G. B. PETSCHE.

CORLISS VALVE GEAR.

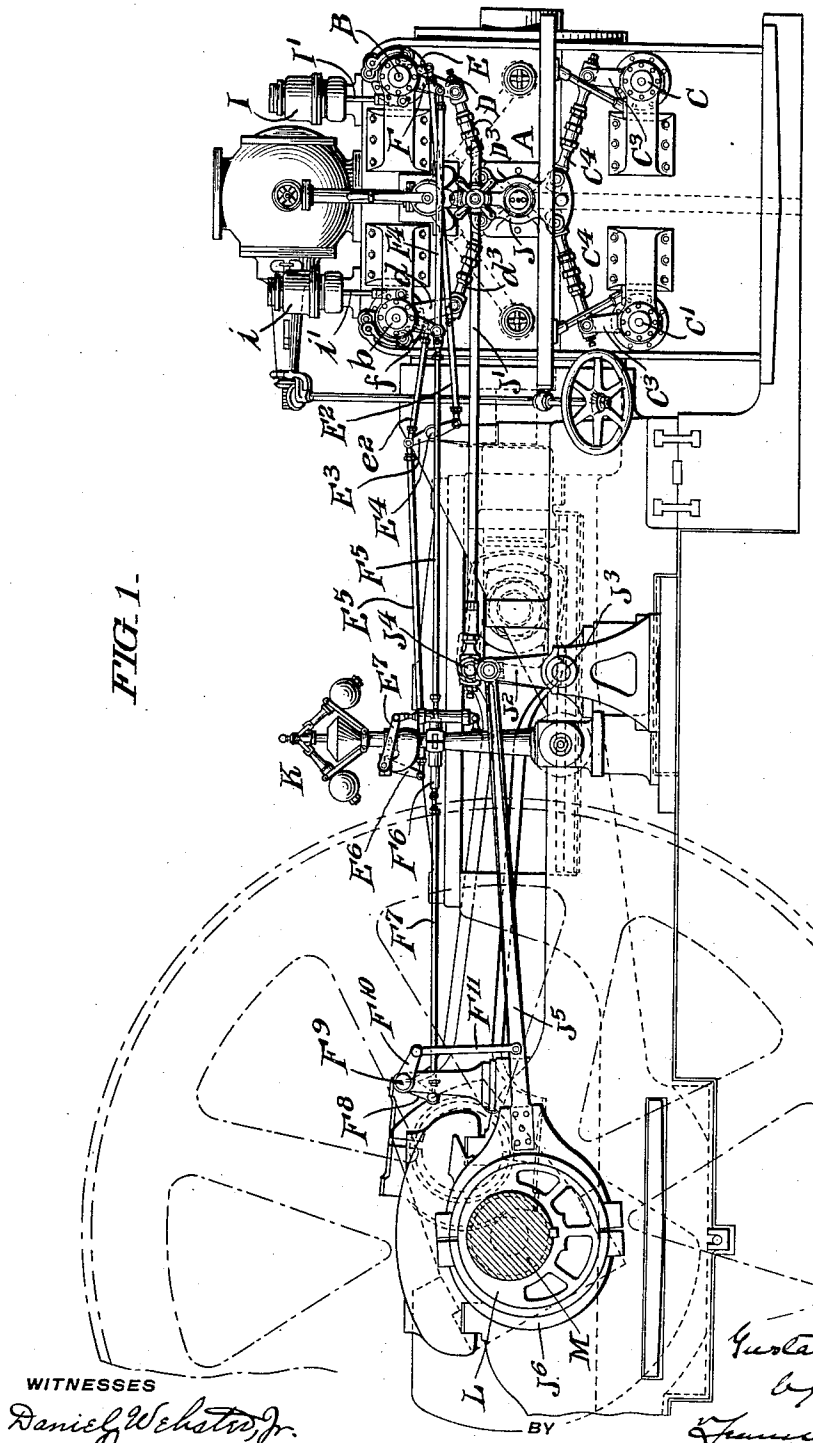
APPLICATION FILED JULY 5, 1910.

1,017,687.

Patented Feb. 20, 1912.

3 SHEETS—SHEET 1.

FIG. 1.



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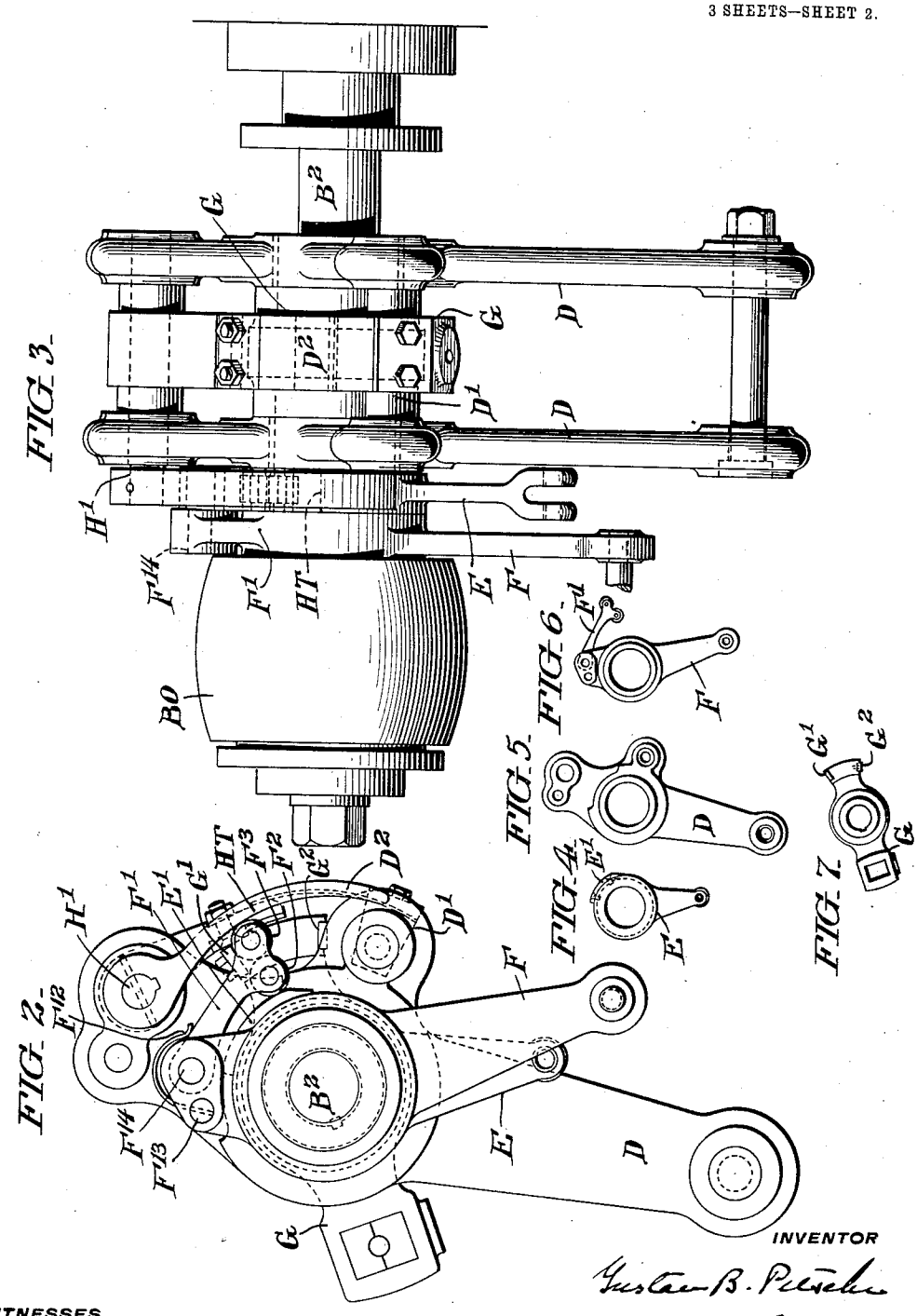
3 SHEETS—SHEET 2.



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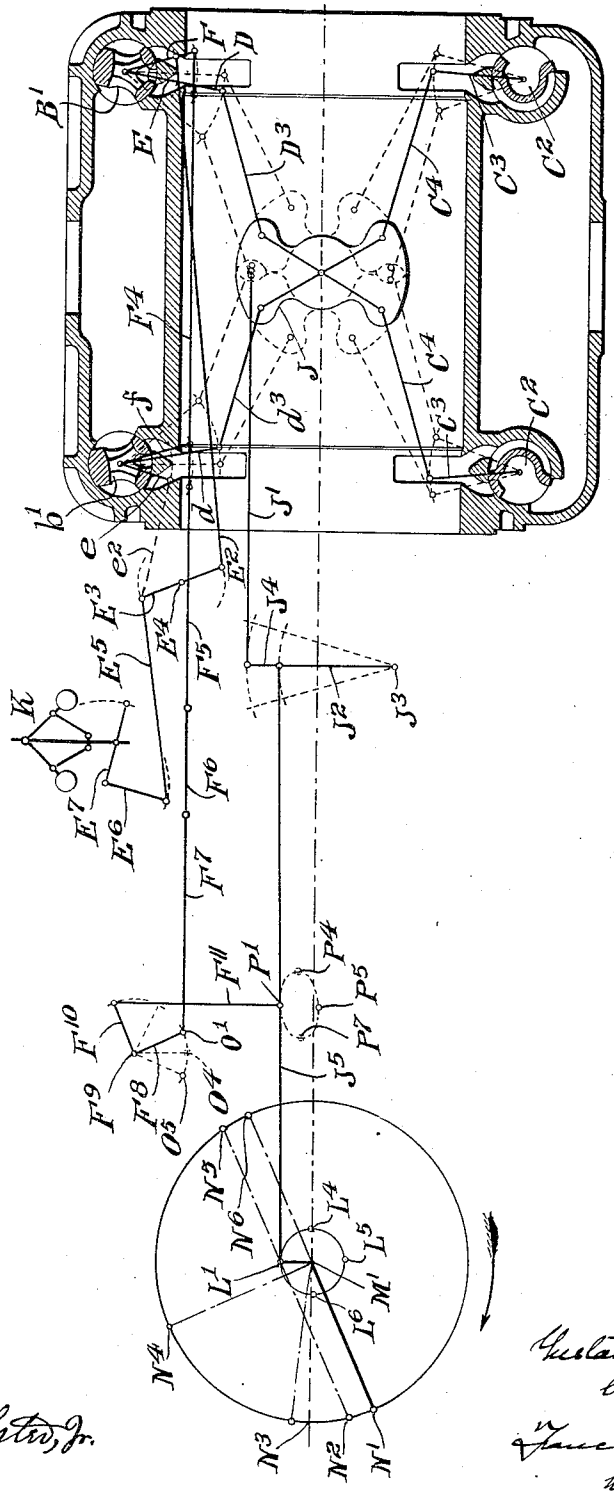
3 SHEETS—SHEET 3.

FIG. 8.



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CORLISS VALVE-GEAR.

1,017,687. Specification of Letters Patent. **Patented Feb. 20, 1912.**

Application filed July 5, 1910. Serial No. 570,258.

To all whom it may concern:

Be it known that I, GUSTAV B. PETSCHE, a citizen of the United States of America, residing in the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Corliss Valve-Gear, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

In the ordinary Corliss valve gear, the cut off, or closure of the inlet valve controlling the admission of steam to the engine cylinder during any piston stroke must occur during the first half, and in practice usually not later than the end of the first forty per cent. of that stroke or not until the end of that stroke.

The object of the present invention is to provide a simple and effective valve gear of the Corliss type in which the closure of the inlet valve, or cut off, may be automatically brought about by the governor mechanism at practically any point on the complete stroke of the engine depending upon the demand for steam.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming part of this specification. For a better understanding of the invention, however, and the advantages possessed by it, reference may be had to the accompanying drawings and descriptive matter in which I have illustrated and described one form of apparatus embodying my invention.

Of the drawings, Figure 1 is a side elevation of an engine equipped with an improved valve gear. Fig. 2 is a front elevation of the inlet valve actuating mechanism. Fig. 3 is an end elevation of the inlet valve actuating mechanism. Fig. 4 is an elevation of one of the cam levers. Fig. 5 is an elevation of one of the idler levers. Fig. 6 is an elevation of one of the trip levers and attached trip member. Fig. 7 is an elevation of one of the valve actuating levers, and Fig. 8 is a diagrammatic view illustrating the manner in which the various parts of the valve gear are given their proper motions.

In the drawings, A represents a cylinder of the engine.

B designates one of the two inlet valve mechanisms, and *b* the other, C and C′ designate the outlet valve mechanisms. The two inlet or admission valve mechanisms B and *b* are alike except that certain parts employed in one mechanism may be regarded as right hand parts and correspond to reversed or left hand parts in the other mechanism, and only the valve mechanism B will be specifically described herein. The valve mechanism B comprises a rotary, or rather oscillating, valve member B′ proper, on the stem B^2 of which are loosely journaled an idler lever D, a governor controlled cam lever E, and a trip lever F.

B° represents an outboard bearing for the stem B^2.

Between the two halves of the idler lever D (see Fig. 3) the valve actuating lever proper G is secured to the valve stem. One arm of the valve actuating lever G is pivotally connected to the stem I′ of the usual dash pot I for closing the valve when tripped. At its opposite end the valve actuating lever G is provided with the usual abutments G′ and G^2. The idler lever D has journaled in it the shaft H′ to which is secured the hook H and the trip arm HT.

D′ is the pusher block carried by the idler D and adapted to engage the abutment G^2 of the valve actuating lever to insure a positive closure of the valve in case the dash pot strikes or is otherwise prevented from closing the valve, when tripped. A spring D^2, secured to the thrust block D′, bears against the hook H and tends to hold the latter at all times in the position in which it will engage the abutment G′ of the valve actuating lever G and move the valve into the open position on the movement of the idler lever D in the valve opening direction. The governor controlled cam lever E carries the usual cam E′, by means of which, though not directly, the trip arm HT is moved to lift the hook H out of engagement with the valve actuating lever to thereby bring about the closure of the inlet valve.

In so far as above described, except for the trip lever F, the valve gear is constructed in a known manner and is of the general character shown by my prior Patents 925,836, June 22, 1909, and 859,331, July 9, 1907. Heretofore, however, it has been usual, as shown for instance in my prior patents referred to, to have the trip arm connected to the hook directly engaged

and operated by the cam on the cam lever to bring about a closure of the valve. In the present case, while the hook arm HT is arranged in the same plane with the cam E′, these parts do not directly engage. In this construction a distance piece in the form of an arm F′, pivoted on a stud F^{14} carried by the trip lever F, is disposed between the cam lever E and the trip arm HT, and is provided at its free end with anti-friction rolls F^2 and F^3 which bear one against the cam lever E and the other against the trip arm HT. A spring F^{12} carried by a stud F^{13} secured to the trip lever F, constantly holds the arm F′ against the cam lever E. The inner side of the trip arm H′ is eccentric, or practically so, with the axis of the valve, and the parts are so arranged that the trip arm H′ will not be moved out of its normal position to thereby shift the hook out of engagement with the valve actuating lever G except when the roll F^2 carried by the arm F′ rides up on to the cam E′.

The parts of the admission valve mechanism *b* are designated by lower case letters and exponents which correspond to the upper case letters and exponents used to designate similar parts of the valve mechanism B.

The idler levers D, *d*, are connected by arms D^3, d^3, to the usual pivoted wrist plate J. Similarly the operating arms C^3 of the exhaust valve mechanism C and C′ are connected by connecting rods C^4 to the wrist plate J. The wrist plate J is given the usual oscillatory movement in the engine construction illustrated, by means of a connecting rod J′ pivoted to one arm J^4 of a rock shaft J^3, a second arm J^2 of which is connected at one end of a connecting rod J^5. The other end of the connecting rod J^5 is provided with a strap J^6 encircling the eccentric L carried by the main shaft M of the engine. The two cam levers E and *e* are connected by rods E^2, e^2, to the opposite ends of a lever E^3 fulcrumed at E^4 and connected by a rod E^5 to one arm E^6 of a bell crank lever, a second arm E^7 of which is connected to the usual governor K. The two trip levers F, *f*, are connected together by a connecting rod F^4 and are operated by connections which include a connecting rod F^5, a slide F^6 mounted in the supporting stand of the governor K a connecting rod F^7, and a bell crank lever pivoted at F^9 and having one arm F^8 connected to one end of the connecting rod F^7, and a second arm F^{10} connected by a link F^{11} to the connecting rod J^5.

In the diagram of Fig. 8 N′ represents the center of the crank pin by which the piston of the engine is connected to the shaft M in the position occupied slightly before the completion of a stroke of the engine piston toward the left hand end of the cylinder. The arrow in Fig. 8 indicates the direction of rotation of the engine shaft M. N^2 represents the position of the crank pin at the instant at which the admission of steam to the left hand of the cylinder begins, this occurring as is usual, slightly before the completion of the stroke of the piston toward the left hand end of the cylinder. N^3 marks the position of the crank pin at the beginning of the following piston stroke. N^4 is ninety degrees in advance of the position N′, and N^5 represents the position of the crank pin when the valve B′ is positively closed by its idler lever if the load conditions are not such as to have caused the valve to be tripped and closed by the governor at some point in the travel of the crank pin between the points N′ and N^5. L′ represents the position of the center of the eccentric L corresponding to the crank pin position N′, and L^4 and L^5 positions corresponding to the crank pin positions N^4 and N^5. The pivotal connection between the links J^5 and F^{11} will obviously travel through an elliptical path, and P′, P^4 and P^5 represent positions of this pivotal connection corresponding to the positions N′, N^4 and N^5. While the pivotal connection between links J^5 and F^{11} is traveling through the elliptical path P′, P^4 and P^5, the pivotal connection between the rod F^7 and lever arm F^8 will travel from the position O′ through the position O^4 into the position O^5 and will return from the position O^5 to the position O′ while the pivotal connection between links J^5 and F^{11} is traveling through its elliptical path from P^5 through the position P^7 to the position P′.

From the foregoing it will be plainly apparent to those skilled in the art that while the piston of the engine and the wrist plate are in synchronism, that is, each has the same time interval between the beginning and end of its movement in one direction, the two movements are out of phase by something more than ninety degrees. In the usual setting of engine valve gears, the difference in phase or the angle of advance, (angle N′, M′, L′) as it is called, is about one hundred and five degrees or so, and this is as it should be, since each of the valves controlled by the wrist plate must open at about the beginning and close at about the end of the piston strokes of the engine piston in one direction or the other. It is on account of this, that in the ordinary Corliss valve gear the governing mechanism is ineffective to bring about cut off except during the first forty per cent., or thereabout, of each piston stroke of the engine. In the ordinary Corliss valve gear in which the hook trip arm corresponding to the arm HT in the construction illustrated is di-

rectly actuated by the cam corresponding to the cam E′, the trip arm must engage the cam by the time the eccentric center reaches the point L^4, or not at all during that stroke of the engine piston because as soon as the center of the wrist plate eccentric passes through position L^4, the movement of the wrist plate is reversed and the idler lever connected to the wrist plate begins to move in the direction which carries the trip arm away from instead of toward the cam on the governor-controlled cam lever. The point N^4 in the path of the crank pin center corresponds to the point L^4 in the path of the eccentric center. In practice, however, cut-off may occur with the ordinary Corliss valve gear somewhat later in the stroke of the engine piston than that corresponding to the crank pin and eccentric positions N^4 and L^4. This is due to the fact that the inlet valves do not close instantaneously, and the engine piston has time to travel an appreciable distance during the period between the tripping and the actual closure of either inlet valve. As before stated, however, cut-off produced by the governor in an engine equipped with the ordinary Corliss valve gear heretofore used, cannot occur in any stroke of the engine piston unless it occurs in the first forty per cent., or thereabout, of that stroke. This is a serious and long recognized disadvantage particularly in the operation of a big steam engine working under widely varying loads.

With the present invention the oscillatory movement of the pivotal connection between the lever F^8 and the connecting rod F^7, and consequently the oscillatory movements of the trip levers F and *f*, each begin and end at about the same instants at which the piston strokes of the engine begin and end. In the improved gear the difference in phase between the engine piston and the trip levers F and *f*, is represented not by the angle N′, M′, N^4, but by the angle N′ M′ N^3, or, more accurately, by the latter angle plus 180 degrees. It is obviously immaterial, so far as the timing of the parts is concerned, whether the lever F and *f* move generally in, or, as in the construction illustrated, generally contrary to the direction of engine piston, provided that the oscillatory movements of the levers F and *f* begin and end at about the same instants that the piston strokes begin and end.

From the foregoing it will be plainly apparent to those skilled in the art, that the trip arm HT of the valve mechanism B, will be lifted and the hook H thrown out of engagement with the valve actuating lever G, to permit the corresponding inlet valve to close at practically any point whatever in the stroke of the engine piston, at which the arm F′ engages the cam E′, and, of course, the valve mechanism *b* is controlled in the same manner as the valve mechanism B.

With the mechanism disclosed I not only obtain the substantial increase in economy of steam consumption in engines operated under certain conditions where a delayed cut-off is highly desirable, but I accomplish this with mechanism which is inherently simple in construction, reliable in operation, and does not involve substantial departures from standard practice in the valve gear as a whole.

While, in accordance with the provisions of the statutes I have herein described and illustrated the best form of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is:

1. In a Corliss valve gear, a combination with an admission valve and its actuating lever of an idler lever, a hook carried thereby, a governor controlled cam, a tripping member adapted on engagement with said cam to disconnect the hook and valve actuating lever, and connections independent of said cam for giving said idler lever and said member oscillatory movements in synchronism with the movements of an engine piston and in substantially quarter-phase relation with each other.

2. In a Corliss valve gear, the combination with an admission valve and its actuating lever, of an idler lever and hook carried thereby, connections for giving the idler lever oscillatory movements which begin and end at about the instants when the engine piston is near its middle position, a governor controlled cam, a tripping member adapted on engagement with said cam to disconnect said hook and valve actuating lever, and connections independent of said cam for giving said tripping member oscillatory movements beginning and ending at about the same instants at which the engine piston strokes begin and end.

3. In a Corliss valve gear, the combination with an admission valve and its actuating lever, an idler lever and hook carried thereby, and a governor controlled cam, of a hook trip arm spaced away from the cam, a tripping piece adapted when moved between the cam and the trip arm, to disconnect the valve from the idler lever, connections for giving the idler lever oscillatory movements which begin and end when the engine piston is near the middle position, and connections for giving the distance piece oscillatory movements beginning and ending at about

the same instants at which the piston strokes begin and end.

4. In a Corliss valve gear of the character described, the combination with an admission valve, of an actuating lever therefor, a governor controlled cam lever, an idler lever, a trip lever, all of said levers being co-axially pivoted, a hook and hook trip arm carried by said idler lever, said hook trip arm being spaced away from said cam lever, and a tripping member connected to said trip lever and adapted to be moved thereby into and out of engagement with said cam and on engagement with said cam to engage said hook trip arm and disconnect the hook and valve actuating lever.

5. In a Corliss valve gear of the character described, the combination with an admission valve, of an actuating lever therefor, a governor controlled cam lever, an idler lever, a trip lever, all of said levers being co-axially pivoted, a hook and hook trip arm carried by said idler lever, said hook trip arm being in the same plane with, but spaced away from, the cam on said cam lever, and having its edge adjacent said cam elongated and curved about the common axes of said levers, and a tripping member connected to said trip lever and adapted to be moved thereby into and out of engagement with said cam and on engagement with said cam to engage said hook trip arm and disconnect the hook and valve actuating lever.

6. In a Corliss valve gear of the character described, the combination with an admission valve, of an actuating lever therefor, a governor controlled cam lever, an idler lever, a trip lever, all of said levers being co-axially pivoted, a hook and hook trip arm carried by said idler lever, said hook trip arm being in the same plane with, but spaced away from, the cam on said cam lever, and having its edge adjacent, said cam elongated and curved about the common axes of said levers, and a tripping member connected to said trip lever and adapted to be moved thereby into and out of engagement with said cam and on engagement with said cam to engage said hook trip arm and disconnect the hook and valve actuating lever, such tripping member being in the form of an arm pivoted at one end to said trip lever and being provided at the other end with anti-friction rolls which bear one against the cam lever and the other against the hook trip arm.

7. In a steam engine having a Corliss valve gear, the combination with the admission valves of an actuating lever, idler lever, hook carried thereby and governor controlled cam for each valve, a wrist plate to which the idler levers are connected, an eccentric and connecting rod for oscillating the wrist plate, tripping members one for each valve and each adapted to disconnect the hook and actuating lever of the corresponding valve on engagement with the appropriate one of said cams, and lever and link connections from said connecting rod independent of said cam for giving said tripping members oscillatory movements in quarter-phase relation with the movements of said wrist plate.

GUSTAV B. PETSCHE.

Witnesses:
EDWARD WIKI LÜZERN,
JULIUS HARTMAN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."