Specification of Patent
dated the 3d Jan.y 1810 —

Description in words, of inventions to move boats or vessels by the power of Steam Engines.

October Second eighteen hundred and ten I Robert Fulton native of Pennsylvania And citizen of the United States of America now residing in the City of New York give the following description of my inventions and discoveries for constructing boats or vessels which are to be navigated by the power of Steam Engines, believing myself to be the orginal inventor and discoverer of the following combinations. To obtain the power for driving the boat I make use of Watt and Boultons Steam engine or any other engine of equal power my claim to invention not extending to the steam engine but to the proportioning combining and applying it in such a manner to a boat or vessel of such dimensions as to drive her to a certainty more than Four miles an hour in still water. . After having determined the length, width and draught of water of the boat the details of my patent dated ~~January~~ February 11th 1809 will shew the mode for ascertaining her total resistance while running 1. 2. 3. 4. 5 or 6 Miles an hour in still water. Also the mode for proportioning the power of the Engine, the Velocity of the piston and diameter of the water wheels with the Velocity of their periphery and the size of each of their propellers to overcome any given resistance of boat while running 1. 2. 3. 4. 5 or 6 miles an hour in still water Having been the first to demonstrate the superior advantages of a water wheel or Wheels I claim As my exclusive right the use of two wheels one over each side of the boat to take the purchase on the water, to turn such wheels forwards or backward I claim as my combinations and exclusive right the following modes for communicating the power from the piston rod of the Steam Engine to them. First by two Triangular beams which are described in the details of my patent dated ~~January~~ February 11th 1809 and only mentioned here to bring together my several combinations. Second by wheels without a beam in this case a crank or crank wheels is on each side of the cylender to which shackle bars descend from the cross bar on the top of the piston rod which turning the cranks and the water wheels being connected with their Axis turn also these two crank wheels, drive two wheels of equal diameters from which a movement may be taken to work the air pump which two wheels drive two pinions on the shaft of which is the fly wheel or wheels, Third by means of a cast or wrought Iron beam on each side of the cylender near the bottom of the boat. from a cross bar on the top of the piston rod a shackle bar descends on each of the cylenders and connects with the ends of the beams. A shackle bar rises from the other end of each beam to a cross bar from which cross bar Shackle bars descend to turn two cranks or crank wheels. to the axels of which the water wheels are connected, the two crank wheels drive two pinions on the shaft of which the fly wheels are fixed, Fourth by means of a cast or wrought Iron beam above the cylender Which receives motion from the piston rod from the other end of the beam a short shackle bar gives motion to a crank on the axel of which or connected with it are the two water wheels, from the crank shaft a movement may be taken to turn the Fly wheels. Or by using sun and planet wheels. the shaft of the sun wheel will act as a fly and drive the water wheels by means of a pinion on the Sun wheel shaft and a wheel on the water wheel shaft thus if required reducing the revolutions of the water wheels to half the number of revolutions of the fly, or if the water wheels are put on the shaft of the sun wheels and weighted with Iron they will act without any other fly but not to such advantage as with a fly and water wheel, because rapid moving and small propellers is a loss of power

I use coupling bolts or any other means to throw the propelling wheels in or out of Gear or to throw one wheel out and work the other as may be required This convenience in combining the machinery of Steam boats I claim as my discovery and Exclusive right whatever may be the mode by which it may be executed. I also claim as my Invention and exclusive right the guards which are round the outside of the propelling wheels which guards may support the outside gudgions of said propelling wheels. and give the convenience of a deposit for fuel bins or lockers for various materials water closets for the

convenience of passengers and steps to enter from, or go into to the row boats, which guards protect the wheels from injury by Wharves Vessels &c&c. I Claim as my invention to project from the side or sides of a steam boat, beams, or timbers or Spars or fenders of wood or iron of any kind to guard or protect the water wheels from injury by wharves Vessels &c&c. I also claim the exclusive right to cover the Water wheels whether by board netting or grating canvas or leather or in whatever manner it may be done to prevent them throwing water on deck or entangling in Ropes. I Claim as my invention to place the teller or Steering wheel and pilot & steersman further forward in steam boats than is usual in other vessels. The reason of which is that the boat being long and the deck covered with passengers the pilot could not see forward unless near the middle of the deck hence any one who moves a steersman further forward in a steam boat than is used in other Vessels shall be considered as using this part of my invention in the convenient arrangement of steam boats. I Claim as my invention the Straight and diagonal braces which I have placed in the sides of my steam boats to give them Strength to support the weight of the engine Boiler and Machenery and which braces extend from a Cap behind the Boiler to a little forward of the Machenery. I Claim as my Invention to set the engine and Machenery on a frame which is laid on the bottom of the boat which frame must be of a length breadth and Strength to bear the weight of the machenery and working of the engine and divide it over so great a surface of the boat as to do her no Injury. I Also claim as my invention to accommodate a steam engine to a boat my mode of setting the air pump and Machenery behind the Cylender that is on the side opposite the hand gear and which is the reverse of the mode in which engines are put up on land. I Claim as my invention and exclusive right the combination of Sails with a steam engine to drive a boat I being the first who have done so and proved by practice the utility of the Union of the two powers of wind and steam. Hence as a boat may be rigged a variety of ways my Invention is not for any particular mode of rigging but for the discovery and proof by practice of the importance of adapting Sails with a Steam engine to drive a Boat. I Claim as my invention my particular mode of proportioning and placing a propelling wheel or wheels in the stern of a boat which wheel or wheels are in a Chamber formed by the two Sides of the boat extending aft one or more feet further than the extreme diameter of the propelling wheel, to each of which side projections there is a rudder, which two rudders connected by a cross bar working in pivots cause them to move together and parallel to each other from this cross bar or from the rudders the ropes or Chains for steering lead on to the pilot. To put a propelling wheel or wheels in motion at the stern of a steam boat a movement may be carried from the engine to it or them by bevel wheels and Shafts to opposite the centre of the axis of the propelling wheel and between two wheels, Or by bevel wheels and a shaft on one side of one propelling wheel, Or by a triangular beam at the Engine and long Shackle bars moving in guides on rollers, and which communication may be performed by Shackle bars leading along the centre of the boat turning a crank between two wheels Or by a shackle bar on each side of the propelling wheel each acting on a crank on each end of the shaft of the propelling wheel

Witnesses
John A Nicholson
Geo Lyon

Robt Fulton

New York October second one thousand eight hundred and ten, I Robert Fulton native of Pennsylvania and citizen of the United States of America, give the following description of my inventions and discoveries for constructing boats or vessels which are to be navigated by the power of steam engines, believing myself to be the original inventor of the following combenations to produce the desired effects; To obtain the power to drive the boat I make use of Messrs. Boulton and Watts steam Engine, or any other engine of equal power my claim to invention not extending to the steam engine, but to the proportioning combining and applying it in such a manner to a boat of such demensions, as to drive her with certainty more than four miles an hour in still water; In constructing a steam boat either for passengers or merchandise, the first consideration is the number of passengers or tons to be carried, on which the length, width, and draught of water of the boat must be determined; Then by refering to the details of my patent dated January first eighteen hundred and nine, the mode to ascertain her total resistance while running 1. 2. 3. 4. 5 or 6 miles an hour in still water will be seen. Also the mode of proportioning the power of the engine, the velocity of the piston, And the diameter of the Water wheels, with the velocity of their periphery, and the size of each of their propelers, to overcome the resistance of any given boat while running 1. 2. 3. 4. 5 or 6 miles an hour in still water; It is a knowledge of these proportions and velocities detailed in my said patent which is an important part of my discovery for the successful construction of Steam Boats. I make use of two wheels one over each side of the Boat to take the purchase on the water; to turn the wheels either forward or backward I have made various communications to carry the power from the piston rod to the cranks or Shafts of the Wheels, The first mode is shewn in drawing 7th and described in the details of my said patent dated ~~January~~ February 11th Eighteen hundred and nine; by means of two triangular beams and Shackle rods, this mode keeps the weight of the beam near the bottom of the boat and causes the whole strain of the engine to have a horizontal pull on the boat, which is less liable to injure her than when a beam is placed in the usual manner of Boulton and Watt which causes a perpendicular pressure from the centre of motion of the beam to the bottom of the boat, having a tendency at each double stroke of the engine to press down and raise up her bottom, For example if a piston in the cylender give Four tons purchase, moving two feet a second, Four tons will be felt on the other end of the beam, and Eight tons will be felt on the centre of motion or gudgions of the beam, pressing from thence to the bottom of the boat, thus at each down stroke of the piston 8 tons will press downwards to the bottom or sides should the timbers which support the engine be framed to the bottom and sides, and at each Up stroke of the engine the bottom of the boat would be pulled upwards with a power of 8 tons, To guard against the injury which the weight of the boiler and weight and strain of the engine might cause to the hull of the boat, Whether the combinations from the piston rod to the wheels be by Triangular Beams, or straight beams below the deck, or a straight beam, or beams above deck, Or a combination without a beam, I place the whole of the works in a strong frame which is laid on the bottom timbers of the boat which bottom timbers being

strongly framed or kneed, into the sides of the boat and the frame having a long and broad bearing receives the pressure from the beam and weight of the Engine dividing it over so great a portion of the boat as to do her no injury.—

The second method of communicating the power from the piston rod to turn the water wheels is without a beam, as will be seen annexed to this specification Drawing 1st. There is on each side of the Cylender a Crank and Wheel, or Crank Wheels, from a cross bar on the top of the piston rod a shackle A is connected with the crank wheels on each side of the cylender; thus while the Engine is in motion the two cranks are turned round and the water wheels indicated by the circle B connected with the shafts of said cranks are turned also. The crank wheels give motion to two wheels of equal diameter C from which a movement is taken for the air pump by a shackle descending from D to the lever E from which rises a shackle F on each side of the air pump, which shackles connect with a cross bar on the top of the bucket or piston rod of the air pump gives the necessary movement for pumping, The levers E at the end G work the plug tree H. I shews one pinion of the fly wheel shaft, the fly wheels may be put on the outsides of the boat as shewn in the ground plan. To work the forcing pump to supply the boilers and a pump to clear the boat of water a movement may be taken from the levers K and L; M. M. M. M. are weights put into the wheels to balance the weight of the piston its rod cross bar and shackles,

In working a steam boat it is important to provide a means to throw the water wheels out of gear, to try the movements of the Engine or to work one wheel at a time when necessary, N in the ground plan shews the mode of casting off the movement of the engine from the water wheel shafts by a Tee piece O on the shafts of the water wheels; and a sliding coupling box P on the shafts of the cranks, Various other modes for throwing the wheels out of gear may be contrived such as by a a square or angular coupling box, or sliding the water wheels inwards, or outwards, or by a bayonet as delineated Q in drawing first, or by two wheels throwing the teeth in and out of gear; the mode here described has been successfully in practice, Therefore being the first to discover the utility and practice the throwing water wheels when applied to steam boats in and out of gear, I claim it as part of my combination and exclusive right whatever may be the method by which it shall be executed.— The third manner of communicating the power from the piston rod to the Water wheels is in drawing Second, by means of a cast or wrought Iron beam on each side of the Cylender near the bottom of the boat as at A, the two beams are fixed on a strong Iron shaft as will be seen by the ground plan; on each side of the Cylender a Shackle rod B connects the cross bar on the top of the piston rod to the ends of the beams as at D, and from the other end of each beam as at E a shackle rod C rises to the cross bar F from whence two shackles G descend to the crank wheels H; to the shafts of which the water wheels are connected as indicated by the circle I: J is the pinion of the fly wheel (See the ground plan) K the fly wheel, A movement for the air pump is taken from the beams at L by two shackles which rise to the

cross bar

on the top of the piston or bucket rod of the air pump, M is a lever receiving motion from the piston rod to work the plugtree, N is the plugtree From the cross bar over the air pump a movement may be taken to work the forcing pump to supply the boiler, and the pump for clearing the boat of water, O.P. Q are strong timbers to support the perpendicular pressure of the centre of motion of the beam, and weight of the works so as to divide such pressure over a large surface of the boat & prevent her wrecking by the motion of the Engine, in these timbers other timbers are to be framed with braces and diagonals to support the wheels and machinery, which combination of timbers may be arranged Various ways, and is so easy conceived that I have not shewn them in the drawing to prevent confusion—

The fourth mode to communicate the power from the piston rod to the water wheels is shewn in Drawing 3^d by means of a wrought or cast Iron beam A placed above the Cylender this beam which need not be more than 8 or 9 feet long is connected by links and the lever B to the piston rod in the usual manner of Boulton and Watts engine, thereby producing a perpendicular motion for the piston rod, or the piston rod may work by a cross piece on its top running in guides, the lever B works the plugtree C, from the other end of the beam by means of the shackle D, the crank E is turned, to the shafts of which crank on each side the shafts of the water wheels are connected by the usual coupling boxes; F is a wheel to communicate with G which is the pinion of the fly wheels; they in this combination are to be on the outside of the boat, H is the rod of the air pump, the forcing pump to supply the Boiler and the pump to clear the boat of water may receive movement from the beam A or links of the rod H, I.J.K.L are strong timbers to support the perpendicular pressure of the beam A; from whence rise diagonals M.N with sufficient braces to support the action of the beam and works and divide it over such a surface of boat as to prevent it doing her any injury. the whole of this frame must be Well bolted straped and buckeled together, O———O Interstice for the [illegible]

In all these combinations to accommodate the engine conveniently to the boat, I have placed the air pump beams & movements behind the Cylender, that is on the side opposite to the hand gear, Whereas Mess^rs Boulton and Watt place the beam and air pump on the same side of the cylender with the hand gear, and work the air pump from the lower end of the plugtree which mode of combining would be very inconvenient for a boat, hence for steam boats I claim it as my particular arrangement and combination to set the air pump, beam or beams and movements for the wheels behind the cylender—,,

See Drawing 5^t (figure 1) instead of a Cat round the condenser and air pump I have a tube as at A descending through the bottom of the boat, in this the water from the river rises and passes through the cock B into the condenser C, from the reservoir of hot water at the discharging Valve of the air pump at D, a tube for the waste water E descends through the bottom of the boat, F is a forcing pump receiving ~~[illegible]~~ hot water through the tube G and forcing it into the boiler by the tube H, when the boiler is supplied the waste water rises by the pipe I through the Valve J and escapes by the pipe K into D, the Valve J is held down by means of a sufficient weight at L to balance the elasticity of the steam in the Boiler; this mode of nourishing a boiler is very convenient for a steam boat, and much superior to the usual mode

of placing engines on land with a hot well over the boiler and from 8 to 10 feet higher than the water in the boiler,

To give the sides of the boat strength and prevent her bending into the weight of the machinery I put in her on each side and extending from behind the Boiler to forward of the machinery for a distance of 60 or 80 feet more or less, Parallel and diagonal braces as shewn Figure 1 Dranny 5th which braces should be of oak let into the side timbers & well bolted the whole well secured to the bottom timbers of the boat, this invention of side bracing to strengthen steam boats, I claim as my invention and exclusive right.

I also claim as my invention and exclusive right the frame work or guards round the outside of the water wheels as shewn figure 2d Dranny 5th the outer side of which guards support the outer end of the shaft of the water wheels; which guards may be one plain band of timber curved or angular, or formed to give the conveniences of a deposit for wood, or coals, inside chambers for fish provisions or other purposes, Stairs on the sides to make an easy descent into the boats, and Necessaries or water closets for the convenience of passengers as in my boats on the Hudson river, all which conveniencies resulting from the wheel guards, together with a covering to the wheels to prevent them throwing water on decks or entangling ropes I claim as my invention and exclusive right;

I also claim as my invention the simple projection of beams, or timber, or braces, of Iron, or wood, of any kind as indicated Figure the 3d Dranny the fourth, with or without diagonals the object of which is to guard the wheels from injury by from Wharves. Vessels &c. I also claim as my invention to cover the machinery of steam boats which rise above deck - I being the first who has done so,

I also claim as my invention, as making part of the convenience of my combinations, my manner of placing the steering wheel further forwards than is usual in Vessels steering with a wheel, and so near the center of the boat that the pilot can see forward without interruption, and from his position give orders to the engineers how to work the engines, this mode of placing the steering wheel is very convenient in long steam boats, particularly when the deck is covered with passengers, to the wheel, or wheel and pinion, or any other instrument to communicate motion from the pilot to the rudder, the Tiller or rudder ropes or chains may lead on the inside or outside of the boat, I shall consider removing the steering wheel, or the pilot or steersman while steering, to a position in steam boats further forward than is usual in other Vessels; as an infringement of this part of my invention; for convenience and safety -

I also claim as my exclusive right, my combination of sails with a steam engine to drive a boat, I being the first who have done so, and proved by practice the utility of the union of the two powers of wind and steam on a boat; Dranny 6th shews the manner in which I now rig my boats, but be it understood that as a boat or Vessel may be rigged an infinity of ways, I consider the proof of the utility and practicability of uniting sails with a steam engine to drive a Boat, as my invention and discovery and my exclusive right whatever may be the manner in which the mast and Sail, or Masts Bowsprit, and sails are placed or worked,

I claim as my invention the four modes which are shewn in drawings 7 and 8 for conveying the power from the piston rod of the steam engine to turn a wheel in the stern of a boat; ~~Drawing~~ 1st and 2d shews a crank or crank wheel on each side of the cylender as at A which turns the wheels B on the axis of which is a bevel wheel C driving another bevel wheel D, conveying the power by the shaft E to the bevel wheels F. G, which turn the water wheel H, The bow of this boat is made sharp like my steam boats already described, but her stern as at I is of a width to admit the wheel H and turns up like the stern of a scow, The sides J. J extend aft one or more feet further than the extreme diameter of the water wheel, and are united by timbers K, and a neat finish on the stern; This forms a chamber for the wheel; and guards it against Sea timbers L L; On the stern projections j j are two rudders l. l. united by a bar M which plays on pins or bolts at N N causing the rudders to move together and parallel to each other. O. O the steering ropes to lead to the wheel on deck; the fly wheels are over the sides P. P. and may have guards round their outside, they are put in motion by the pinions Q Q. R is a lever to work the plug tree, S the plug tree; the air pump may be worked by an oval round the shaft B. B. Or it and the other pumps may be worked by such movements as are already described in my other combinations,

See drawing 8 "Figure 1." is a combination of the cylender and fly wheel air pump &c like that in the last drawing, but here the shaft A instead of being on one side of the water wheel works in the middle of it as at B, Figure 2, in this combination the shackle rods A give motion to the triangular beams B, which communicates to the long and strong bar C which is connected to another beam D communicating by the shackle rod E the power from the engine to the crank of the water wheel;

Figures 3 and 4 are ground plans of this combination, Figure 3 working by one rod in the centre of the water wheel and Figure 4 by a rod on each side of the water wheels; In this combination figure 2, the fly wheels may be over the sides of the boat, ~~driving~~ putting in motion by shackles from the triangular beam B, turning the wheels F, driving the pinions G of the fly wheel or wheels H,

In this mode of combining with a wheel behind the boat it must be observed that, it diameter, velocity of its Periphery, and surface of each propeller, must be proportioned to the intended Velocity and resistance of the boat to be driven, as will be seen in the details dated ~~from~~ the 11th eighteen hundred and ~~nine~~ of my patent for steam boats, As to the fly wheel or wheels to steam boats, the experience on my steam boat on the Seine at Paris in 1803 proves that a steam boat may be made to act without a fly. or that the water wheels may be made to serve for fly wheels also, this I prove by throwing the flies out of gear & working without them, the reason is when the engine has put the boat in motion, her action forward is so

a

power to pull the propellers of the water wheels round by drawing them against the water, and thus make the Crank pass the point where it would be in a[t] like with the shackles; having been the first who made this discovery it is my intention to construct a pair of water wheels to act as fleid should they succeed I claim this discovery as my exclusive right,

I also claim as an important discovery in the construction of steam boats and one on which their success greatly depends, that to drive a boat by the power of a steam engine 4 or 4 1/2 miles an hour in still water, she must be of a size to displace more than 50 tons of water; The reason is that the resistance of a boat displacing only 50 tons of water, is much greater in proportion to her capacity to carry passengers or merchandise, than the resistance of a boat displacing 110 or more tons of water is in proportion to her capacity to carry passengers or freight;; And the weight of the engine and machinery is much greater in proportion to the Volume of the small boat; than it will be in proportion to the Volume of the large boat.;

For Example First

Boat 90 feet long 10 feet wide drawing 2 feet of Water bow and stern on angles of 66 degrees she will displace 1600 Cube feet of water & about 50 tons, being two feet in the water she will present 20 feet to the water, the plus and minus resistance of one foot to run 4 miles an hour is 12 [tt] 37 [lbs] multiplied by 20 the bow of the boat 247
Friction on 1120 Superficial feet of bottom and sides at 7 [tt] 50 [lbs] for 50 Superficial feet 165
Total resistance of the boat running 4 miles an hour 412
A like power for the propellers 412
Total power felt at the propellers 824
The boat running 4 miles an hour is 6 feet a second
this is 3 times faster than the piston runs hence X 3
Necessary power of the engine, the piston running 2 feet a second. 2472 [lbs]
This will require a 17 inch Cylender allowing 9 pounds clear purchase to the pound Inch. This engine would occupy at least 33 feet by 6 in the boat. and with the water in the boiler weight of Machinery &c would weigh 20 tons the boat built strong to support such an engine would weigh 24 tons or more hence if 12 tons of passengers or merchandize were put in her, it would press her down 6 inches more in the water, increasing her resistance, and hence the same engine could not drive her 4 miles an hour nor could she carry an engine to run 4 1/2 miles an hour.

Example Second

My first steam boat on the Hudson river was 150 feet long 13. wide drawing two feet of water bow and Stern 60 degrees she displaced 3640 cube feet equal 100 tons of water, her bow presents 26 feet to the water plus and minus resistance of one foot running 4 miles an hour is 12 [tt] 37 [lbs] multiplied by 26 the bow of the boat — 321
Friction on 2380 Superficial feet of bottom and sides at 7 [tt] 50 [lbs] for 50 superficial feet 352
Total resistance of the boat running 4 miles an hour 673
a like power for the propellers 673
Total power felt at the propellers 1346
The boat running 4 miles an hour is 6 feet a second
this is three times faster than the piston hence X = 3
Necessary power of the engine the piston moving 2 feet a second = 4038
This will require a 22 inch cylender allowing 9 pound purchase to the round Inch, This engine would not occupy in the boat more space than in the small one, and it would not weigh ~~more than~~ ten tons more than the 17 Inch cylender, hence 24 weight of engine 22 tons weight of Boat 40 tons total 62 tons this leaves 38 tons for passengers or merchandize with ample space, before it would bring her down to 2 feet in the water — but drawing not more than 18 inches befor cargo & passengers were on, and her resistance being diminished near one third the above power would drive her 4 1/2 miles an hour

The two preceding Examples exhibit in a clear point of view the advantage to be gained in building a large boat to carry a large and powerful engine; All persons who tried experiments on steam boats before me, seeing the weight and great space which Watt and Boultons engine ~~encumbered the boat~~ (was adopted) which was fitted to Boats, Attempted to construct engines powerful, lighter and more compact than those of Watt and Boulton, and thus they endavored to accommodate the engine to a small boat hoping by that means to drive her 4 or more miles an hour, as they did not endavour to compress and lighten the engine, the always built their boats and engines on too small a scale, and thereby ~~impossible~~ made it impossible to gain a Velocity of 4 or 4½ miles an hour in consequence of working on erroneous principles; I discovered this error, and not attempting to accommodate an engine to a small boat, I constructed a large boat ~~&c~~ and accomodated its dimensions to a large and powerful engine; The success of my boats on the Hudson river has proved the truth of these principles, and the importance of my discovery, that to construct useful and convenient steamboats which shall run more than 4 or 4½ miles an hour in still water; they must be of a size to displace more than 50 tons of water, and this discovery making an essential part of my invention and combination, I Claim the exclusive right to construct steamboats of a size exceeding a displacement of 50 tons of water by which means I am enabled to accommodate the boat to the engine and produce a Velocity from 4 to 5 or 6 miles an hour

Robert Fulton

Received January 29th 1811 of Robert Fulton of New York
THIRTY DOLLARS, in conformity to an Act of Congress, dated 21st February, 1793, entitled, "An act to promote the progress of useful arts," &c. for which I have signed duplicate receipts this day.

30 DOLLARS.

W. T. Tucker
Treas. U. States

References explanatory of the figures hereunto annexed —

Figure 1.

A The Main Cylinder
BB Steam Chests
C Steam pipe
D Condensing pipe
E Condeser
FF Large Cog Wheels
G Fly Wheel
H Small wheel on axis of the Fly Wheel
I Axis of Fly Wheel
J Main Axis
K Piston Rod
LL Connecting Rods
MM Rods connecting with triangular beams of the air pump
N Main beam of the piston Rod
OO Triangular beams for working Air pump.
P Cast Iron frame supporting 4 Axis for work'd valves
QQ Cast iron plates supporting axis
RR&c. Cast iron pillars supporting plates
S Pillers supporting Cylinder
T Cast iron plate supporting Condenser, Air pump &c
VVVV Wooden guide posts
VV Wooden frame work supporting cast iron pillars &c
WW Beams supporting cast iron plate T
Z Guides for the ends of Main beam
1118 Cranks on the end of the Axis 2222.
4444 Levers on Axis 2 & raising the Valve Stems 333.

Figure 2d.

The Alphabetical Letters & the Numerical figures 1
2 3 4 the same as in figure 1.

5 5 Brass Cylinders for seats to Valves 6 6 6,
7 Communication between condensor & air pump
8 8 Valves in E for discharging Water from condenser
9 Communication between top of condenser & top of air pump
10 10 Valves in D exhausting air from top of condenser
11 11 Links of parrellel motion attached to piston rod of air pump
12 Shackle pin on large Cog wheel F
13 Supply pump
14 14 Pipes for discharging condensing Water

Figure 3rd.

1 Crank on Axis
4 Lever on Axis 2 raising Stem 3 with its Valve 6
5 Valve Seat
7 Weight on lever for shutting Valves
10 Rod connecting crank 1 with lever 9
10 Section of cylinder with projection 11 which in each
" revolution of the cylinder moves the lever 9
12 Cog wheel working in the teeth of wheel 13 on same
Axis with cylinder 10.
13 Cog wheel on Axis of fly wheel being half the diameter
of wheel 12, and giving it one revolution, for every double
Stroke of piston of Steam engine.

Figure 4

T Cast iron plate &c
1 Bottom of the Condenser
2 Apperture in communicating under-plate T with
apperture 4.
3,3 Appertures for Valve Seats
5 Bottom Air pump

Figure 5 & 6

AA Two main Cylinders
B Small Cylinder
CC Two flues passing thro' main Cylinders
DD Concave heads in main Cylinders
EE Ribs for strengthening concave heads
F Curved plates iron supporting
G Inverted brick Arch
HHHH Pillars supporting said Arch
II Furnace doors
JJ Ash pit doors
K Brick work of the Furnace
L Main Flue under the Cylinders

Figure 7th

A Large Cog Wheel
BBBB Small do half the diameter
CCC&c Half Cranks
DDDD Side of troughs containing float boards EEEE

This matter to be introduced after the mark thus ——— in the Specification.

Drawing 4 Shews two modes in which I combine and apply the sun and planet wheels to convey the power from the beam to turn the water wheels.

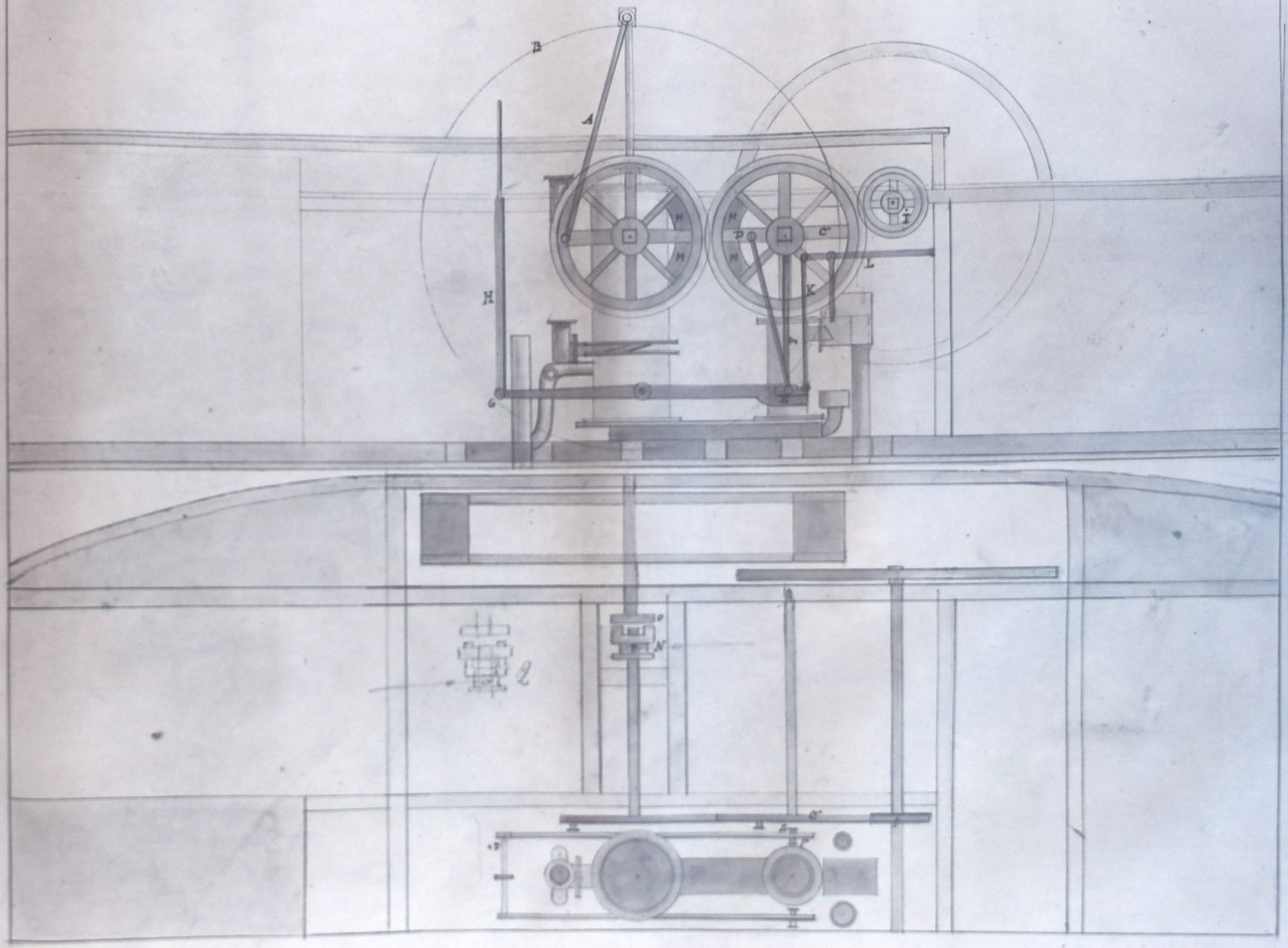
Figure 1st Shews two sun and planet wheels A B & A B united by one shackle D, which wheels B, B driving A A turn the shafts of the water wheels C, C, in this combination A and B being equal diameters A will perform 2 revolutions while the piston of the engine makes one stroke down and one up, In such case the water wheels performing two revolutions for each double stroke of the engine no other fly wheel than the water wheels will be required (they must be made heavy with Iron) This has been proved by an experiment which was made on the North River steam boat in 1808. having lost both her wheels near Esopus, propelling boards were put on the fly wheels which then were over the outside of the Boat

The fly wheels had twice the velocity of the water
wheels that is the fly wheels performed two revolutions
while the engine made one double stroke, in this
manner the boat worked well from Esopus
to New York, not so well however as with her
water wheels, which made only one revolution
while the piston made one double stroke -
because it is an error to have a small and
moving
rapid propeller as shewn in the details of
of my patent dated Febry 1st 1849 - Figure
2d Shews the side view of the sun and planet
movement D the shackle to connect with the
engine beam Figure 3d Shews a mode
to combine the sun and planet movement
so as to give the water wheel only one revolution
while the piston makes one double stroke, the
wheel A and shaft C performing 2 Revolutions
for one double stroke of the engine. Let D a tooth
wheel on the shaft C, be half the diameter
of E a tooth wheel on the water wheel Shaft

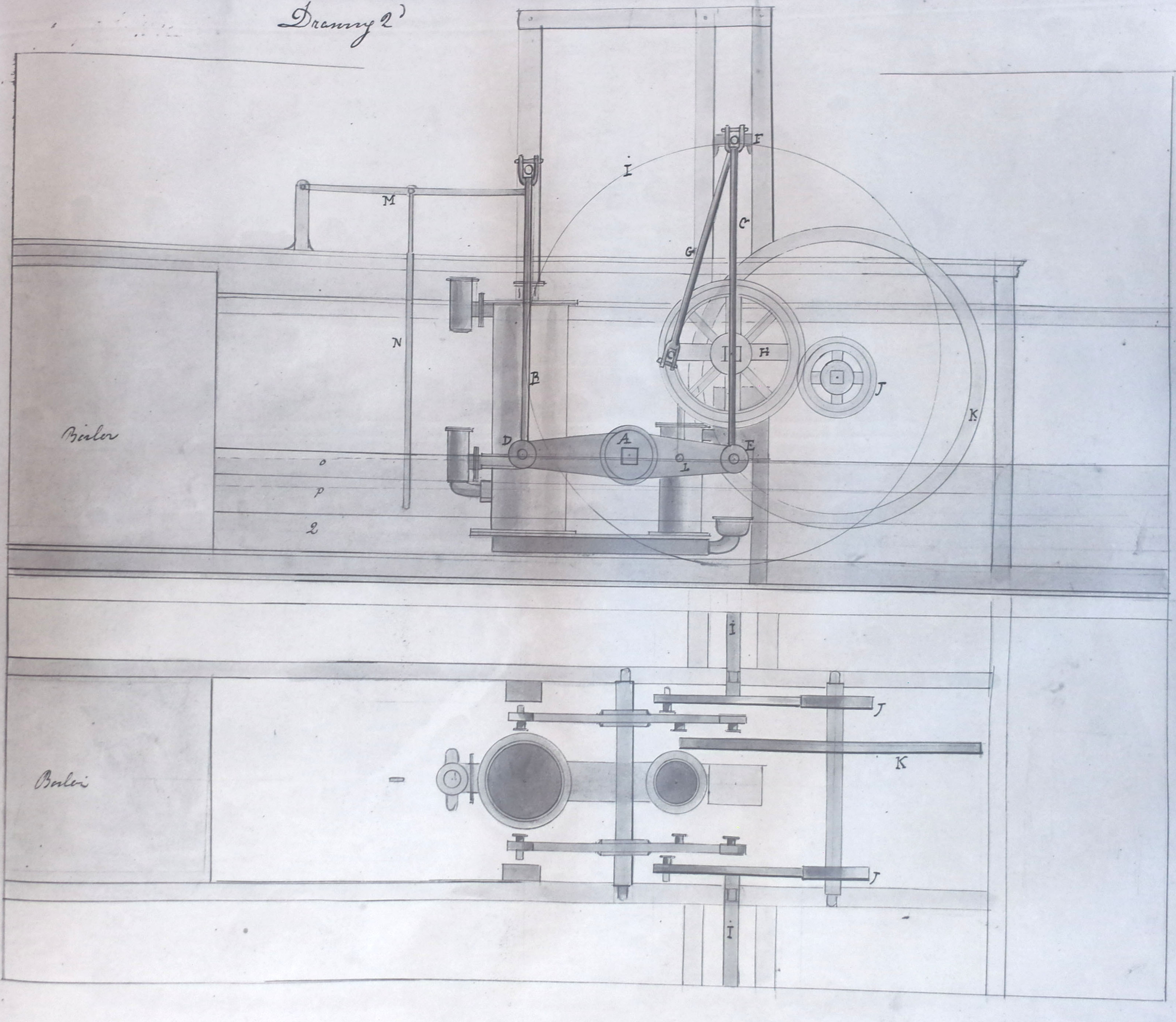
I and then the water wheels will perform only one revolution for each double stroke of the engine; by this mode of combining, as with wheel and pinions the water wheels may be given any required velocity for boats moving under 4 miles, an hour, or more than 10 miles an hour, = Thus the fly wheel or wheels will perform 2 revolutions for each double stroke of the engine -

These modes of combining in a compact manner and adapting the Beams and sun and planet movements to convey the power from the piston of the engine, to turn water or propelling wheels when applied to steam boats, I claim as my invention -

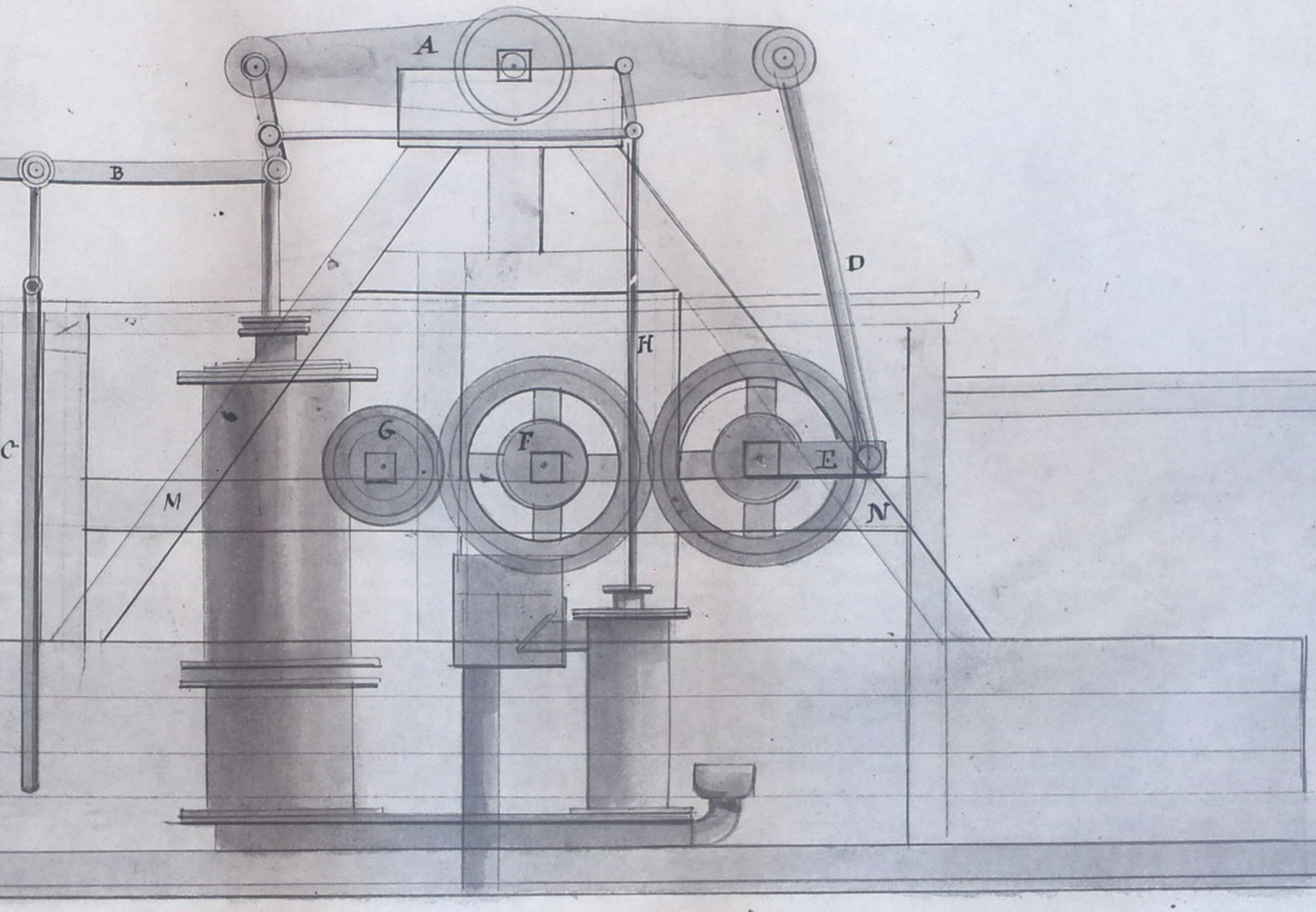
November 26th 1810 Drawing 1st.



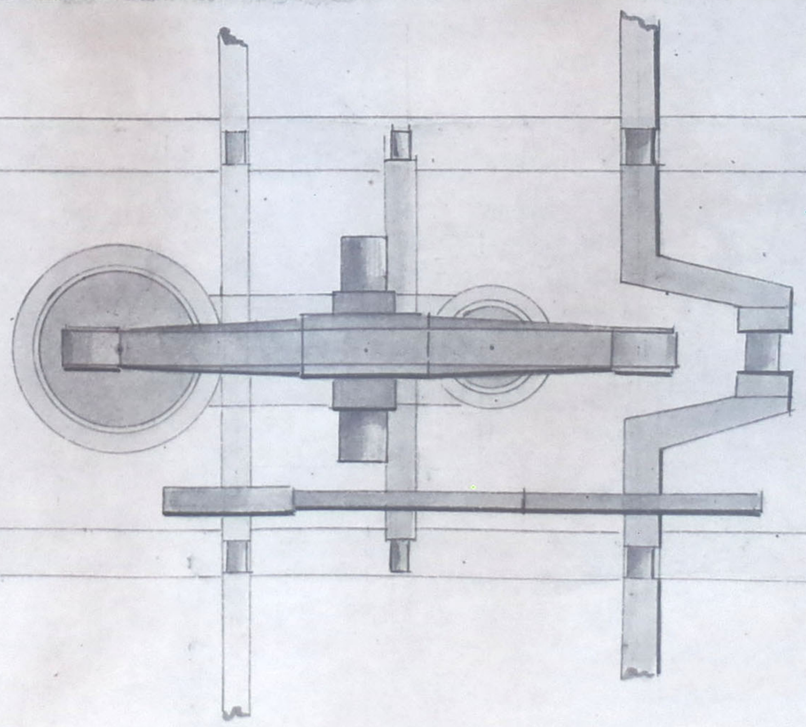
Drawing 2



Drawing 3



Boiler



Boiler

Drawing 4

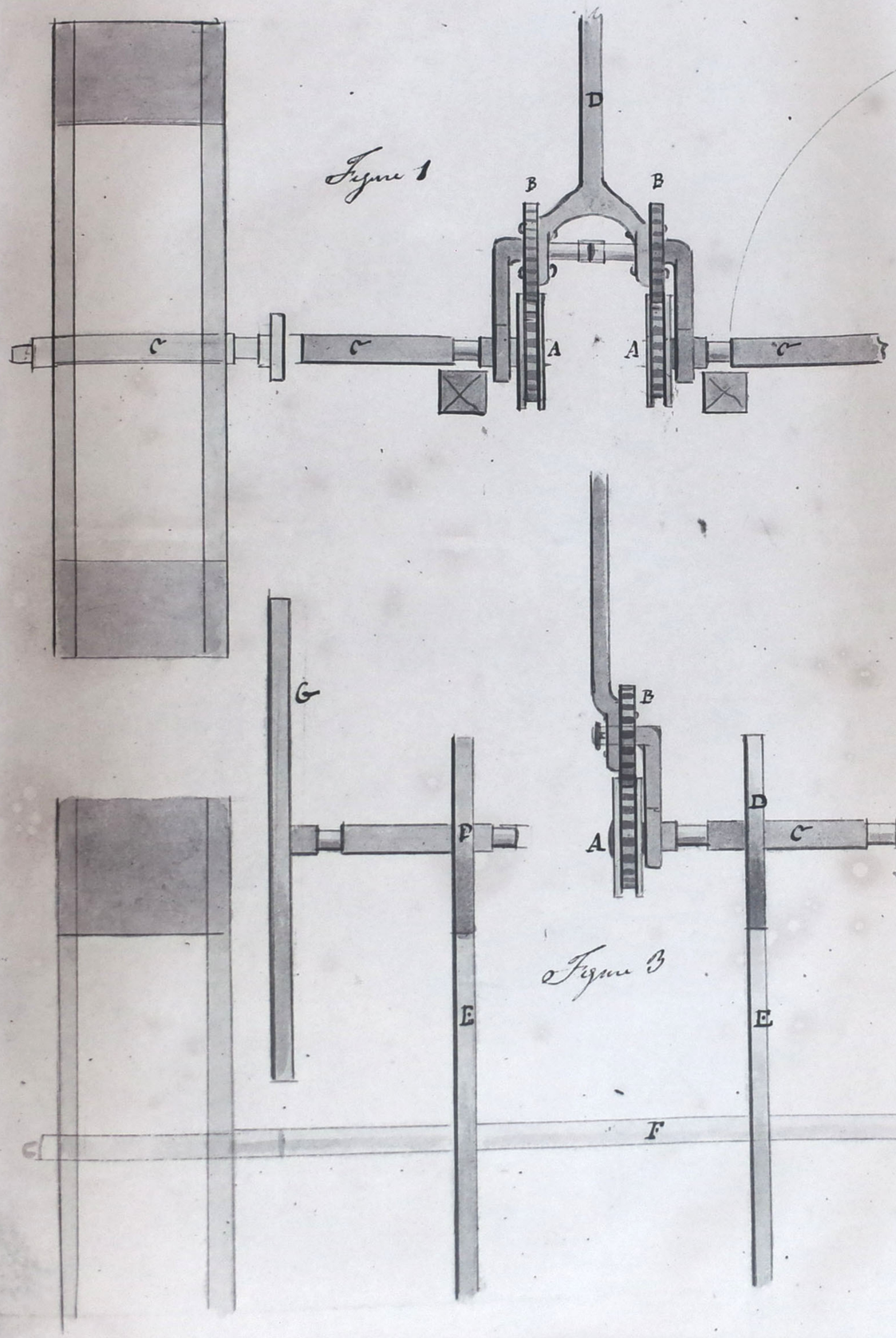


Figure 1

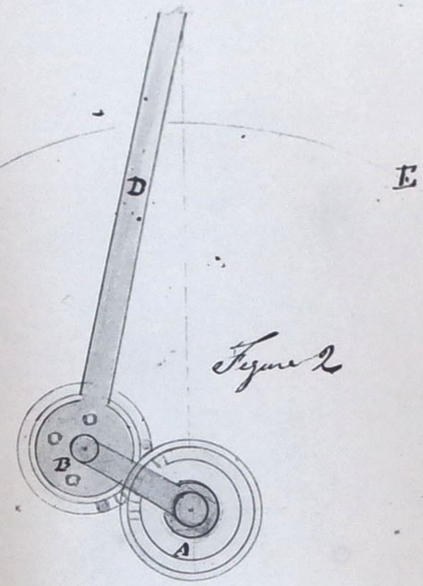


Figure 2

Figure 3

Drawing 5.

Figure 1"

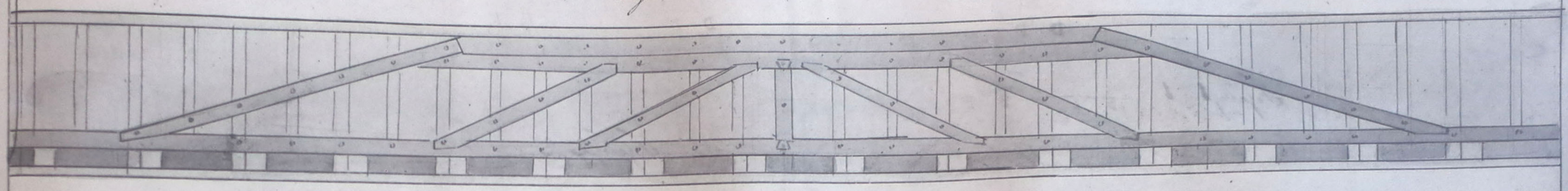


Figure 2

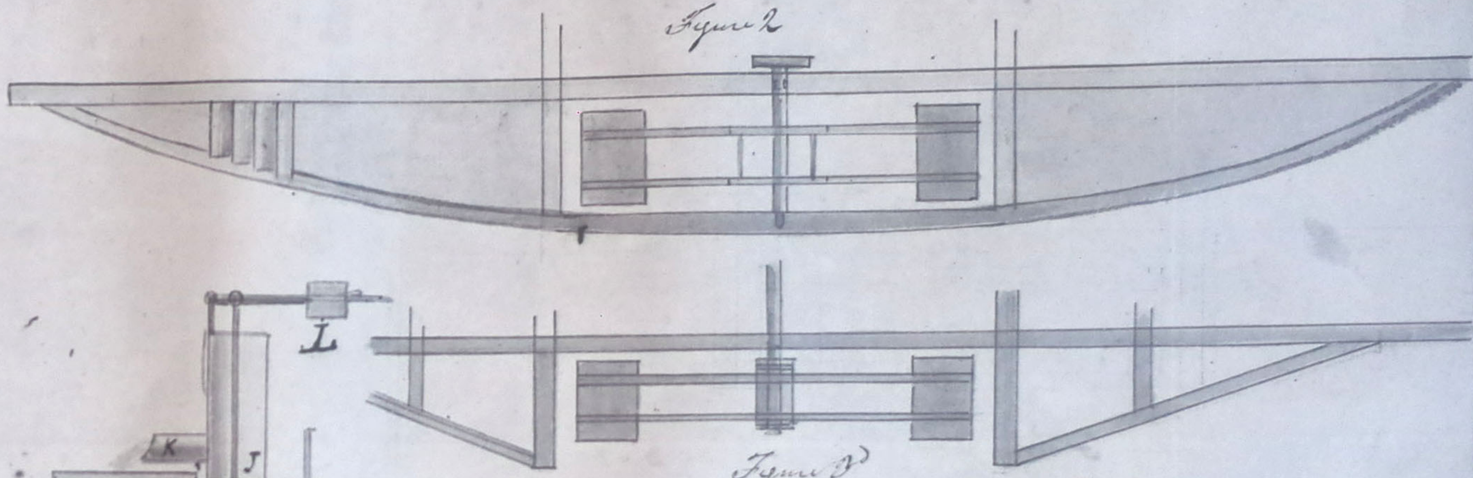
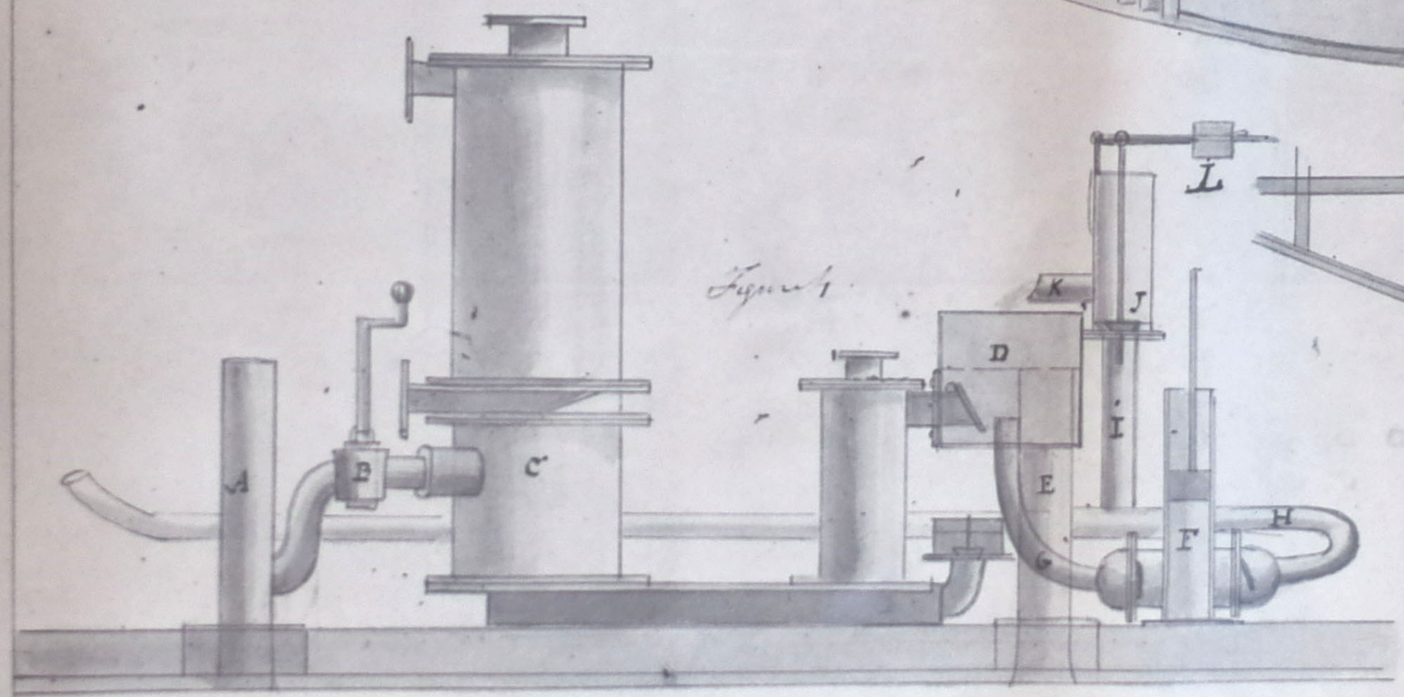
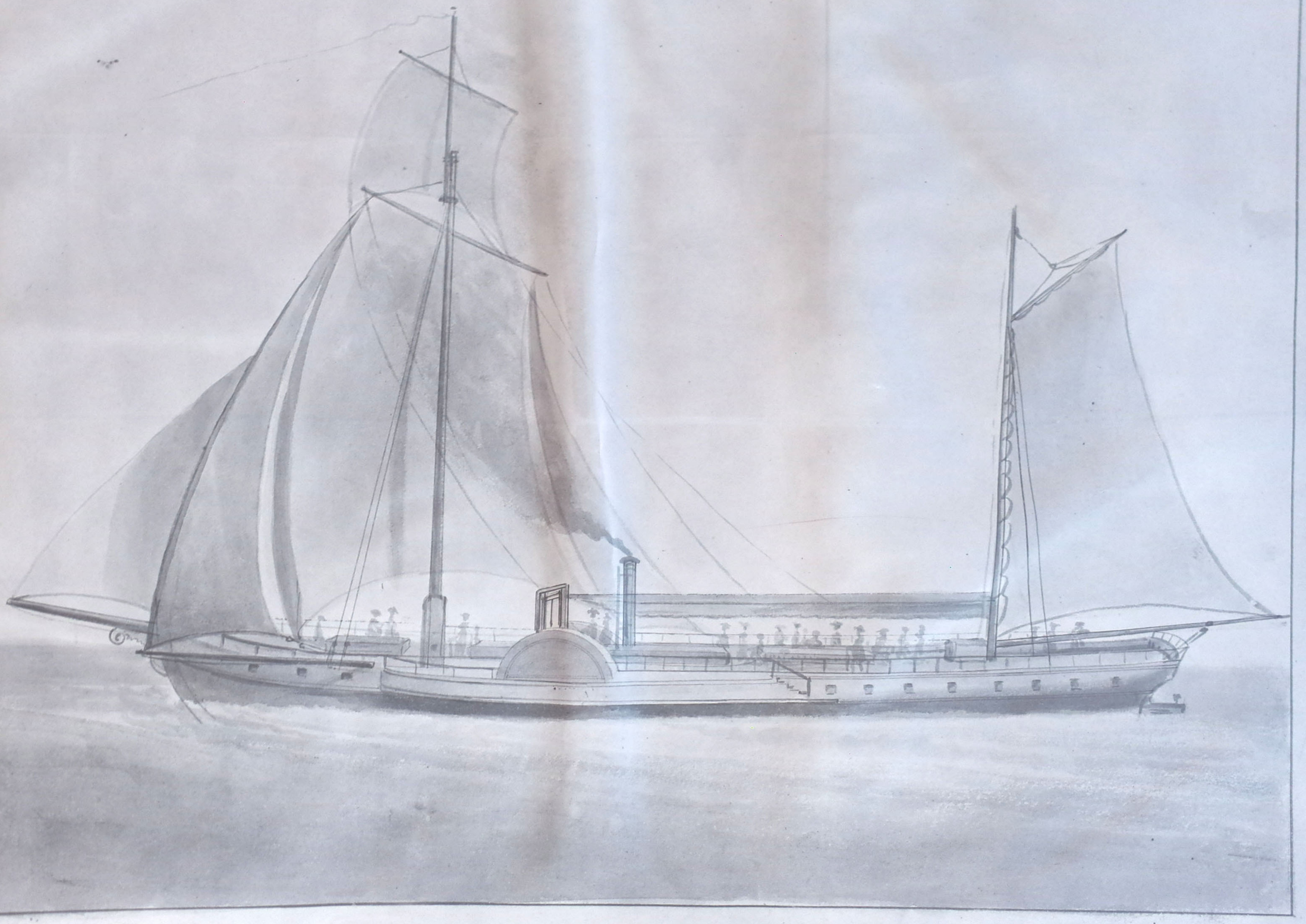


Figure 3

Figure 4



Drawing 6th



Drawing 7th

Fig. 1

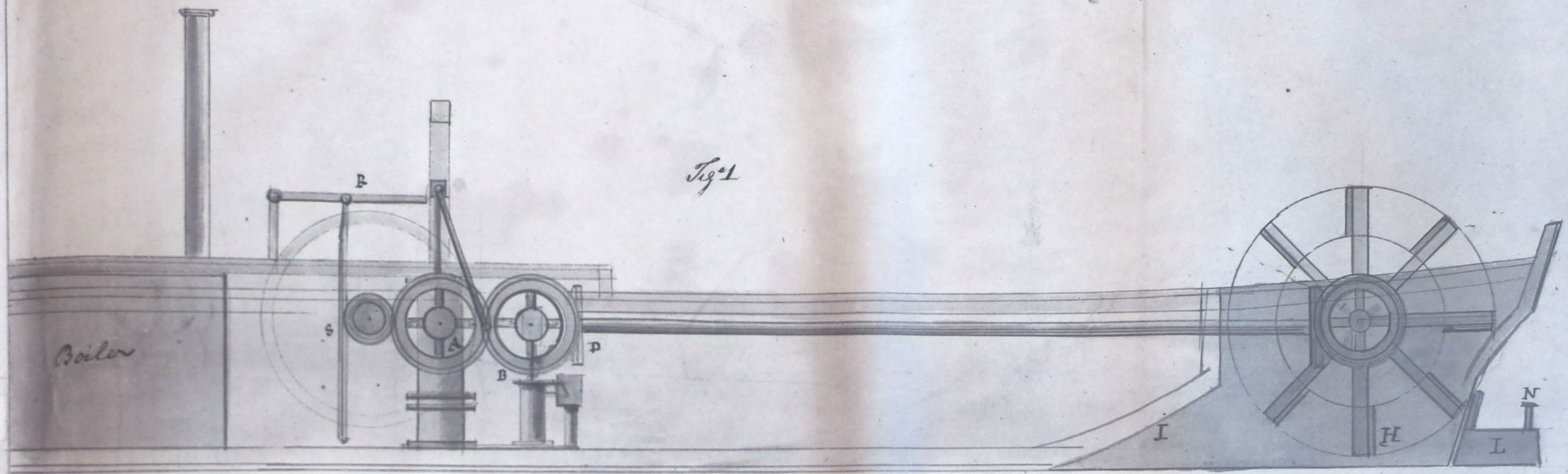


Figure 2

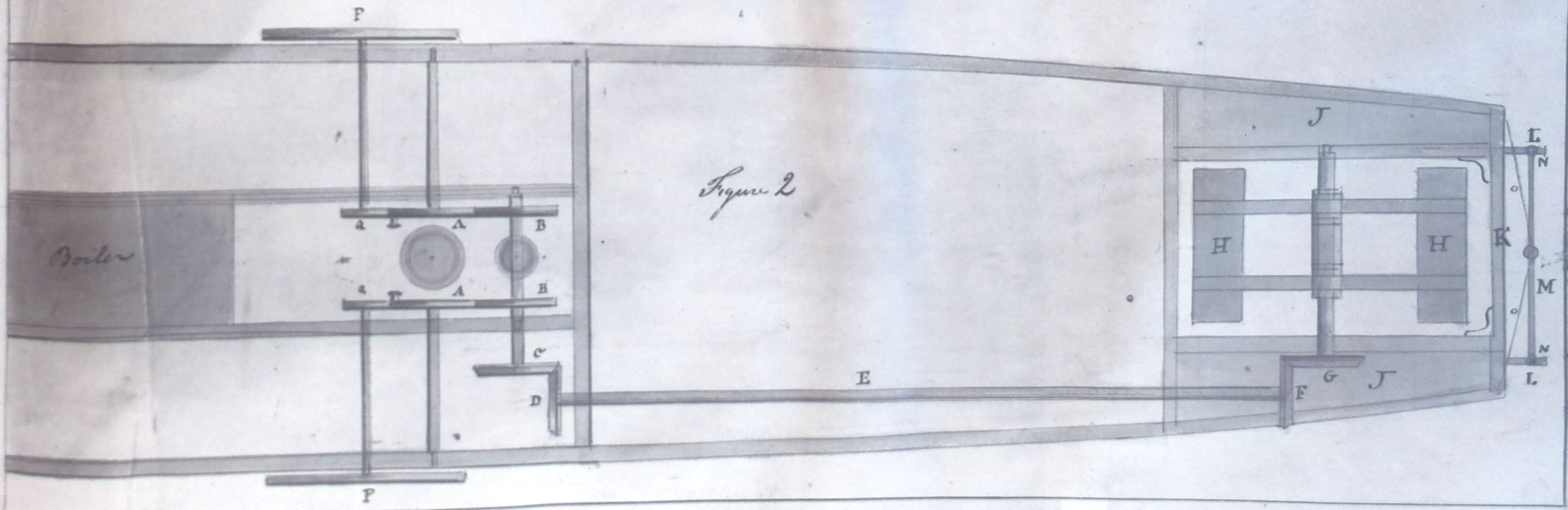
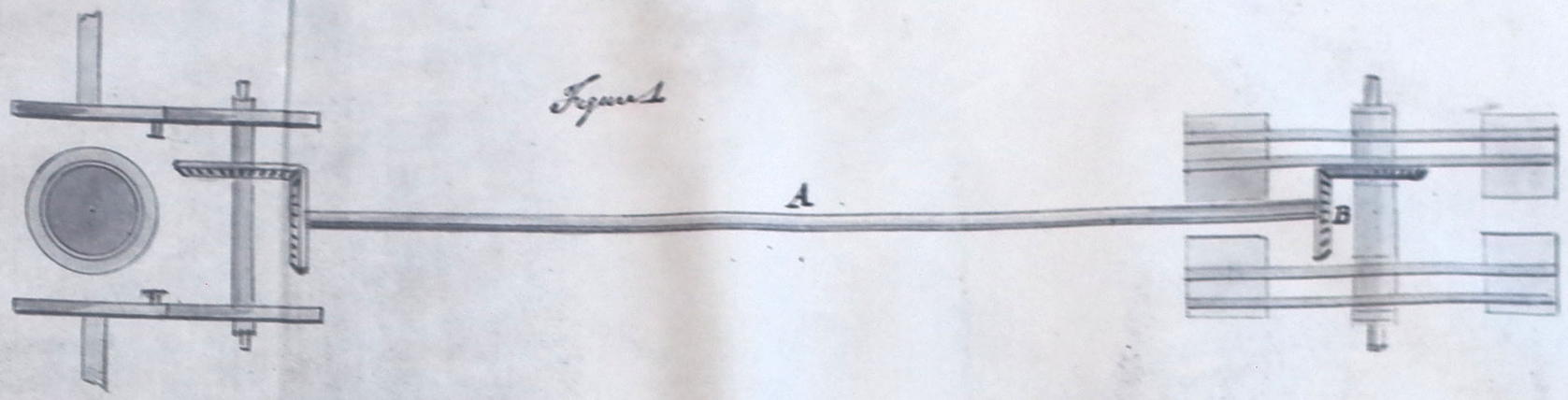


Planche 8e

Figure 1



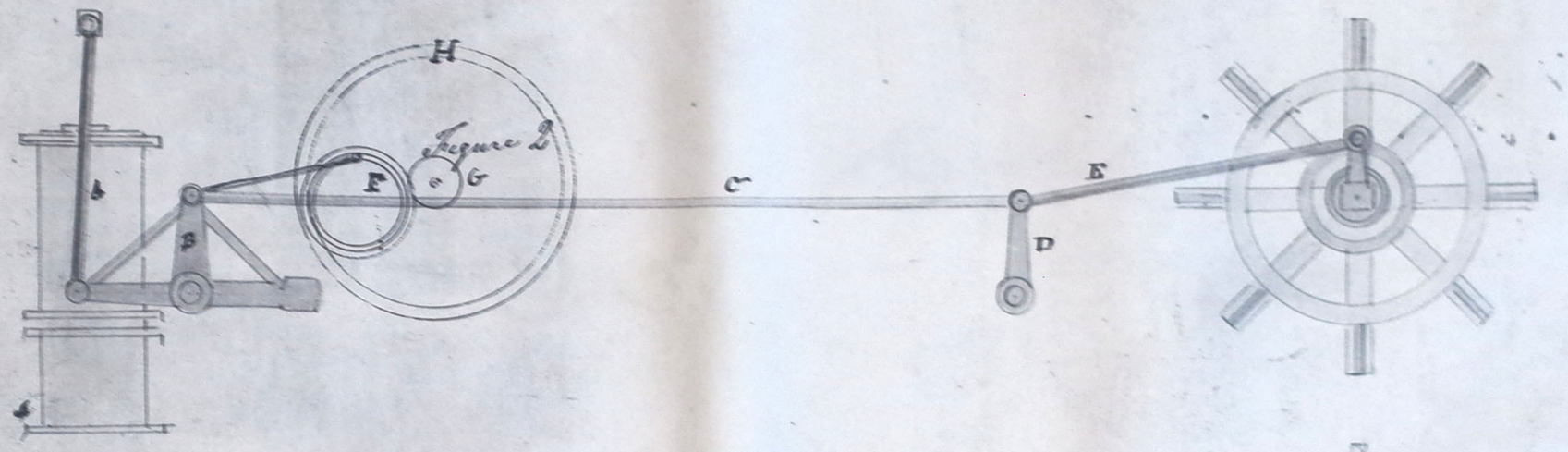


Figure 3

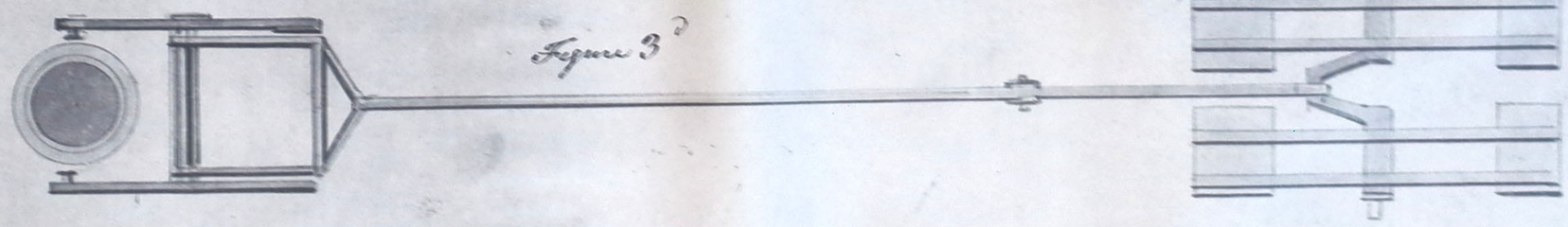


Figure 4