

# JONATHAN HULLS AND HIS STEAM-BOAT

BY

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## Introductory

Of all stories connected with the history of steam navigation, that concerning Jonathan Hulls is one of the most intriguing. It tells of a simple countryman who was born and lived in the Cotswolds, far removed from any signs of maritime activity, who possibly never even saw a ship, and yet, at the age of thirty seven took out a patent for a steam-propelled vessel and, a year later, published a pamphlet describing his invention. Although nothing came of the scheme it gave Hulls sufficient notoriety to warrant his being referred to—in some quarters at least, as the inventor of the steam-boat. It is of interest to note that amongst those who so referred to him was Sir John Barrow, a past Secretary to the Admiralty who, in his *Auto-Biographical Memoirs*, published in 1847, wrote:

‘But the fact is that neither Lord Stanhope, nor Fulton, nor the American Livingstone, nor Patrick Miller, or his assistant Symington, have the least claim or priority to the application of steam and wheels for propelling vessels through the water. Long before any of these had concerned themselves, there was printed in London a small volume, bearing the date 1737, under the following title:—“Description and Draught of a new-invented Machine for carrying vessels or ships out of or into any harbour, port, or river, against wind or tide, or in a calm; for which His Majesty George II has granted letters patent for the benefit of the Author for the space of fourteen years. By Jonathan Hulls”. Prefixed to this little book is the “Draught” of a stout boat with a chimney, as at present (smoking), paddle wheels on each side not far from the stern, and from the stern is a tow-line fixed to the foremast of a large three-masted ship, which the steam-boat is towing through the water. There can be no doubt, then, that Jonathan Hulls is the real inventor of the steam-boat.’

Throughout the literature of engineering, and particularly of marine engineering, mention is made of Hulls and his steam-boat project and, consideration of the various accounts given, soon convinces one that very little is known of the subject. It seems tolerably certain that to compensate for their lack of absolute knowledge of Hulls, some writers have indulged in flights of fancy concerning him. Thus it is that one can find a number of statements which, on investigation, prove to be quite untrue. This unduly imaginative

treatment of the subject is even more marked in the matter of the figure of the proposed steam-boat and, from time to time, there have appeared in newspapers and periodicals, drawings of weird and wonderful craft, all ascribed to Jonathan Hulls. As reproductions of Hulls's original drawing are by no means unobtainable, it is curious that writers have troubled to invent their own designs for his boat.

There are a number of unsolved mysteries connected with the subject of Jonathan Hulls, chief of which is probably that concerning his scientific knowledge. How was it that this son of a poor peasant became possessed of such knowledge as enabled him to write freely on scientific matters? Later in this paper it will be shown that he was most probably self-educated, and much influenced by reading the scientific literature of his day. The



MR. JONATHAN HULLS

portrait of Hulls, engraved by Fry, which was published in Stuart's *Historical and Descriptive Anecdotes of Steam-Engines*, 1829, present another mystery, for there is no trace or record of the painting from which it was made. Equally mysterious is the fact that although it is recorded that Jonathan died surrounded by his family in Campden, his grave cannot be traced. These and various other enigmas make the subject of Jonathan Hulls one of absorbing interest.

### Biographical

Jonathan Hulls was born at Hanging Aston (now Aston Magna) in the Parish of Blockley, Glos., in the year 1699. His father Thomas Hulls was a weaver, and it is possible that Jonathan's interest in mechanics arose from his early and constant contact with the loom. He has been described as a 'village mechanic', 'clock-repairer' and a 'clockmaker', but these descriptions are probably misleading. There is no doubt that he was keenly interested in mechanics and it is likely that, as a handyman, he was often called upon to attend to a neighbour's clock or other mechanical device. In his patent he describes himself as a Yeoman, of Broad Campden in the county of Gloucester. A yeoman of those days was a small landowner, below the class of gentleman, and not entitled to bear arms. He was often a man of substance, and even of wealth. Many yeomen farmed their own land, but some employed labourers to work for them. There is little known of Hulls's personal history, and the following extracts from *A History of Campden* by Rushen give most of what is available:

'At an early age Jonathan married Anne, daughter of Stephen and Rebecca Davis, of Broad Campden. The record of the marriage has not up to the present been found, but it must have been before 1719, for a daughter Rebecca was born to him in that year. It has been handed down that Jonathan and his family were reared and lived in poverty, but this is quite incorrect. On the 7th of April, 1730, Jonathan took by two leases of the Countess of Gainsborough, one yardland of hay and common, one yardland of dispersed arable, one little close, and one messuage, all in Broad

Campden, for the lives of himself, Anne his wife, and Thomas his son. Therefore Jonathan must have had a nice little capital which secured him a holding of 60 odd acres and a house at nominal rent. It seems probable that he settled in Broad Campden on his marriage, because he is described as of that place in the record of the baptism of his eldest child in Campden Parish Register.'

Although according to tradition Jonathan's end is "wropt in mystery", and he is supposed to have died in poverty and obscurity in London, the fact of the discovery of his Will would seem to discount these views:

'In the name of God, Amen. I Jonathan Hulls, of the Parish of Chipping Campden, in the County of Gloucester, yeoman, being of sound mind and memory att the time of making this my last will and testament. Imprimis, first I bequeath my body to the ground, to be decently interred at the will of my Executor, and there to lie in hopes of a joyful ressurection att the last day, and further hope that the Lord will receive my soul. Item, I give and bequeath to my loving wife, Anne Hulls, all that farm and the house, etc., thereto belonging, with all my goods and chattels to me in any wise belonging lying in Broad Campden, and where she now dwells, with all and every house, lands, etc., except as hereafter excepted, viz, the middlemost house in the row in Broad Campden aforesaid I give and bequeath to my loving son Jonathan Hulls, immediately after my decease; and, further, I constitute and make my loving friend, Robert Fletcher, whole and sole executor of this my last will and testament, not doubting his justice, and beg it as my last request that he will deal friendly between widow and children. And I further explain myself that I leave what I have above to my wife, provided she keeps herself single during her natural life, and after her death to my children, share and share alike, and hereby revoke all other Wills and Testaments whatsoever by me before made. In witness whereof, I have hereunto sett my hand and seal, this seventeenth day of May, one thousand seven hundred and fifty-eight.'

The will was subsequently proved by the Executor on June 14th 1758 and, therefore, Jonathan's death must have occurred between May 17 and June 14 of that year.

### **The Steam-boat Patent**

As far as can be ascertained, the early manhood of Hulls was not marked by any action which brought him to the public notice and, in fact, the first real information we have concerning him is that of his patent, granted in December 1736 when he was thirty-seven years of age. It is numbered 556 and reads of follows:

'To all to whom these presents shall come, I, Jonathan Hulls send greeting.

Whereas our Sovereign Lord George the Second, by the Grace of God King of Great Britain, etc., hath by His Letters Patent under His Great Seale of Great Britain, bearing date at Westm<sup>r</sup>, the Twenty-first day of December, in the tenth year of His reign, given and granted unto me, the said Jonathan Hulls, my exors, admors, and assigns, His especial license, full power, sole priviledge and authority, to make, use, exercise, and vend my new Invention of "A Machine for Carrying Ships and Vessels out of or into any Harbour and River against Wind and Tyde, or in a Calm", within that part of Great Britain called England, His Dominion of Wales, and Town of Berwick-upon-Tweed, in such manner as to me,

the said Jonathan Hulls, my exors, admors, and assigns, or any of us, shall in our discretions seem meet, to have, hold, exercise, and enjoy the said lycense, powers, priviledges, and advantages unto me, the said Jonathan Hulls, my exors, admors, and assigns, for and during the terme of fourteen years from the date thereof, according to the Statute in such case made and provided; in which said Letters Pattent there is contained a provisoe that if I, the said Jonathan Hulls, should not particularly describe the nature and forme of my said Invention by an instrument in writing under my hand and seale, and cause the same to be inrolled in the High Court of Chancery within three calendar months next and immediately after the date of the said Letters Pattent, that then the said Letters Pattent should be void, as in and by the said recited Letters Pattent (relacon being thereunto had) may more fully and at large appear.'

It is evident that Hulls complied with this condition, for page 2 of the patent contains his description of the proposed machine:

'Now know ye, that I, the said Jonathan Hulls, pursuant to the said provisoe, have described and ascertained, and by these presents do describe and ascertain, the nature and form of my said Invention to consist in manner following (that is to say): —

Of two beams of timber laid paralel to each other, between which and near each end thereof is fixed an axis, and behind the fore axis is fixed a standard of one or more upright piece or pieces of timber, with pulley or small wheel on the top; on the said fore axis is fixed three wheels, and on the hindermost axis two wheels, with an intervening space, in which space are fixed six fans that turn upon that axis; to each of the outermost wheels on the fore axis is fixed a rope, one end of which is also fixed to the hindermost corresponding wheels, and directed in an alternate manner, and another rope is to go from the left hind wheel over the standard, with a large weight at the end, so that as the wheels move backward or forward the fans are brought into and keep a direct motion in the water, which forces forwards the vessell in which the machine is placed. The power that is to put and keep this machine in motion is a fire engine, which operates upon the machine in the following manner:— A rope is fixed at one end to the middle of the wheel on the fore axis, and the other end to a piston which goes into a cylinder vessell placed near a boyler, containing a proper quantity of water, in which boyler the water is rarified and from thence the steam is conveyed into the cylinder vessell, and there condensed, in order to obtain a vacuum, which causes the weight of the atmosphere to press on the piston, and so gives motion to the whole machine. This machine is not to be placed and fixed on board the ship or vessell which is to be carryed out of or into any harbour or along a river, but rather in a tow boat to be used for that purpose in shallow rivers. This machine, instead of fanns, works by two cranks fixed to the hindmost axis, to which cranks are fixed two shafts of proper length to reach the botom of the river, and which move alternately forward from the motion of the wheels by which the vessell is carryed on. For smooth and deep waters the beams of the machine will be made shorter, and proper fanns fixed to work on each side of the vessell.

In witness whereof, I have hereunto sett my hand and seal, the Seventh day of March, in the tenth year of the reign of our Sovereign Lord King George the Second, over Great Britain, etc., and in the year of our Lord One thousand seven hundred and thirty six.

Jonathan Hulls.

Sealed and delivered (being first duly stamped) in the presence of Tho. Mathew.

Jas. Hen. Kent.'

From the above one gathers that Hulls's idea was to propel a vessel by means of stern paddles driven by the power of an atmospheric steam engine. Although he did not propose the use of cranks for the conversion of reciprocating to rotary motion, it is of interest to note that he uses the term crank in describing his idea of pushing the boat in shallow water.

### The Pamphlet and its clue to Hull's Scientific Ability

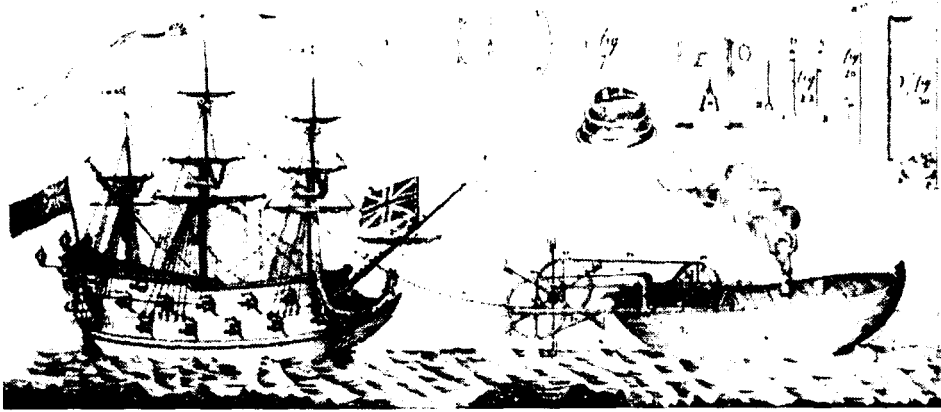
In 1737 Hulls published in pamphlet form a description of his invention, to which was appended a large diagram showing a small stern-wheeled vessel towing a three-masted Man-o-War. The top right hand corner of this folding plate contains various figures illustrating points in hydrostatics and mechanics to which the text of the pamphlet refers. This publication which was sold by T. Boreman, near Child's Coffee House in St. Paul's Church Yard, and at the Pamphlet Shops in London and Westminster, was priced at sixpence. A few years ago a copy of it was offered for sale by a London bookseller for £40.

Although Hulls's pamphlet is mentioned quite frequently in engineering literature, sometimes with considerable quotations made from it, it does not appear that any previous writer has noticed the clue it offers towards a solution of the mystery of his scientific knowledge. Before considering it in this light it may be of interest to quote Hulls's introductory remarks, which give us some idea of his nature.

'Whereas several persons concerned in the Navigation have desired some account of my invention for carrying ships out of or into harbours, ports, and rivers when they have not a fair wind. But I could not fully describe this machine without writing a small treatise of the same, in which I shall endeavour to demonstrate the possibility and probability of the matter undertaken.

There is one great hardship lies too commonly upon those who propose to advance some new, though useful scheme for the public benefit. The world abounding more in rash censure than in a candid and unprejudiced estimation of things; if a person does not answer their expectation in every point instead of a friendly treatment for his good intentions he too often meets with ridicule and contempt. But I hope that this will not be my case, but they will form a judgment of my present undertaking only from trial. If it should be said that I have filled this tract with things that are foreign to the matter proposed, I answer, there is nothing in it but what is necessary to be understood by those that desire to know the nature of that machine which I now offer to the world; and I hope that through the blessing of God it may prove serviceable to my country'.

After this introduction, Hulls proceeds to discuss "Mechanical Powers" and, as a "Demonstration" cites the action of a balance in weighing. The whole of this is a quotation from s'Gravesande's *Introduction to Philosophy*. The author next deals with "The Axis in Peritrochio", and this also is largely copied from s'Gravesande. This is followed by a description of "Fluids" and then, "of the actions of liquids against the bottoms and sides of the vessel that contains them". This too is almost wholly taken from s'Gravesande. The pamphlet next deals with specific gravity, and here Hulls indicates that the table of specific gravities he has introduced was taken from "Mr. Clare's



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treatise on Fluids". There follow several pages of notes on hydrostatical matters and, finally, a fairly brief description of the proposed steam-boat. The small figures which appear on the plate of the pamphlet are intended to amplify the various points discussed in the text. The last of these figures is a diagrammatic representation of the cylinder of an atmospheric steam engine. Of this Hulls says:

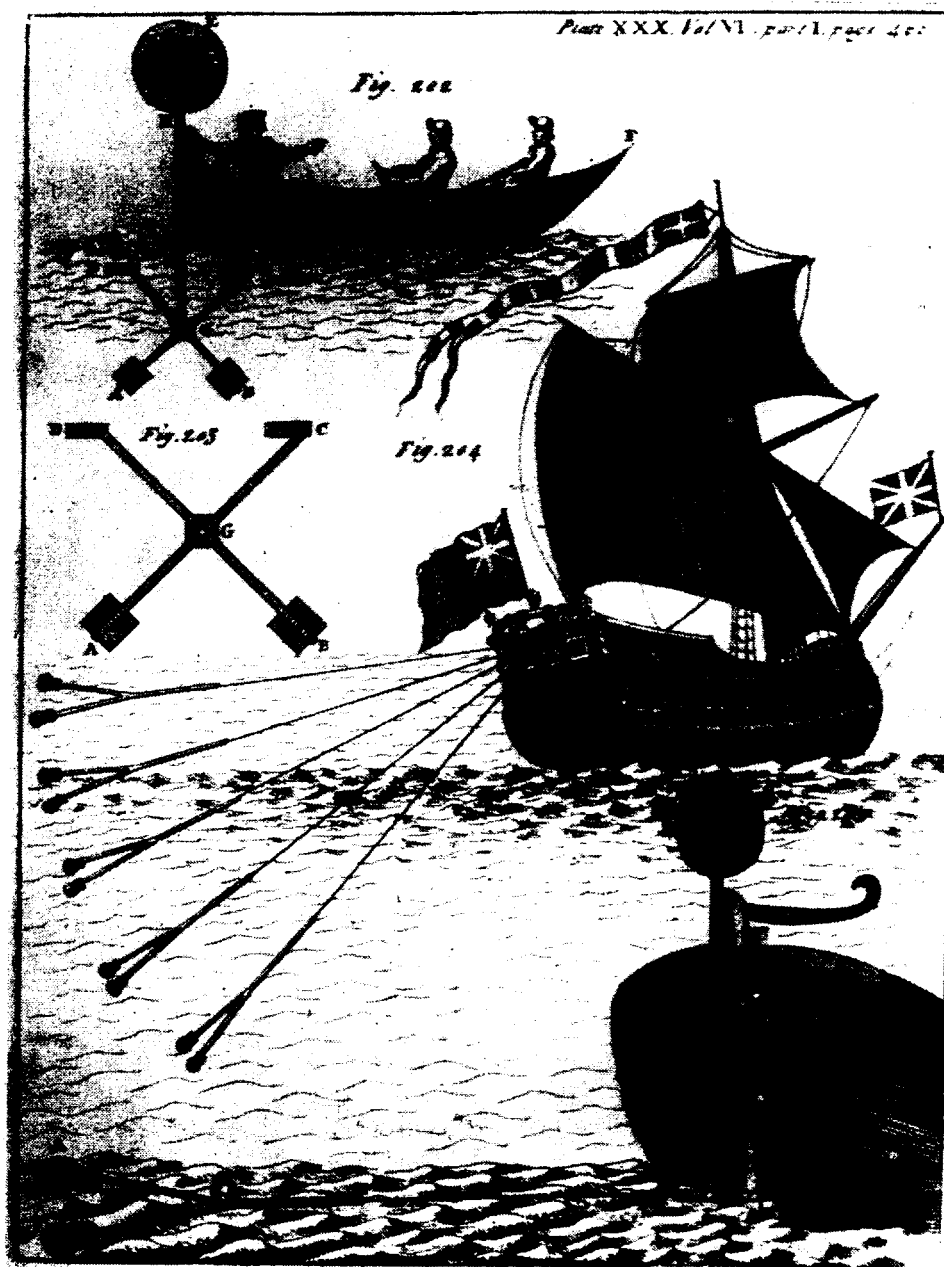
'In some convenient part of the tow-boat there is placed a vessel about two-thirds full of water, with the top close shut. This vessel being kept boiling, rarefies the water into a steam; this steam being conveyed through a large pipe into a cylindrical vessel and there condensed, makes a vacuum, which causes the weight of the atmosphere to press on this vessel, and so presses down a piston that is fitted into this cylindrical vessel in the same manner as in Mr. Newcomen's engine with which he raises water by fire.'

From the foregoing it is quite clear that Hulls made very full use of s'Gravesande's *Introduction to Philosophy*, and it is evident that he was able to understand the work. It is clear, too, that Hulls must have used Desaguliers's translation of s'Gravesande, for the many large (and unacknowledged) quotations which occur in the pamphlet agree word for word with the English edition by Desaguliers. There were various editions of the book just prior to Hulls's patent, and they were produced by the printer responsible for the production of the abridged *Philosophical Transactions*. Actually, some editions of Desaguliers's book carried the printers' advertisement for the *Phil. Trans.*, and, therefore, one may assume that Hulls knew of these volumes.

In 1734, two years before the steam-boat patent, there was published in London an abridgement of the *Phil. Trans.* covering the years 1719-33. There were two volumes:

- |          |   |                                       |
|----------|---|---------------------------------------|
| Vol. VI  | { | Part 1.—Mathematical papers           |
|          | { | Part 2.—Physiological papers          |
| Vol. VII | { | Part 3.—Anatomical and Medical papers |
|          | { | Part 4.—Philological papers           |

We are concerned with Part I, chapter 7, which is headed "Geography, Navigation". This contains a paper entitled: "A Method for Rowing Men of War in a Calm", communicated by M. Du Quet. The paper opens with the following paragraph:



THE "MARINE SURVEYOR" OF HENRY DE SAUMEREZ

'To perfect the art of navigation, two things seem principally wanting. An easy method for finding the longitude at sea; and a way to give a vessel its course when there is no wind stirring. I flatter myself to have found the last; and hope to make it appear, that a Man of War may make a league an hour in a calm by means of revolving oars, which are easily applied to the sides of the ships, without occasioning any incumbrance.'

There follows a report by M. de Chazelles of trials made at Marseilles, and a memoir by him in which he answers possible objections, in a manner which forcibly reminds one of Hulls's method in his tract. Did this scheme for a hand-driven paddle-wheel set Hulls thinking? It had been written that the Roman army under Claudius Caudex was transported to Sicily in boats

propelled by wheels moved by oxen, and a similar scheme, in which a horse supplied the power was said to have been in use in Chatham in 1682. Hulls may not have been aware of these reports, but it seems tolerably certain that he would have read this paper of Du Quet. If you could so propel a boat, it was but a short step to replace manpower by steam, and already Newcomen's atmospheric steam-engine had proved very useful for diverse tasks.

Strangely enough, the next paper in this volume of the *Phil. Trans.*, is by Henry de Saumerez, and describes his 'Marine Surveyor'. The illustration accompanying his paper shows a small boat with the apparatus fixed in the stern. It consists of a large dial inboard, connected to a four-bladed paddle which is submerged astern. Both the above papers remind one very much of Hulls's idea, and one cannot but feel that they may possibly have been responsible for it. The suspicion that he was influenced by reading this particular volume of the *Phil. Trans.* is heightened by its further perusal. Thus there are various papers communicated by Desaguliers which appear to have a bearing on Hulls's pamphlet. Of these one may mention:

'Experiments relating to the resistance of fluids'

'A proposition on the balance . . .'

'An experiment explaining a mechanical paradox, that two bodies of equal weight suspended on a certain sort of balance do not lose their equilibrium by being removed one farther from the other nearer to the centre.'

'An examination of Perault's new invented Axis in Peritrochio . . .'  
There is also a paper on Specific Gravity by Fahrenheit.

### The Literature

Earlier in this paper it was stated that numerous references to Hulls and his steam-boat may be found throughout the literature of engineering, but the sum total of information thus given is certainly meagre. In some instances the accounts are of considerable historical interest, whilst in others, startling inaccuracies occur. As an example of the latter we may quote from *A Historical Account of the Steam Engine*, compiled by James Cleland and published in *Political Tracts* dated 1825:

'The application of steam in the propelling of vessels has engaged the attention of mechanical genius for a considerable length of time. In 1736, Mr. Jonathan Hulls, then residing in the neighbourhood of Exeter, obtained a patent for what he called "A New-invented machine . . . etc." Hulls's engine had a horizontal cylinder, and the wheel which propelled the vessel was placed in the stern. The merits of this invention were disputed and, at any rate, its success was but trifling and of short duration.'

This statement contains much which might be queried, and it would certainly be of great interest to know the reason for connecting Hulls with the Exeter neighbourhood. In the *Dictionary of National Biography* we may read that Hulls was born at Campden, and that he experimented with his boat on the river Avon at Evesham. Hulls was not, of course, born at Campden and, despite the fact that at least one writer has named the foundry wherein the boat was constructed, there is absolutely no evidence to prove that the prototype was ever made. Indeed, the foundry in question did not exist in the time of Hulls. Of other inaccuracies mention may be made of the prize-winning essay on *The Nature and Application of Steam* by Alderson, published in 1834, from which we learn that the date of the patent was 1773—i.e. 15 years after Hulls's death!



Some interesting information on the subject is to be found in *A Budget of Paradoxes* by Augustus de Morgan, published in 1872. After giving the title of Hulls's pamphlet, de Morgan says:

'I ought to have entered this tract in its place. It is so rare that its existence was once doubted. It is the earliest description of steam power applied to navigation. The plate shows a barge, with smoking funnel, and paddles at the stern, towing a ship of war. The engine, as described, is Newcomen's.'

'It is not known whether Hulls actually constructed a boat. In all probability his tract suggested to Symington, as Symington did to Fulton.'

It was de Morgan who suggested that the lines of prophecy written by Erasmus Darwin in his *Botanic Garden*, viz.:

Soon shall thy arm, unconquered steam afar  
 Drag the slow barge, or drive the rapid car ;  
 Or, on wide waving wings expanded, bear  
 The flying chariot through the fields of air.

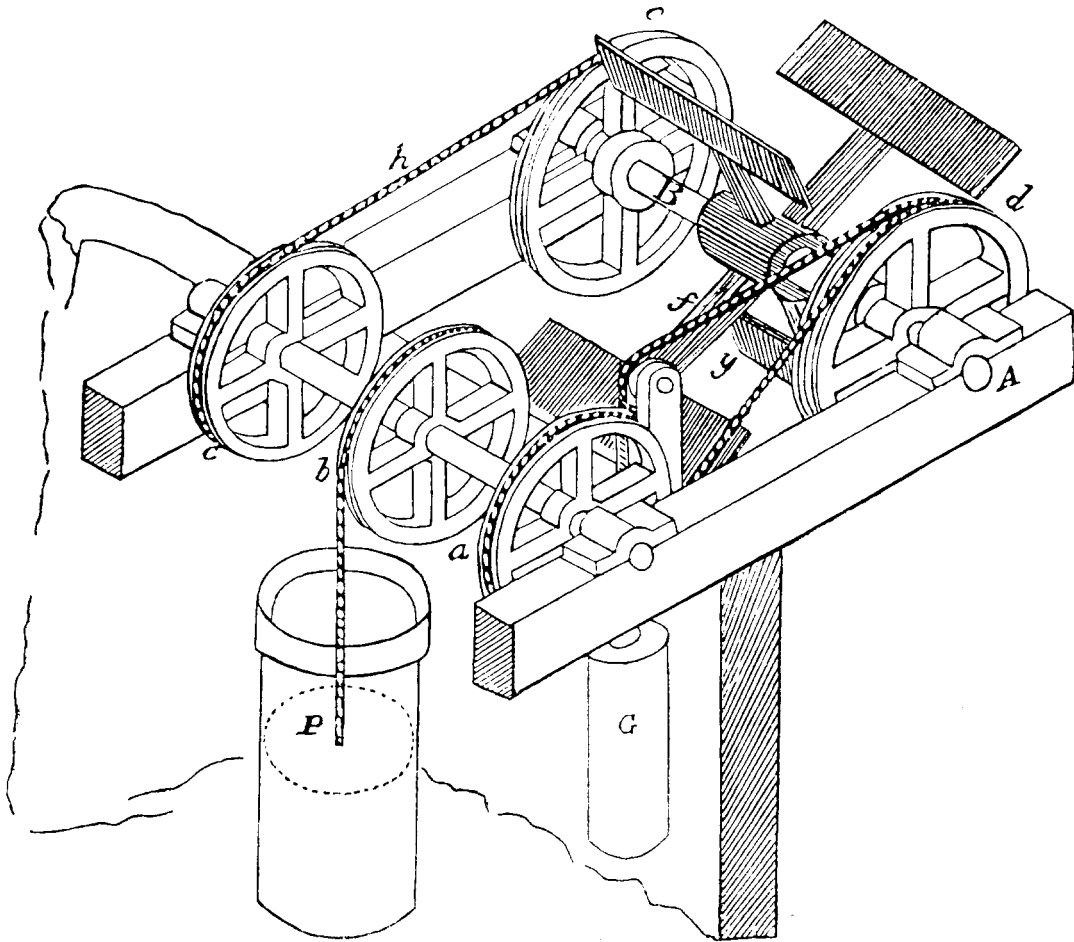
were inspired by Hulls's invention.

Further interesting information on the subject of Hulls is to be found in the *Imperial Dictionary of Universal Biography*, published in three volumes during the period 1857-63. Here Hulls is described as 'An English mechanical inventor, of whom nothing is known except his invention'. Of the pamphlet we read 'the original edition is very scarce, but a reprint of it has lately been issued by Messrs. Spon'. The pamphlet commences with a very clear and correct summary of the scientific principles on which the invention is based. The writer then goes on to describe the machine:

' . . . which consists of what would now be called a steam tug-boat, propelled by one paddle wheel or "fan" as he calls it, the axis of which is supported by beams projecting over the stern, and is made to revolve by an apparatus of ropes and ratchet wheels receiving motion from the piston of an atmospheric steam engine. The details of the mechanism are described in a manner which proves Hulls to have been a man of practical skill, as well as scientific knowledge. The invention however, was rendered useless by the mode of communicating motion from the piston to the axle, by means of ratchet work ; a mechanical combination which would soon have destroyed the engine, if not the boat, by shocks and vibration. The same defect was fatal to all attempts at steam navigation made by Jouffroy, Miller, and others, until Symington in 1801, applied Watt's double acting rotative engine, with its crank, to drive the paddle-axis.'

As a final quotation from the literature it may be of interest to give the words of Tredgold in his authoritative work on the steam engine, published in 1851:

'The atmospherical steam engine, as improved by Beighton, began to be very generally adopted in the coal works and copper mines: and it does not seem to have required any great stretch of invention to direct such an efficient power to other purposes, besides that of raising water. The first attempt, however, on record, was one to apply steam to navigation, and was made by Jonathan Hulls who, on the 21st of December 1736, obtained a patent for what may strictly be considered a steam boat. The letters patent, and a description of this boat, illustrated by a plate, was published in a tract, by Hulls in 1737. . . . As the origin of the invention of steam boats has been strongly contested, this pamphlet, which



TREDGOLD'S DIAGRAM OF THE MECHANISM

is now difficult to obtain on account of its rarity, has been brought forward to prove that Jonathan Hulls was the first person who suggested the power of steam as a means of propelling paddle-wheels. His mode of converting the reciprocating motion of the engine into a rotatory one, is less simple than the crank, but it appears to have been the first attempt, and was done in the following manner :

Let a, b, c, be three wheels on one axis and d, e, two wheels loose on another axis A, with ratchets so as to move the axis only when they move forward ; f, g, h, are three ropes, and P is the piston of the engine. When the piston descends, the wheels a, b, c, move forward, and the ropes g, h, cause the wheels e, d, to move, the wheel e forward and the wheel d backward, and the latter raises the weight G, which moves the wheel d forward during the ascent of the piston ; consequently, the axis A B with the paddle-wheels would be constantly moved round in the same direction and by an equable force.'

Tredgold was evidently quite impressed by Hulls's idea, and concludes his account with the following remarks :

'This is certainly a beautiful contrivance for rendering so irregular a first mover equable ; and, considering the object it was intended for, it

is not a complex arrangement ; for besides equalizing the power, it gives a means of increasing or diminishing the velocity in the ratios of the wheels. The pamphlet of Hulls bears evidence of being the work of an ingenious and well informed mind, and we must regret the causes which prevented his views meeting the encouragement they merited.'

### Conclusion

Although the foregoing account adds nothing new to our knowledge of Jonathan Hulls and his work, it may perhaps help in an understanding of his nature. One cannot but feel that he was a man who, by his own exertions, acquired a considerable knowledge of theoretical science and then pondered as to how it might be put to practical use. It is unlikely that he was particularly interested in ships, and it was probably purely fortuitous that his efforts were led in this direction. This view is supported by the fact that his name is later connected with a patent for a slide rule, and a hydrostatic balance. Although Hulls would undoubtedly have welcomed any financial gain accruing from his work, it seems reasonable to assume that his inventions were primarily due to a creative urge and that he was not unduly concerned about turning the honest penny. Outside engineering circles his name is hardly known, and in his birthplace, there is no monument to perpetuate his memory. His name was considered worthy of mention by Weld in his *History of the Royal Society*, published in 1848, and Sir Walter Scott thought it fitting to present his copy of Hulls's pamphlet to the Royal Society of Edinburgh of which he was President. It is, however, ironical to realize that Jonathan Hulls is probably known to some only by reason of a doggerel verse composed by a poor wit of his time :

Jonathan Hull with his paper skull,  
 Tried to make a machine  
 To go against wind and stream ;  
 But he, like an ass couldn't bring it to pass,  
 So as last was ashamed to be seen.