J. F. METTEN.

STEAM POWER CONTROL.

APPLICATION FILED APR. 22, 1913.

1,127,484.

Patented Feb. 9, 1915.

5 SHEETS—SHEET 1.

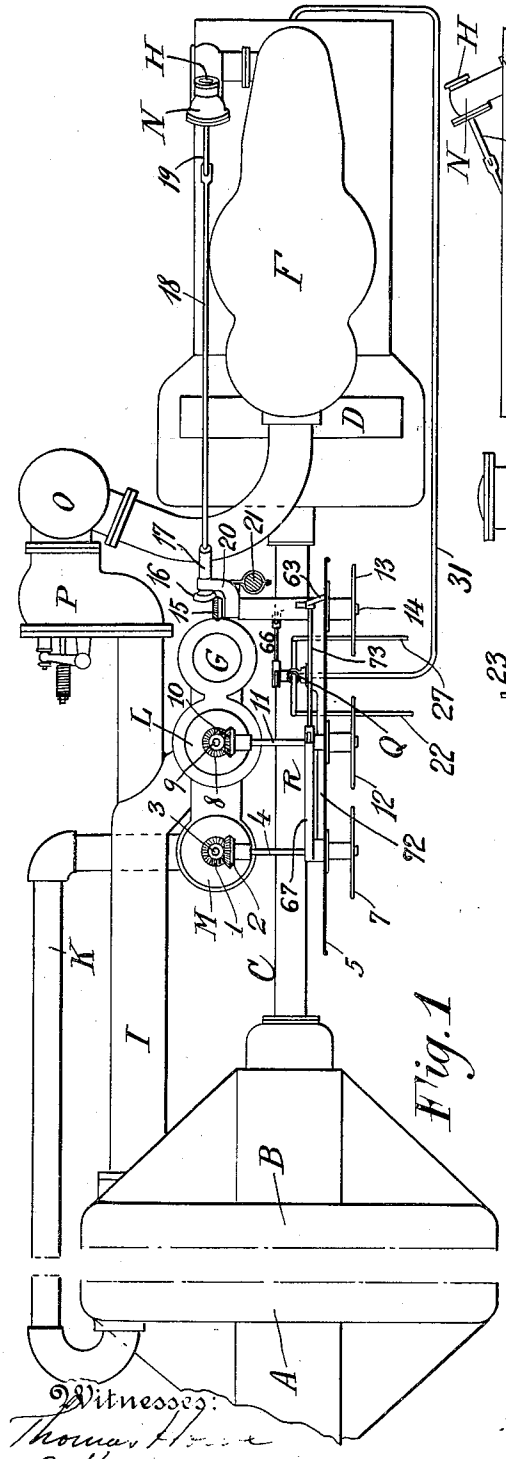


Fig. 1

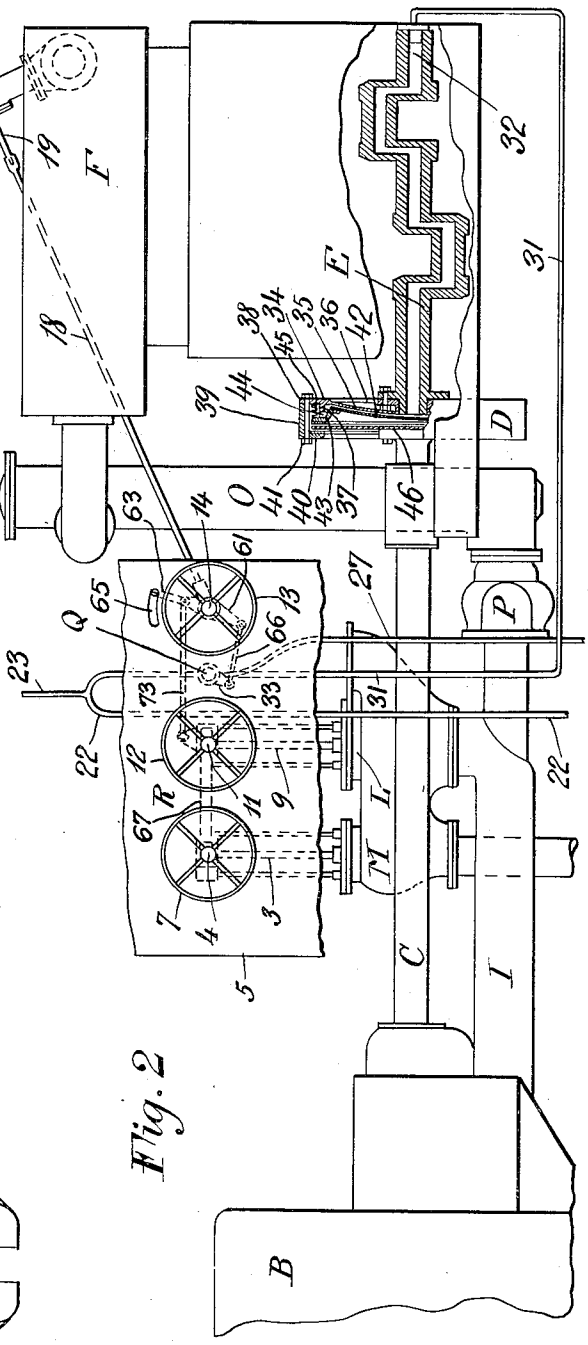


Fig. 2

Witnesses:
Thomas Howe
J. Konigsberg.

John F. Metten Inventor
By his Attorneys
Edwards, Sager & Wooster.

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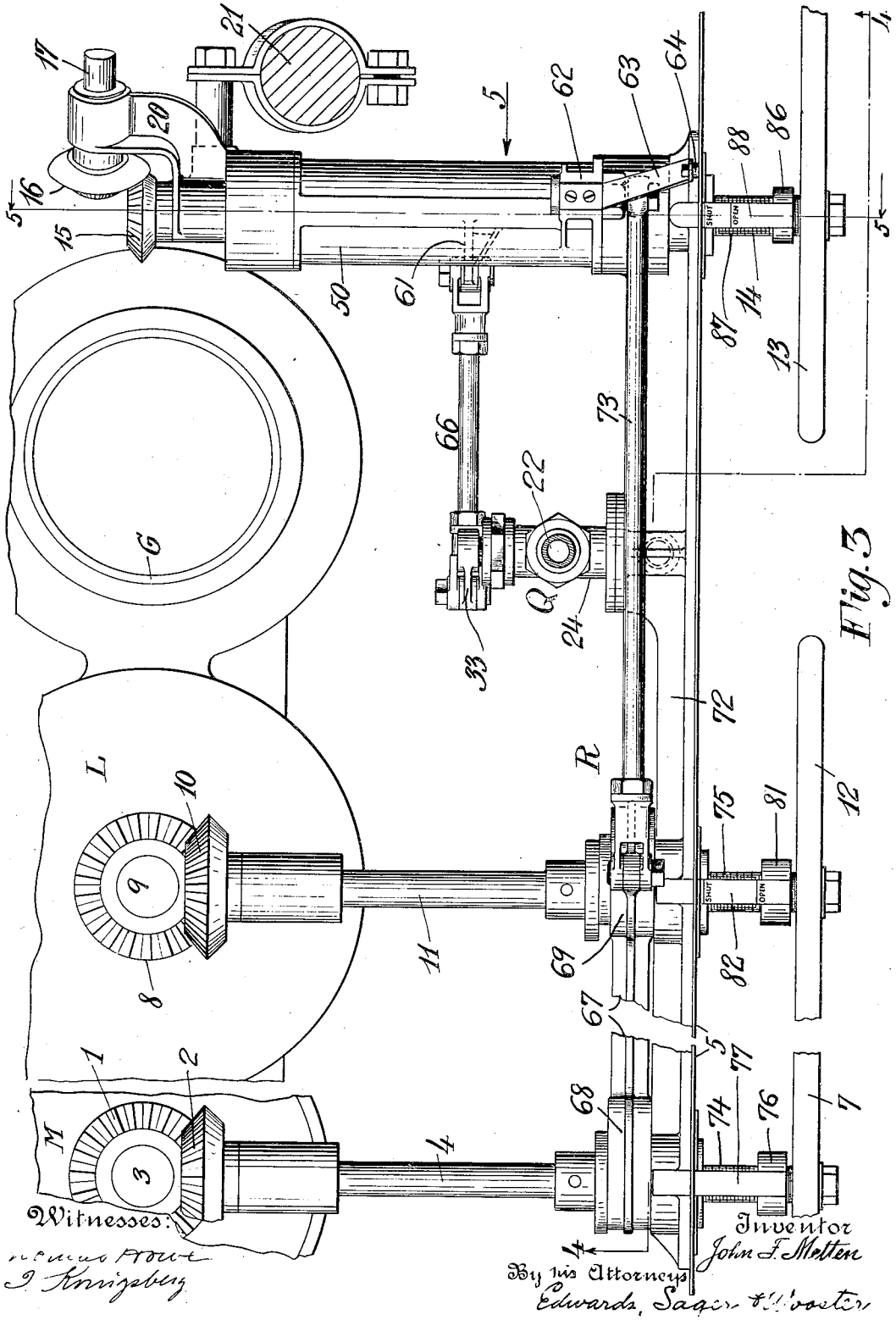


Fig. 3

Witnesses:

Inventor
John F. Metten

By his Attorneys
Edwards, Sager & Webster

J. F. METTEN.

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5 SHEETS-SHEET 3.

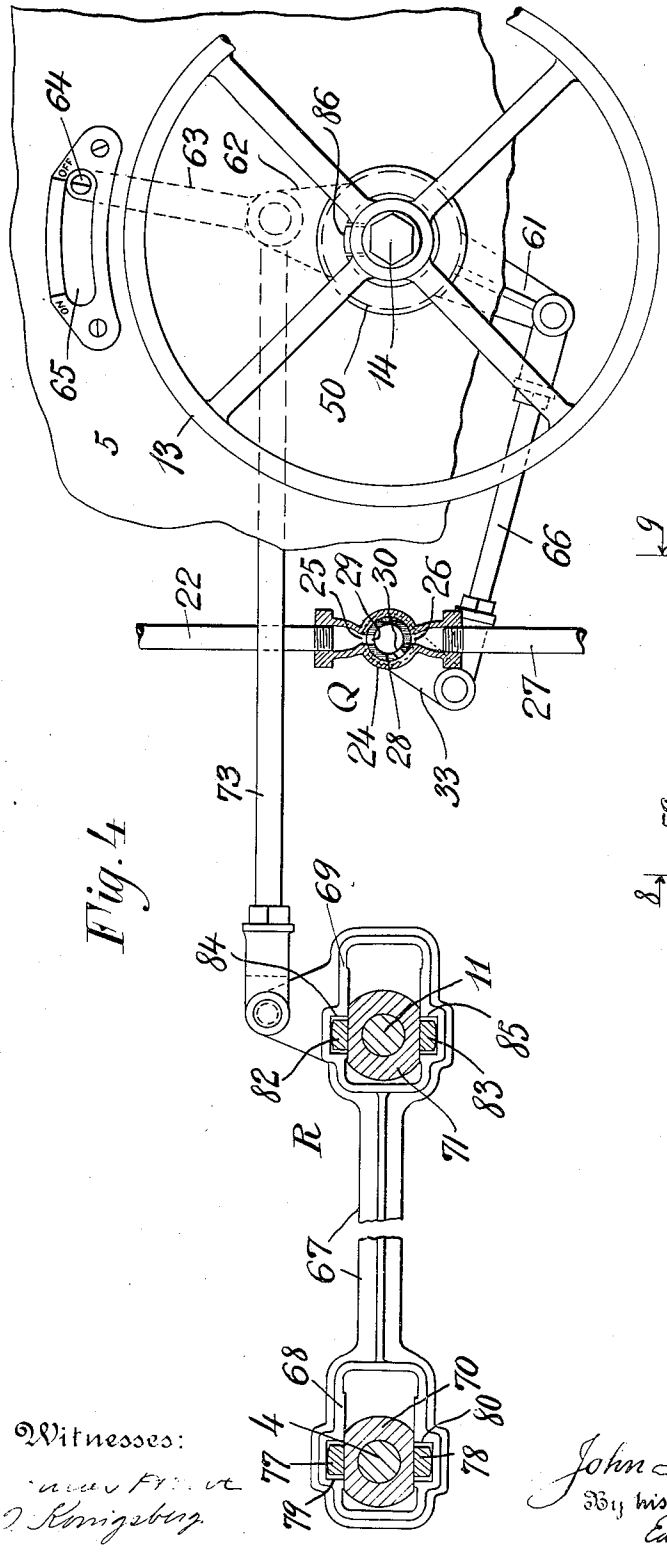


Fig. 4

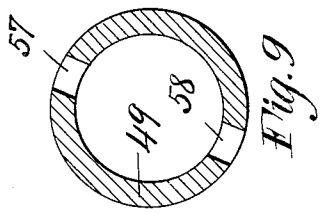


Fig. 9

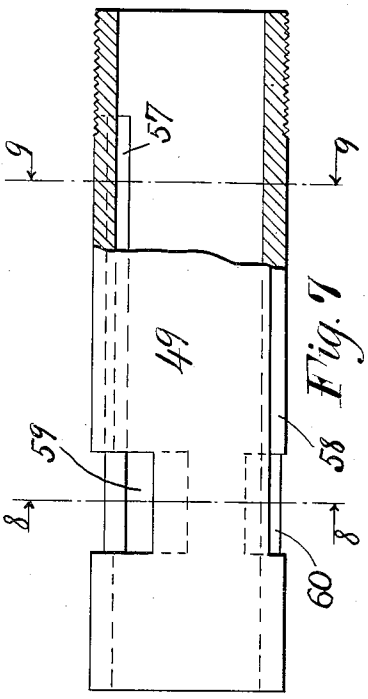


Fig. 7

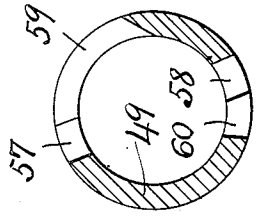


Fig. 8

Witnesses:

J. Königsberg.

John F. Metten Inventor

By his Attorneys

Edwards, Sanders & Wilson

J. F. METTEN.

STEAM POWER CONTROL.

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5 SHEETS—SHEET 4.

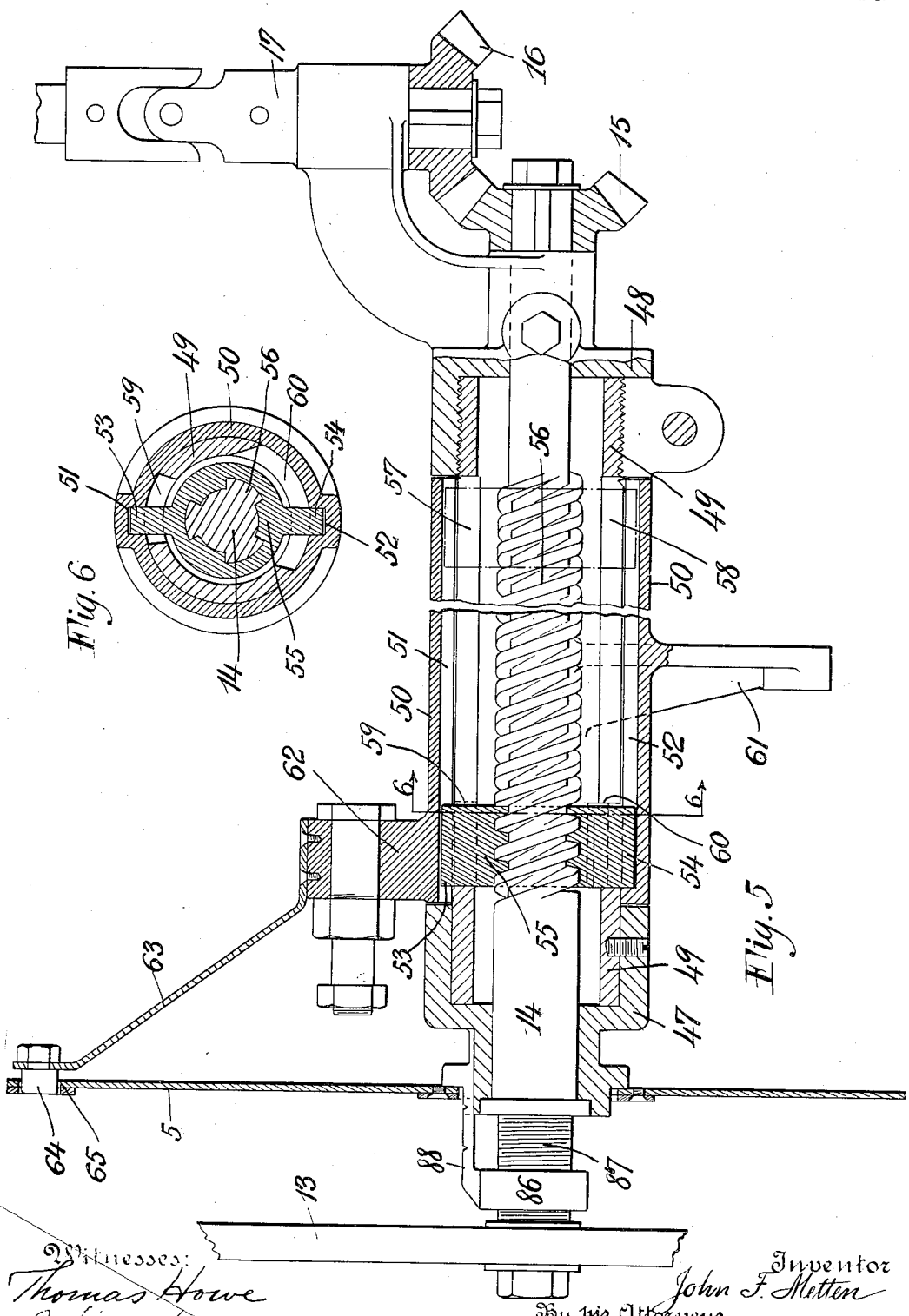


Fig. 6

Fig. 5

Witnesses:
Thomas Howe
J. Konigsberg

Inventor
John F. Metten
By his Attorneys
Edwards, Sager & Wooster

J. F. METTEN.

STEAM POWER CONTROL.

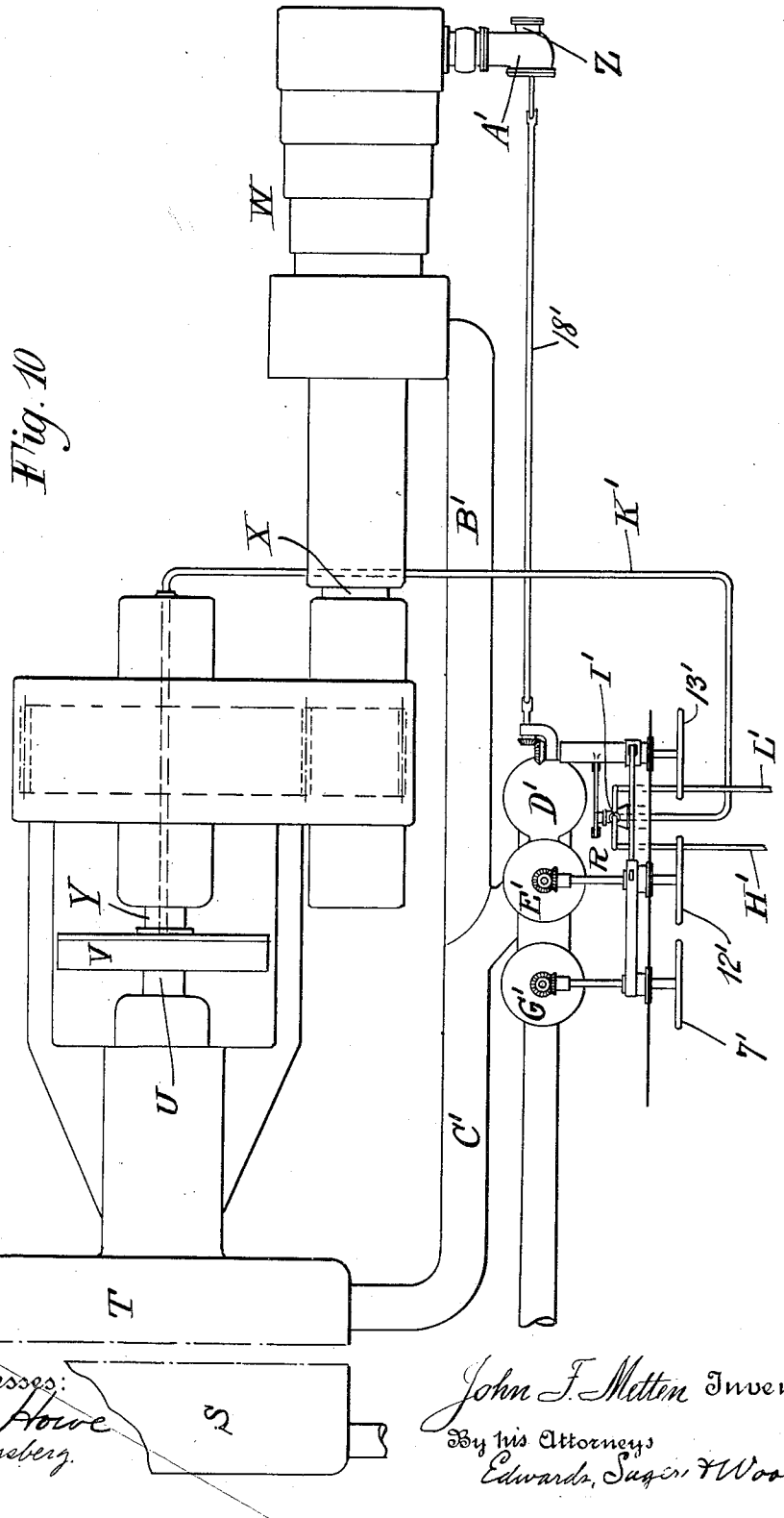
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5 SHEETS—SHEET 5.

Fig. 10



Witnesses:
Thomas Howe
I. Konigsberg.

John F. Metten Inventor
By his Attorneys
Edwards, Sager & Wooster.

UNITED STATES PATENT OFFICE.

JOHN F. METTEN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE WILLIAM CRAMP & SONS SHIP & ENGINE BUILDING COMPANY, A CORPORATION OF PENNSYLVANIA.

STEAM-POWER CONTROL.

1,127,484. Specification of Letters Patent. Patented Feb. 9, 1915.

Application filed April 22, 1913. Serial No. 762,904.

To all whom it may concern:

Be it known that I, JOHN F. METTEN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Power Control, of which the following is a full, clear, and exact specification.

This invention relates to means for controlling the application of steam power to driving purposes.

The invention is particularly useful in connection with the propulsion of ships but may have other applications.

In the propulsion of vessels by steam it is desirable to run sometimes at full speed and sometimes at cruising speed and, under different circumstances, it may be necessary or desirable to steam at three or four or a greater number of different speeds. To this end the steam prime movers of the vessel may be divided into different parts which may be used singly or in combination to effect the different speeds at which the vessel is to be driven.

The main object of the present invention is to provide steam units and means for controlling and connecting the same, combined therewith, so that the different speeds desired may be efficiently secured, danger of injury to the apparatus avoided, and proper manipulation of the apparatus insured.

Other and ancillary objects of the invention will appear hereinafter.

In the accompanying drawings, which illustrate the invention, Figure 1 is a top plan view of prime movers related according to the present invention; Fig. 2 is a side elevation of the apparatus of Fig. 1; Fig. 3 is a top plan view on an enlarged scale of prime mover control mechanism; Fig. 4 is a partial section and partial elevation on the line 4—4 of Fig. 3 looking in the direction of the arrows; Fig. 5 is a section on the line 5—5 of Fig. 3 looking in the direction of the arrow; Fig. 6 is a section on the line 6—6 of Fig. 5 looking in the direction of the arrows; Fig. 7 is a view partly in elevation and partly in section of a portion of the apparatus shown in Figs. 5 and 6; Fig. 8 is a section on the line 8—8 of Fig. 7 looking in the direction of the arrows; Fig. 9 is a section on the line 9—9 of Fig. 7 looking in the direction of the arrows; and Fig. 10 is a top plan view of a modified arrangement of prime movers and controlling means according to the present invention.

Referring to the drawings and first to Figs. 1 to 9, inclusive, an astern turbine A and an ahead turbine B are mounted upon a propeller shaft C. This propeller shaft is connected by means of a clutch D with the shaft E of a reciprocating engine F. High pressure steam from the boiler is supplied through the pipe G to the turbines and to the reciprocating engine through a pipe connecting at H. Steam is supplied to the ahead turbine through the pipe I, to the astern turbine through the pipe K and the admission of steam to these pipes respectively is controlled by the ahead valve L and the astern valve M. The admission of steam to the reciprocating engine is controlled by the valve N. The reciprocating engine exhausts through the pipe O and check valve P into the supply pipe I for the ahead turbine. The check valve permits the steam to pass from the reciprocating engine to the turbine, but prevents the reverse flow. The exhaust from the turbines may be discharged into an exhaust belt in communication with a condenser as is well known. The fluid for operating the clutch is controlled by a cock Q and apparatus R is provided for operating the steam valves and cock and securing this operating in proper relation. The reciprocating engine is suitably designed to drive the propeller shaft at cruising speeds and effect such driving by means of the clutch D which serves to detachably connect it with a propeller shaft C. The exhaust from the reciprocating engine is conducted through the ahead turbine so that the remaining energy of the steam may be utilized in the turbine to aid in driving the propeller shaft. When it is desired to drive the ship astern the valve N controlling the supply of steam to the reciprocating engine is closed, the clutch is disconnected and the valve M is opened; when high pressure steam is then supplied to the astern turbine which then drives the propeller shaft in the reverse direction and the vessel is propelled astern. Should it be desired to drive the vessel forward at full speed, the clutch D is disconnected and the valve N closed. Also the valve M is closed. The valve L is opened, however, and the high pressure steam is supplied directly to the ahead turbine which exhausts into a con-

denser as before described. The ship is then propelled at full speed ahead. The valve M is operated by means of beveled gears 1 and 2, one of which is fixed on the valve stem 3 and the other upon a rod 4 which extends through the gage-board 5, on the outside of which it has secured to its end a hand wheel 7. It will be apparent that by turning the hand wheel in one direction or the other the valve will be moved to open or close it. Similarly the valve L is operated by a beveled gear 8 on the end of its stem 9, which engages a beveled gear 10 upon the rod 11 operated by the hand wheel 12. The valve N for controlling the admission of steam to the reciprocating engine is operated by the hand wheel 13 fixed on the rod 14, to the end of which is secured a beveled gear 15 meshing with a beveled gear 16 which is secured on the end of a shaft section 17. This shaft section 17 is connected by means of a universal joint with a rod 18 and this in turn is connected by a universal joint with the stem 19 of the valve N. It will be apparent that upon turning the hand wheel 13 in one direction or the other, the valve N will be moved to open or close the steam passage which it controls. Bearings for the shaft 14 and the shaft section 17 are provided in a bracket 20 which is supported on the post or stanchion 21. The fluid pressure for operating the clutch is obtained from a source of oil or other suitable fluid under pressure which is connected to the pipe 27. The discharge pipe 22 is carried up to a sufficient height to prevent any of the operating fluid draining out of the clutch, except that which is forcibly expelled by the retraction of the clutch diaphragm. An air pipe 23 is connected at the highest point of pipe 22, to break the siphon formed by this loop. The cock Q comprises a casing 24 having a port 26, with which the fluid pressure source is connected and the port 25 which is connected with the discharge pipe 22. Fitted within the casing is a sleeve 28 having ports 29 and 30, the interior of the sleeve being connected with the pipe 31 leading to the clutch through the axial hole 32 in the engine crank shaft. Fitted to the sleeve 28 is a crank arm 33 and by turning this arm the ports 30 and 26 may be brought into registry when pressure will be applied to the clutch or the ports 29 and 25 may be brought into registry as shown when the pressure source will be cut off and the clutch will be connected with the discharge pipe and its pressure relieved. The clutch may comprise a circular frame or head 34 bolted to a flange on the engine shaft. This frame or head has a concave web 35 and ribs as 36 may extend from the outer end of this web to the central hub or flange secured to the engine shaft. At the outer edge of the web 35 a longitudinal flange 37 extends inwardly. Also, from the outer edge of the concave web a radial flange 38 extends to the outer edge of the clutch. To this flange is secured a gib which gib comprises a longitudinal portion 39 and a radially extending flange or ring 40, the gib being bolted to the head or frame by bolts 41. Within the frame or head and the gib is a diaphragm plate 42 of boiler plate or other suitable material and at the outer edge of this plate is secured a diaphragm ring 43 in such manner that the joint is water and oil tight. Secured to the diaphragm ring 43 are projections or lugs 44 which extend into guiding grooves formed in the longitudinal flange 37. Secured to the outer edge of the diaphragm ring 43 and extending entirely around the same is an expansion ring 45 of wrought steel. This expansion ring is fluted or corrugated as shown so that it may be extended axially and possess resilience so that when released it will resume its original condition. One edge of this expansion ring is secured to the head 34 while the other edge is secured to the diaphragm, the two edges of the expansion ring being so secured about their entire circumference that the joints are fluid-tight. Between the gib ring and the diaphragm ring 43 is interposed a disk 46 which is secured to the shaft which is to be connected to the crank shaft of the engine. This disk may be made of saw steel and while of sufficient strength to transmit the power desired, may be made flexible so as to compensate for differences in alinement between the connecting shafts or for other reasons. Of course, engaging faces may be supplied with any suitable facing material. If now fluid under sufficient pressure be supplied to the fluid-tight chamber inclosed by the expansion ring, the diaphragm ring, the diaphragm and the frame or head, the expansion ring will be extended and the disk will be frictionally gripped between the gib ring and the diaphragm ring so that driving connection will be established. If the pressure in the clutch is released the expansion ring will retract the diaphragm ring and the driving connection will be released.

The reciprocating engine being adapted to drive the propeller shaft at low speeds ahead for cruising, the astern turbine being adapted to drive the propeller shaft to move the vessel astern and the ahead turbine being adapted to drive the vessel ahead at full speed when supplied with high pressure steam, the steam should be shut off from the reciprocating engine and the clutch disconnected whenever high pressure steam is supplied to either the ahead or astern turbines and, on the other hand, high pressure steam should be cut off from both of the turbines and the clutch should be connected whenever

high pressure steam is supplied to the reciprocating engine. This operation and manipulation of the apparatus is insured by means which will now be described.

The shaft 14 for operating the valve controlling the steam to the engine is journaled in the fixed caps 47 and 48 within which is fixed the sleeve 49. Adapted to turn about the sleeve 49 is an outer sleeve 50. In this outer movable sleeve 50 are the opposite longitudinally extending slots 51 and 52 into which project fins 53 and 54 extending from the nut 55 which is in screw-threaded engagement with the threads 56, these being triple threads so as to secure the advantages of a steep pitch so that the nut and threads will not bind but will always be readily operable. In order that the fins from the nut may project outwardly into the grooves in the outer sleeve there are provided in the stationary sleeve 49 longitudinally extending slots 57 and 58 which are of sufficient width to permit the fins to slide therein but prevent any material rotation thereof. At one end of the slots 57 and 58 are formed enlargements 59 and 60 which extend circumferentially of the sleeve 49 and are of sufficient width to permit the fins to enter therein so that the nut may turn about its axis. The enlarged opening 60 is of sufficient extent to permit the necessary turning of the nut in the operation of the apparatus, and the enlargement 59 is made larger so that in assembling the apparatus the nut may be passed in through the opening.

Fixed to the outer sleeve 50 is a bracket 61 serving to operate the clutch cock. Also upon this sleeve is fixed a lug 62 which serves to operate an interlocking mechanism for controlling the operation of the turbines. To the lug 62 is secured an indicating arm 63 which has a stud 64 projecting through a slot 65 in the gage-board, the position of the stud at one end or the other of the slot indicating the condition of the apparatus.

The clutch cock is operated from the bracket 61 by means of a link 66 which is pivoted at its ends to the cock crank arm 33 and to the bracket 61. As the sleeve 50 is turned about its axis, the arm 61 will swing about this axis in one direction or the other and the crank arm 33 will move the internal sleeve of the cock to alternately connect the clutch with the pressure source or with the discharge pipe.

The means for securing the proper operation of the turbines in relation to the clutch and engine comprises a bar 67 having cross-heads 68 and 69 which slide upon projections 70 and 71 from the frame 72, the sliding of the bar and its cross-heads back and forth being effected by a link 73 pivoted at one end to the cross-head 69 and at the other to the lug 62. Through the projections 70 and 71 pass the rods 4 and 11 for operating the valves for the ahead and astern turbines. The rods 4 and 11 are screw-threaded at 74 and 75. Engaging with the screw-thread 74 is a nut 76 from which extend projections 77 and 78 which slide in grooves in the frame 72 and, when the cross-head 68 is in proper position, enter within the recesses 79 and 80, when the nut is driven inward by the turning of the rod 4, and are withdrawn from these recesses when the nut 76 moves outwardly. Similarly, a nut 81 is in engagement with the screw-thread 75 on the shaft 11 and has projections 82 and 83 which slide in grooves in the frame 72 and move in and out of recesses 84 and 85 in the cross-head 69 as the nut 81 moves back and forth with the turning of the shaft 11. The cross-heads 68 and 69 are held substantially stationary when the projections referred to on the nuts 76 and 81 are entered within their recesses and if the projections have been withdrawn from the cross-head recesses, and the cross-heads have been moved so that their recesses are out of register with their projections, the turning of either of the shafts 4 or 11 will be prevented by the coming of the ends of the projections against the sides of the cross-heads thereby arresting the travel of the nut and locking the shaft. The nuts with their projections as referred to afford also a means of indicating by their position whether the valves with which they are operatively connected are opened or closed and this may be emphasized by placing the word "Shut" and "Open" upon the top projections as indicated on the projection 82, the valve being shut when that word appears outside the gage-board and when the valve is open that word only will be visible. A similar indicator is the nut 86 upon the screw-threaded portion 87 of the shaft 14, this nut having the projection 88 with the indications of "Shut" and "Open" upon it which moves back and forth through the gage-board as the shaft 14 is turned in one direction or the other. It is to be understood that the pitches of the screws 74, 75 and 87 are such that the projections on the nuts 76 and 81 will enter within the recesses sufficiently to lock the cross-heads when their respective valves are open and will be withdrawn from the recesses when the shafts 4 and 11 have been turned sufficiently to shut these valves, and the nut 86 will move back and forth to effect the desired indications while the shaft 14 is moved sufficiently to effect the opening and closing of the engine valve as before referred to. With the proportions shown the pitch of the thread 87 must be much less than that of the thread 56 as the movement of the nut 86 is much less than that of the nut 55.

In the operation of the apparatus, if it be desired to run at cruising speeds, the hand wheel 13 is turned in the direction to open the valve N to admit steam to the reciprocating engine. If the cock Q is so positioned that the source of fluid pressure is connected with the clutch and the clutch consequently in connecting condition, the fins on the nut 55 will be in line with the slots 57 and 58 in the stationary sleeve 49. As the shaft 14 is then turned to open the valve N, the fins will enter the slots 57 and 58 thus locking the outer movable sleeve 50 to the inner stationary sleeve 49 so that the clutch cock is locked in position. The turning of the shaft 14 may be continued until the valve N is fully opened and during this time the fins of the nut 55 are within the slots in the stationary sleeve and project into the grooves in the outer sleeve 50 so that the locking of the sleeve 50 against movement is maintained throughout this motion. The engine valve being open and the nut 55 at the inner end of its travel, the valve N can be closed by turning the hand wheel 13 and shaft 14 in the opposite direction when the nut will travel outwardly until it reaches the end of the opening in the fixed sleeve 49. The fins of the nut having come against the ends of these openings the nut cannot advance farther and, therefore, will turn with the shaft 14 until it comes against the side of the opening 60. In thus turning the nut will carry the outer sleeve 50 with it, the bracket 61 being swung will cause the cock to be turned so that the fluid pressure source is cut off from the clutch and the clutch is connected with the discharge pipe thereby releasing it. With the apparatus in the position as just indicated, if it be desired to again turn steam into the reciprocating engine, the wheel 13 will be turned in the reverse direction from that in which it moved in opening the valve. The fins of the nut 55 fitting closely within the openings in which they are located, the nut will be unable to travel along the shaft 14 and will consequently turn with it until it comes into alinement with the slots 57 and 58 in the stationary sleeve when it can again travel along the shaft 14 while the engine valve is being opened as before described. This turning of the nut with the shaft will operate the clutch cock to disconnect the clutch from the discharge and connect it with the pressure source. In turning the external sleeve 50 through the instrumentality of the nut 55, the cross-heads 68 and 69 will be slid back and forth as before referred to and the recesses 79, 80, 84 and 85 will be moved into and out of registry with the projections 77, 78, 82 and 83. These projections and recesses are only in registry when the sleeve 50 has been turned so that the clutch cock is turned to cut off pressure from the clutch and establish connection with the discharge pipe. If, therefore, the clutch is released and the steam engine valve is shut, either of the hand wheels 7 or 12 may be turned to open the valve of the astern or ahead turbine. This operation, however, causes the projections to enter the recesses in the cross-head corresponding to the valve operated. This locks the cross-head in position and prevents the movement of the exterior sleeve 50 or the shaft 14 so that the sleeve 50 cannot move to turn the clutch cock to apply pressure to the clutch, nor can the shaft 14 be turned to open the engine valve. Upon turning the hand wheel to close the valve, the projections will be withdrawn from the recesses in the cross-head and, the projections being withdrawn from the recesses in both cross-heads, the hand wheel 13 may be turned and pressure applied to the clutch and the engine valve opened. This movement, however, operates to throw the recesses in the cross-heads out of alinement with the projections 77, 78, 82 and 83, so that neither of the shafts 4 or 11 can be turned to open the valves of either the ahead or astern turbines. This is because the ends of the projection will come against the sides of the cross-head and arrest their travel thereby locking the shafts 4 and 11.

From the foregoing, it will appear that the clutch cock and the valve for the engine are operated by a common means which effects the engagement of the clutch before the engine valve has opened to any considerable extent and the clutch is maintained engaged during all the time that the engine valve is open and is only disengaged when the engine valve has become substantially closed; further, upon the turning of the clutch cock in the position to apply pressure to the clutch, and the opening of the engine valve, the operating means for the turbine valves will be locked to prevent opening of the valves and it is only when the clutch cock has been turned to release pressure from the clutch and the engine valve has been closed that the apparatus is moved into a position where either or both of the turbine valves may be operated. Upon the operation of either of these valves the apparatus will be so locked that it will be impossible to move the clutch cock to apply pressure to the clutch or to open the steam engine valve. When both the turbine valves are closed, however, the apparatus may be moved to apply pressure to the clutch and open the steam engine valve.

Referring to Fig. 10, an astern turbine S and a turbine T for full speed ahead are mounted upon the propeller shaft U. A clutch V serves to connect and disconnect the turbine W with the propeller shaft. The turbine W is for driving the vessel at low or cruising speed. Preferably, the tur-

bine W runs at such a high speed that in order to reduce the speed of the propeller shaft the turbine is connected therewith through speed reducing gearing such as a small spur gear on the turbine shaft X engaging with a relatively larger spur gear on the shaft Y. High pressure steam from the boiler is supplied to the turbine W through the pipe Z controlled by the valve A'. This turbine exhausts through the pipe B' whence it passes into the steam supply pipe C' for the full speed ahead turbine T and the energy remaining in the steam after it passes through the turbine W is thus utilized in assisting the driving of the propeller shaft. High pressure steam from the boiler is supplied through the pipe D' and its admission to the ahead turbine pipe C' is controlled by the valve E', and its admission to the astern turbine pipe F' is controlled by the valve G'. The pipe L' is connected with a source of fluid pressure which is controlled by a cock I' which serves to alternately connect a pipe K' leading to the clutch with the pressure source and with the discharge pipe H'. The pipe K' leads to the end of the gear shaft Y whence it connects through an axial hole in this shaft with the interior of the clutch V. The clutch V may be of the construction as shown in Fig. 2. The admission of high pressure steam to the astern turbine, the ahead turbine and the cruising turbine are controlled respectively by the hand wheels 7', 12' and 13', also the clutch cock I' is controlled by the wheel 13' by apparatus the same as previously described as operated by the hand wheel 13, the cruising turbine valve A' being operated through the rod 18' having universal joints at its ends and being similar in construction and operation to the rod 18 of previous figures. Further, the operating means of the turbine valves G' and E' are interlocked with the operating means for the cruising turbine valve and the clutch cock, by means similar to that shown for interlocking the engine valve N and clutch cock Q with the turbine valves L and M in the apparatus of Figs. 1 and 2. It will thus appear that if the steam is shut off from all of the turbines of the apparatus of Fig. 10, the wheel 13' may be turned to open the turbine valve A' to admit steam to the cruising turbine W. Before the valve has opened to admit a sufficient amount of steam to start the turbine, the clutch cock has been moved to connect the clutch with the pressure source and so connect the cruising turbine with the propeller shaft. The opening of the valve A' continuing, this turbine will start up, driving the vessel ahead at cruising speed, the propelling effort being assisted by the power exerted in the ahead turbine T' by reason of the exhaust steam from the turbine W passing therethrough. With the cruising turbine thus in operation the valves G' and E' are locked against opening. To drive the vessel astern or at full speed ahead, the wheel 13' is turned to shut off the steam from the turbine W and at the last end of the movement of the wheel 13' in this operation the clutch cock is turned to connect the clutch with the discharge pipe, whereupon the clutch is released and the driving connection between the propeller shaft and the turbine W is broken. Either of the valves G' or E' may now be operated to send the vessel astern or full speed ahead, as desired, and when either of these valves has been opened the clutch cock and valve A' will be locked against movement to supply pressure to the clutch or steam to the cruising turbine.

The apparatus described is such as used on twin screw vessels and, when so used, an equipment as described would be provided for each of the two propeller shafts. A description of the application of the equipment to one shaft, however, as has been done, is sufficient to show how it would also be applied to the other shaft in a twin screw installation. It is, therefore, unnecessary to lengthen this specification by describing the application of the equipment to each of the two shafts. Also, it will be understood by those skilled in the art that the invention herein may be applied to not only one propeller shaft or twin screw propeller shafts, but to any number of shafts.

While the invention has been illustrated in what are considered its best applications, it is to be understood that it may have other applications and is not, therefore, limited to the structures shown in the drawings.

Having thus described my invention, I declare that what I claim as new and desire to secure by Letters Patent, is:—

1. The combination with a steam operated prime mover, of fluid pressure operated means for detachably connecting said prime mover with a load, a valve for controlling the supply of steam to said prime mover, a cock or valve controlling the supply of fluid pressure to said connecting means, and a common means for operating said steam controlling valve and said fluid pressure controlling means.

2. In a propulsion means for ships, the combination with a propeller shaft, of an elastic fluid prime mover adapted to drive the ship ahead, fluid pressure operated means for detachably connecting said prime mover with said shaft, a valve controlling the supply of elastic fluid to said prime mover, a cock or valve controlling the supply of fluid pressure to said connecting means and a common means for operating said valves.

3. The combination with a steam operated

prime mover, of fluid pressure operated means for detachably connecting said prime mover with a load, a valve for controlling the supply of steam to said prime mover, a cock or valve controlling the supply of fluid pressure to said connecting means, and a common means for operating said steam controlling valve and said fluid pressure controlling means, the said connecting means being placed in connecting condition when the elastic fluid is admitted to the prime mover to operate the same and said connecting means being placed in disconnecting condition when the operating fluid is cut off from said prime mover.

4. In a propulsion means for ships, the combination with a propeller shaft, of an elastic fluid prime mover adapted to drive the ship ahead, fluid pressure operated means for detachably connecting said prime mover with said shaft, a valve controlling the supply of elastic fluid to said prime mover, a cock or valve controlling the supply of fluid pressure to said connecting means and a common means for operating said valves, the said connecting means being placed in connecting condition when the elastic fluid is admitted to the prime mover to operate the same and said connecting means being placed in disconnecting condition when the operating fluid is cut off from said prime mover.

5. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers adapted to drive the ship, fluid pressure operated means for detachably connecting certain of said prime movers with said shaft, a valve controlling the supply of fluid to a prime mover adapted to be detachably connected to said shaft, a valve or cock controlling the supply of fluid pressure to said connecting means and common means for operating said valves.

6. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers adapted to drive the ship ahead, fluid pressure operated means for detachably connecting certain of said prime movers with said shaft, a valve controlling the supply of fluid to a prime mover adapted to be detachably connected to said shaft, a valve or cock controlling the supply of fluid pressure to said connecting means and common means for operating said valves.

7. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers adapted to be connected in driving relation to said shaft to drive the ship ahead and astern, fluid pressure operated means for detachably connecting the ahead prime mover with said shaft, a valve controlling the supply of fluid to the detachably connected prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means, and common means for operating said valves.

8. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers adapted to drive the ship ahead at full and cruising speeds, fluid pressure operated means for detachably connecting the cruising prime mover with said shaft, a valve controlling the supply of fluid to the cruising prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means and a common means for operating said valves.

9. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers adapted respectively to drive the ship ahead at full and cruising speeds and to drive astern, fluid pressure operated means for detachably connecting the cruising prime mover with said shaft, a valve controlling the supply of fluid to the cruising prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means and a common means for operating said valves.

10. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers adapted to drive the ship, fluid pressure operated means for detachably connecting certain of said prime movers with said shaft, means for preventing the admission of high pressure steam to other of said prime movers when the valve to the detachably connected prime mover is open, a valve controlling the supply of elastic fluid to the detachably connected prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means and common means for operating said valves.

11. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers adapted to drive the ship, fluid pressure operated means for detachably connecting certain of said prime movers with said shaft, means for preventing the admission of high pressure steam to other of said prime movers when the detachably connected prime mover is connected with the shaft, a valve controlling the supply of elastic fluid to the detachably connected prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means and common means for operating said valves.

12. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers adapted to drive the ship ahead, fluid pressure operated means for detach-

ably connecting certain of said prime movers with said shaft, means for preventing the admission of high pressure steam to other of said prime movers when the valve to the detachably connected prime mover is open, a valve controlling the supply of elastic fluid to the detachably connected prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means and common means for operating said valves.

13. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers adapted to drive the ship ahead, fluid pressure operated means for detachably connecting certain of said prime movers with said shaft, means for preventing the admission of high pressure steam to other of said prime movers when the detachably connected prime mover is connected with the shaft, a valve controlling the supply of elastic fluid to the detachably connected prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means and common means for operating said valves.

14. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers respectively adapted to drive the ship ahead and astern, fluid pressure operated means for detachably connecting the ahead prime mover to said shaft, a valve controlling the supply of fluid to the ahead prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means, common means for operating said valves, means controlling the supply of fluid pressure to the astern prime mover and means for preventing the admission of elastic fluid to the astern prime mover when elastic fluid is admitted to the ahead prime mover to operate it.

15. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers respectively adapted to drive the ship ahead and astern, fluid pressure operated means for detachably connecting the ahead prime mover to said shaft, a valve controlling the supply of fluid to the ahead prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means, common means for operating said valves, means controlling the supply of fluid pressure to the astern prime mover and means for preventing the operation of said astern prime mover when the ahead prime mover is connected with the shaft.

16. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers respectively adapted to drive the ship ahead at full and cruising speeds, fluid pressure operated means for detachably connecting the cruising prime mover with said shaft, a valve controlling the supply of elastic fluid to the cruising prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means, common means for operating said valves, and means for preventing the admission of elastic fluid to the full speed prime mover when elastic fluid is admitted to the cruising prime mover to operate it.

17. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers respectively adapted to drive the ship ahead at full and cruising speeds, fluid pressure operated means for detachably connecting the cruising prime mover with said shaft, a valve controlling the supply of elastic fluid to the cruising prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means, common means for operating said valves, and means for preventing the admission of elastic fluid to the full speed prime mover when the cruising prime mover is connected with said shaft.

18. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers respectively adapted to drive the ship astern and at full and cruising speeds ahead, fluid pressure operated means for detachably connecting the ahead cruising prime mover with said shaft, a valve controlling the supply of elastic fluid to the ahead cruising prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means, common means for operating said valves, and means for preventing the admission of elastic fluid to the full speed ahead or the astern prime mover when elastic fluid is supplied to the ahead cruising prime mover to operate it.

19. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers respectively adapted to drive the ship astern and at full and cruising speeds ahead, fluid pressure operated means for detachably connecting the ahead cruising prime mover with said shaft, a valve controlling the supply of elastic fluid to the ahead cruising prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means, common means for operating said valves, and means for preventing the admission of elastic fluid to the ahead full speed prime mover or the astern prime mover when the cruising prime mover is connected with said shaft.

20. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers respectively adapted to drive the

ship astern and at full and cruising speeds ahead, fluid pressure operated means for detachably connecting the ahead cruising prime mover with said shaft, a valve controlling the supply of elastic fluid to the ahead cruising prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means, common means for operating said valves, and means for preventing the connection of said cruising prime mover with said shaft when elastic fluid is admitted to the ahead full speed prime mover or the astern prime mover.

21. In a propulsion means for ships, the combination with a propeller shaft, of a plurality of elastic fluid operated prime movers respectively adapted to drive the ship astern and at full and cruising speeds ahead, fluid pressure operated means for detachably connecting the ahead cruising prime mover with said shaft, a valve controlling the supply of elastic fluid to the ahead cruising prime mover, a valve or cock controlling the supply of fluid pressure to said connecting means, common means for operating said valves, and means for preventing the admission of fluid pressure to the cruising prime mover when elastic fluid is admitted to either the astern prime mover or the full speed ahead prime mover.

22. The combination with an elastic fluid turbine, of a fluid operated clutch for detachably connecting the turbine in driving relation to a load, gearing for connecting said turbine in driving relation to said load, the shafts of one of said gears having an axial duct for supplying fluid to said clutch.

23. The combination with an elastic fluid prime mover, a fluid operated clutch for detachably connecting the prime mover in driving relation to a load, gearing for connecting said prime mover in driving relation to said load, the shafts of one of said gears having an axial duct for supplying fluid to said clutch.

In testimony whereof I affix my signature, in presence of two witnesses.

JOHN F. METTEN.

Witnesses:

FRANCIS L. CRAMP,

JAMES H. KURTZ.