeping the apparatus in order, have hitherto prevented it from being generally used; for, although it possesses advantages in many respects, still, upon the whole, they do not counterbalance the disadvantages, and the old system of condensation by jet, with the aid of the brine pumps, is more generally employed. The brine pumps and refrigerators were invented and patented by Maudslay and Field in 1825, and were used on board the "Enterprise." After the "United Kingdom," numerous vessels of similar and even greater size were constructed, to ply between London and Leith, Glasgow and Liverpool, and elsewhere.

The next great step in advance was the crossing

the Atlantic. This had long been in agitation, and was freely discussed by numerous enterprising minds, anxiously bent upon working out the fulfilment of such a desirable and important object; but the great practical difficulties involved in the execution were not so easily overcome.

To construct a vessel of sufficient size, with engines of adequate power to propel her through the storms of the Atlantic, and carrying with her sufficient fuel to keep the engines in motion, was considered by many (and among them were very competent authorities) to be extremely doubtful, but by the world in general the task was considered to be wholly impracticable. To Bristol the origin of this great undertaking is due, and a company of enterprising individuals, with Brunel as their consulting engineer, was formed for that object; it was, however, with difficulty that they found engineers to carry it into effect, some of the first constructors of the day having declined to undertake it. Messrs Maudslay and Field, however, who had already taken such a prominent part in the prosecution of steam navigation, saw their way, and boldly engaged to construct engines of the requisite power, well adapted for the purpose. Accordingly a vessel, called the "Great Western," was designed by Paterson, and built by him at Bristol; and the engines were completed and fitted on board in March, 1838. The vessel was 210 feet long and 38 feet beam, drawing 15 feet when laden, being 1240 tons burthen, and capable of carrying 500 tons of coals, which it was calculated would last twelve days. The engines were upon the side-lever principle, each of 210 H.P., with cylinders 73 inches diameter and 7 feet stroke, making 15 strokes per minute; they were fitted in cast-iron frames, with the latest improvements. The boilers were constructed with the flues over the fires; they

were called double-storey boilers, and have been since much used ; they had brine pumps, and were worked under a pressure of 5 lbs. per square inch ; the total weight of the engine and boilers, including the water and paddle-wheels, was 420 tons. The vessel was completed with her engines, and made her first trial on the Thames in March, 1838, realising 12 miles per hour. On Sunday, 8th April, she started on her first voyage from Bristol, under the command of Captain Hosken, with seven passengers, and a cargo of 50 tons of goods, besides 500 tons of coals, and reached New York on Monday, 23d April, a distance of 3000 miles in 13 days and 10 hours. Her arrival created the greatest interest—the quays were crowded with spectators, anxiously waiting to give a hearty welcome to the enterprising and successful adventurers, who had thus so triumphantly solved the grand problem, and had brought the New World within a few days' sail of the Old. On her return she left New York on the 7th May, and reached Bristol on the 23d, with 70 passengers ; performing the voyage in 15 days. The success of this voyage across the Atlantic having exceeded the most sanguine expectations of its promoters, and indeed of the whole world, there seemed no bounds to the extension of steam navigation; other companies were projected, and numerous larger and more powerful vessels were designed, in equal confidence and success ; then followed the "British Queen" by Napier, of 500 H.P., the "Liverpool," of 500 H.P., and the "President," of 600 H. P., whose melancholy fate served for a time to damp the ardour of speculation. The practicability of steam communication across the Atlantic having thus been established, and its superiority over the old sailing system being clearly proved, time only was necessary to render it perfect.

The line from Liverpool to Boston was then designed, and carried into effect by Cunard, for conveying the mails ; it consisted of four fast vessels, the "Acadia," "Caledonia," "Hibernia," and "Cambria," of about 1000 tons and 450 H.P. each. This was followed by the gigantic project of the Royal Mail Company, for carrying the mails between England and the West Indies, consisting of twelve vessels, each of about 1200 to 1300 tons burthen, and 420 H.P. The engines of these vessels resembled very much those of the "Great Western," whose complete success induced their being taken as models by others. The great weight and space occupied by these engines, being upon the average of about a ton for every horse-power, rendered it difficult for them to carry any great amount of cargo beyond the passengers, and thus the profits as a mercantile speculation were materially lessened ; it became extremely desirable, therefore, to ascertain whether engines, equally efficient, could not be made of less weight, and to occupy considerably less space.

In order to effect this object, engines were invented, by which the power was applied directly from the piston to turn the paddle-wheel shaft, without the intervention of side levers. These were called direct acting engines, and at first great objections were made to them in consequence, as was asserted, of the loss of power arising from the obliquity of the action of the piston-rod upon the crank on the paddle-wheel shaft. Messrs Seawards were among the first to introduce this system into the "Gorgon," and notwithstanding the objections above stated, it has been improved by them and by other engineers, and has materially gained ground. The obliquity of action of this system, compared with that of the side-lever system can only be considered in the light of a little extra friction, which

is fully, if not more than compensated for, by the reduction of weight and space. The modifications of the system by Miller, have been very successful, and combined with the forms of vessels adopted by him, have enabled great speed to be attained both by sea-going vessels, and his boats on the Rhine and other rivers. Even the objection of extra friction, however, if tenable, is obviated by the vibrating cylinders described in Trevithick and Vivian's patent in 1802; patented by Witty in 1813, and by Manby in 1821, by whom the first engines of the kind were constructed; subsequently improved by Maudslay & Field, and Spiller; and now extensively manufactured by Penn, Miller, and others; Maudslay & Field's double cylinder engines, so arranged that a long connecting-rod is obtained by its being enabled to descend between the cylinders; the trunk engine by Humphery; and the modification of the concentric cylinders by Joseph Maudslay; as well as other varieties of this system by different makers. The substitution of wrought iron for cast, in a large portion of the frame and condensers; the tubular instead of the common flue boiler, first proposed by Blakley in 1764, and afterwards improved in the locomotive boiler, and introduced into steam vessels by Maudslay, Spiller, Bramah, and others about the year 1829, as well as the use of steam of higher temperature and increased expansive action, have combined materially to increase the effect of the engines, and reduce the consumption of fuel; so that the space and weight occupied by them is now reduced to nearly one-half what it was originally, or in other words, engines of double the power now only occupy the same space and tonnage in the vessel; thus a material advantage has been gained in enabling vessels to carry a larger quantity

of fuel ; by which they can extend their voyage ; and greater power is rendered disposable for propelling the vessel through the water. As economy of time becomes daily more important, every means which can effect it are brought into operation; and thus the power of the engines has been continually augmented, in order to produce greater speed and shorten the duration of the voyages. Referring to the navy, we find, that in 1822, 80 H.P. was the largest ; in 1827, 160 H.P. ; in 1828, 200 H.P. ; in 1830, 220 H.P. ; in 1838, 440 H.P. ; and in 1845 we have the "Retribution" and "Terrible," with nearly 1000 H.P. in each,* and it is not improbable that ere long greater power will be employed. Whilst the royal steam navy has been making such rapid progress, the mercantile steam navy has not only kept pace with it but has even led the way ; for the enterprising commercial spirit of this country is ever on the alert ; every improvement is seized upon with avidity, and the greatest inducements are held out to make new discoveries; in fact, nothing but constant progress can satisfy the restless spirit of improvement. In the infancy of the art, we were satisfied with 5 or 6 miles per hour, now, when we have attained about 17 miles per hour, we are confidently looking to a still greater result.

Whilst the improvements, above described, have been making in the engines and in the mode of applying them, various attempts have been made to obviate the inconveniences and loss of power occasioned by the concussion of the floats of the ordinary paddle-wheel entering the water, as well as the heavy drag or back action of the water when the floats leave it ;

* The total amount of steam power employed at that time in the Royal Navy was about 35,000 H·P.

numerous experiments and inventions have been tried for constructing a wheel of such a form that the floats shall always enter the water in the most advantageous manner, and having effected the object, shall leave it again with the least resistance. To describe the numerous inventions of this kind would be foreign to my purpose, and would occupy too much of your time; it will suffice to mention that of Buchanan, by which the floats always enter and depart from the water perpendicularly; those of Cave, Oldham, Morgan, Perkins, Seaward, and Barnes, which are modifications of it, differing chiefly in the angle at which the floats enter and leave the water, and the mechanism attached to the wheel by which the motion is communicated to the float-boards; the principle of this invention is extremely good, but in practice it has unfortunately been found, that the wheels of this construction, after a little use, are liable to get out of order; it is not therefore generally adopted, although, whilst they are in order, considerable advantage is doubtless gained. To obviate this inconvenience, as well as that of the common wheel, Field invented what is technically termed the Cycloidal Wheel; this consists in dividing each float board into several parts or narrower boards, and arranging them as nearly in cycloidal curves that they shall all enter the water at the same place in immediate succession; as the active force of each is radiating, it propels whilst passing under the water in the ordinary way, and when it emerges, the water escapes simultaneously from each narrow board; this principle was not followed up by its inventor, and was afterwards patented by Galloway, since which it has been very generally adopted. The principle of reefing the paddle-wheels is also used, so that when the vessel is

deeply immersed, the leverage of the paddles can be shortened, and when light, it can be lengthened, and can thus be always adjusted to the power of the engines.

As economy of fuel is an object of the greatest importance, so in long voyages it is advisable to employ the wind as a moving power, as much as possible, when favourable ; it became therefore desirable to contrive a simple means of detaching the paddle-wheels from the engines so as to allow them to turn round with the motion of the vessel through the water, and thus to prevent them from impeding her way ; various contrivances of this kind have been invented, but one of the most simple, and which is now much employed, was invented by Braithwaite and Milner ; it consists of a friction clutch attached to the paddle-shaft, which, by means of keys and screws, can be tightened or slackened with facility, and thus the paddle-wheel is attached or released at pleasure. Numerous attempts have been made to introduce the rotative engine without pistons, but they have hitherto not been successful.

The great results rendered by steam navigation induced the mechanical world to turn their attention towards the extension and improvement of it ; Boulton and Watt, Maudslay, Field, Robert and David Napier, Jessop, Glynn, Barnes, Miller, Ravenhill, Girdwood, Manby, Spiller, Scott, Sinclair, Caird, Todd, Fawcett, Bury, Forester, Seaward, Penn, Fairbairn, Hall, Rennie, and numerous other able men devoted their minds to it, and have produced some splendid examples of engines and mechanism in that department. When we look back to Symington's original engine, in 1788, it appears to have been so changed as scarcely to be recognisable as the same,

and from a speed of 5 to 6 miles an hour in smooth water, we now find that a speed of 8 and 9 miles an hour against a heavy gale and head wind in the Atlantic, and above 17 miles in still water, has been obtained, whilst improvements are in progress which lead us to anticipate at no very distant period far greater results.

These high speeds have not been obtained by the improvements made on the engines alone. They have been obtained by giving more power to vessels, which at the same time have been much improved from being built with finer lines—thereby forming less resistance in passing through the water. It will be seen by a reference to the drawing of Symington's steam-boat of 1801 (his last patent), that the engine and paddle-wheels were equally as perfect as those used in any steamer of the present day; and any fault or objection to the steam-boat of 1801 was, that she was *too fast*, which caused the then directors of the Forth and Clyde Canal to prohibit her from working, as they thought she would injure the canal banks. She was, therefore, laid aside in 1803, and there were no steam-boats used on the canal, their birthplace, until 1826, when various plans of propulsion were tried. But none seemed to give any hope of success until the year 1856, when the screw propeller was adopted, the use of which is now extremely common. No less than 34 screw steamers since that year have been launched in the Canal. This will be better illustrated by the following communication, furnished by the Engineer and Superintendent of the Forth and Clyde Canal Company:—

"CANAL OFFICE,

"Glasgow, 8th Feb., 1862.

"DEAR SIR, — In reply to your letter of the 7th

inst., I beg to send you the following statement of the steam craft now employed on the Forth and Clyde and Monkland Canals, and propelled by steam power :—

1	Passenger Boat.			
1	Ice Breaker.			
2	Goods Boats, carrying from	30 to	40	tons.
12	Mineral Scows, ,,	55 to	65	,,
11	Lighters, ,,	70 to	85	,,
7	Do. ,,	100 to	120	,,

"The first of the above craft (the 'Thomas'), was put to work with engine-power in September, 1856—has worked satisfactorily since that time, and continues to do so.—I am, &c., JAS. MILNE."

These show that inland steam navigation is increasing very fast, as well as oceanic steam navigation—the numerous vessels employed in which have arrived at a tremendous size and speed. We have the Great Eastern, the commercial monarch of the seas, measuring 692 feet long, 58 feet deep, 83 feet in breadth, 120 feet from the extreme of the one paddle-box to the other, paddle-wheels 56 feet in diameter, a screw 24 feet in diameter, and 3000 horse-power. The following are the principal proportions of this leviathan :—

DIMENSIONS.

Length over all	692 feet
Breadth	83 —
Do. across paddle-boxes	120 —
Depth from deck to keel	60 —
Number of small transverse bulkheads or water-tight compartments	19
Ditto, partial	7
Longitudinal bulkheads running fore and aft at a distance of 36 feet apart for a length of 350 feet	2

Width of space between the two skins of ship	2 ft. 10 in.
Length of forecastle	140 feet
Do. of poop	140 —
Height of ditto	8 —
Height of saloons on lower deck ...	13 ft. 8 in.
Number of saloons	5
Height of saloons on upper deck ...	12 feet
Number of ditto	5
Length of upper saloons	70 feet
Ditto lower	120 —
Thickness of iron plates in keel	1¼ inch
Ditto inner and outer skins	⅞ —
— bulkheads	½ —
— iron deck	⅜ —

POWER.

PADDLE ENGINES.

Number of cylinders	4
Diameter of ditto	74 inches
Weight of ditto (each)	26 tons
Length of stroke	14 feet
Number of boilers	4
Furnaces for ditto	40
Horse-power	1000
Diameter of paddle-wheels	56 feet

SCREW ENGINES.

Number of cylinders	4
Weight of ditto (each)	30 tons
Diameter of ditto	84 inches
Length of stroke	4 feet
Number of boilers	6
Furnaces for ditto	72
Diameter of screw	24 feet
Number of blades to ditto	4
Length of screw shaft	160 feet
Horse-power	1600
Weight of ditto (about)	130 tons
Weight of ship, engines, &c., as at its launching, ...	12,000 tons
Immersion of this weight	15 ft. 6 in.
Ordinary light draught	22 feet
Probable maximum immersion, when fully laden	30 —
Quantity of coal which can be carried for voyages	11,379 tons
Anchors	10
Weight of ditto, cables, &c.	253 tons

Let us conclude with a reference to the progress which Steam Navigation is making in the Royal Navy. Referring to the year 1819—only forty-two years ago—Rennie, the engineer, with the assistance of Lord Melville and Sir George Cockburn, had such difficulty to get our Admiralty to consent to let them have the "Hastings," a 74 line-of-battle ship, to be towed, as an experiment, from Woolwich to Chatham by the "Eclipse," a Margate steamer. The Government at last did consent, and during the same year agreed to build a boat about 100 feet long and 80-horse power. This was the first steam-vessel in the Royal Navy, named the "Comet." Now there are the "Warrior" and the "Black Prince," which are 400 feet long and 1250 horse-power; also, above a thousand more smaller fry afloat. The Government are, at present, building the "Achilles," the greatest of them all. She is to bid defiance to the waves and all enemies. She will be clad with iron plates of great thickness, and will be supplied with steam power, and have a high speed. Forty years ago our navy was composed of wood, rope, and canvass, and were only useful when the wind was favourable; now it is composed of iron, coal, and steam, which are serviceable either in calm or storms.

All honour to the name of Symington, who gave this great invention of Steam Navigation to the world—who died unrewarded, and lies buried without a stone on his grave.

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