

the cross-head which is fixedly mounted on the rudder-head, one connecting rod being on the one side and one on the other side, and disposed in opposite directions. A set of buffer springs are arranged at one end to relieve the device of shocks. The steering chains are placed around and fastened to the periphery of the quadrant wheel.

The operation of the device is as follows: When the quadrant wheel is moved by the steering chains about its axis, the racer guides move their respective block and cross-head outwards from, or inward to, the centre of the rudder-head by reason of the movement of the blocks being controlled by the eccentric path of the racer guides. The rectilinear motion of the slide cross-heads upon their guides is communicated to the ends of the rudder cross-head by the connecting rods which cause the rotation of the rudder-head. It will be obvious that the locking of the rudder is practically positive, for to produce any motion it would be necessary for the rudder to revolve the quadrant wheel through the movement of the slides in the racer guides, an operation which is practically impossible, because of the enormous mechanical advantage of the eccentric racer guides over the rudder-head.

At first sight it may look somewhat complicated, but it must be borne in mind that the largest vessels now built have a complete quadrant wheel on the rudder-head, instead of the ordinary tiller, and all that is added to that in this device is the eccentric racer guides and their connections.

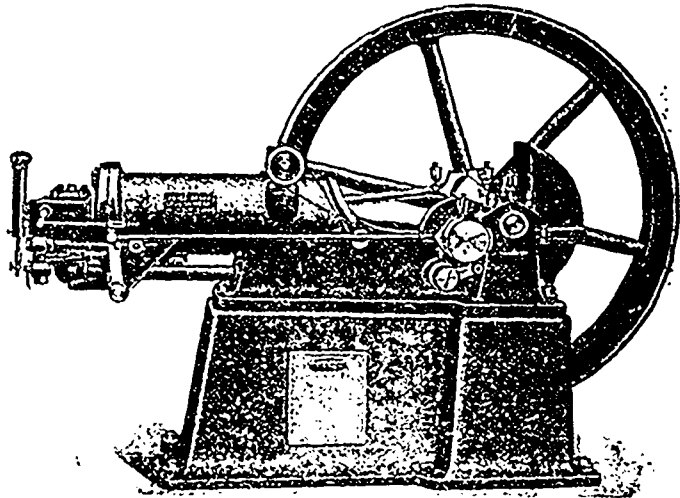
We understand that Lloyd's committee have had the matter submitted to them, and that they are of opinion that, with this type of device, no right and left hand screw gear was necessary, and that the secondary form of auxiliary steering gear, which has to be fitted into every ship as a stand-by, should take the form of a spare tiller keyed on the rudder-head, and therefore the right and left handed screw gear may be entirely done away with. It is claimed that so automatic is the locking on this apparatus that should the chains carry away, the machine will hold itself in position, and therefore separate rudder brakes are necessary. The device is being put upon the market by Davis & Co., of 12 Fenchurch street, London.

#### THE KRUPP GAS ENGINE.

There is a growing interest in gas engines not only as a motive power for electric lighting, but for general industrial purposes, and our readers will be glad to have their attention directed to a new gas engine produced by the Krupp Works in Germany, for whom the Canadian agents are Jas. W. Pyke & Co., Montreal. The fact that this great firm have taken up such an engine may be accepted as a guarantee that it has more than ordinary merit, but the first sample engine shipped to Canada is now being tested at the establishment of Samuel Fisher, 57 St. Sulpice street, who is acting as local agent for Montreal; and the engineers who have examined it admit that it is a fine piece of workmanship, and runs with remarkable smoothness. The accompanying illustration shows a horizontal engine for industrial purposes, but the Krupp Works are building a gas engine of this type especially suited also for electric lighting purposes.

These engines are not made too cramped or too short. On the contrary, it is considered an advantage to keep the piston and connecting rod long, in order to keep the surface-pressure in cylinder as low as possible. The piston has on its front end a longer guide in place

of a cross-head, while the piston rod has about six times the length of crank. This reduces the wear and tear to a minimum, and in addition an automatic lubricator prevents the possibility of wear of cylinder or piston. The larger the engine, the more favorable is the gas consumption, and at full load the largest engines require 0.45 cub. m. per brake horse power and hour, a result unsurpassed by any other gas engine. The regulation of the gas, as also the speed of the engine, is accomplished by a simple but very sensitive patent governor. The gas consumption keeps pace with the power required. In the engines for industrial purposes, the governor gives either full gas load or shuts it off for the whole stroke, according to the power required. The speed of these engines is small; the smallest engines make 230 revolutions per minute, while the larger ones



work at 200 revolutions or less. These engines are not therefore to be put in the same class as the "highspeed" engines, which make from 250—500 revolutions. The speed of the engines can be altered while running, which is for many industries a great advantage. The valve gear is very simple. One rod works the governor, the gas supply, and the igniting arrangement, while another works the exhaust valve.

The igniting method, which is one of the novel points of this engine, is very simple and very sure in its action. The ignition is effected by an incandescent body of peculiar composition. The explosive mixture passes to it at the right moment and is fired by coming in contact with its white hot walls. By this arrangement the continual extinction of the igniting flame and the puffing noise, so common in other engines, is obviated. The incandescent body is made of a material which is very durable and will last for many months, if properly treated.

The engine has no slide valve. The frame is strong, the bed plate long, and the number of moving parts, as can be seen from the figure, the smallest number possible. The cylinder cover and the frame are made in one piece, the former being sustained for one-third of its length; the cylinder itself is made of especially hard and solid material, and is slid into the cylinder cover. The moving parts are made of steel and are hardened where necessary.

The following is a summary of the Krupp gas engine: Simplicity of construction, ease of working, repairs small; working parts accessible and easily cleaned; easily and quickly started; economy in working, also when running light and with half load; very small gas consumption; automatic lubrication; number of revolutions small, small wear and tear; easy regulation of speed and almost noiseless motion.