The above arrangement will be better understood by referring to section "C" It also shows that it prevents the falling of rock from the bucket into the pit when the sinkers are at work, as it is not over the mouth of the pit when emptied. It also does away with the necessity of having an extra bucket on the bank, as the bucket is not detached from the rope until it returns to the bottom of the shaft again. The water was disposed of by placing the cistern beneath the floor of the bank, so that when the bucket came up, and the centre was in line with the floor, the link was removed, the bucket turned over, and the water was emptied into the cistern. From thence it was conveyed to a drain by pipes, so that it did not get back into the shaft. The water buckets were hung from the centre while the stone buckets were hung three inches below the centre, so that they would empty without any effort on the part of the bank top man. The following is a statement of labor and supplies for the sinking of shaft.

STATEMENT.

Sinking from surface to rock 8 feet	$ 108.10
Cribbing shaft	188.26
Sinking in rock	3994.01
Other labor performed for shaft	254.35
Erecting bank-top and pulley-frame	87.29
	$4632.01
Supplies for sinking, including cement, dynamite and oil and sundry material	1710 06
	$6342.07
Sinking labor cost per foot	$ 28.77
Sinking material " "	7.58
Cribbing " " "	3.04
	$ 39.39

The S. S. "Turret Bay"—Novel Type of Coal Steamers employed by the Dominion Coal Company.

Among our illustrations this month we reproduce a photograph of the S. S. "Turret Bay," one of the three new type of cargo steamers employed by the Dominion Coal Company in handling their extensive St. Lawrence trade. These vessels are of an entirely novel type of construction, and have been designed, patented and built by Doxford & Sons, Ltd., Sunderland. The new design is essentially adapted for cargo steamers, and it is therefore with vessels of that kind that she may most profitably be compared. The chief virtue of the design from a commercial point of view is the large deadweight and measurement capacity it gives in terms of the registered tonnage.

If the same deadweight capacity, draught of water, and co-efficient of displacement that are embodied in the design of the "Turret Bay" were adopted in a partial awning deck steamer of the usual type, the net register tonnage would be about 20 per cent. greater. It is needless to point out what this would mean, as the working expenses of a cargo steamer may be said to vary with the register tonnage, and the one-fifth additional cargo carried would therefore be clear gain to this extent, a fact which would mean a handsome profit to a vessel of the Turret design, whilst an ordinary well decker would be working possibly at a loss. It should be stated, however, that the internal capacity for measurement of cargoes is 7 per cent. less in the Turret design than in the partial awning deck vessel.

Perhaps a closer comparison can be made between this new type of vessel and spar deck vessels. In this case also the Turret design shows an advantage in the matter of register tonnage over that of spar deck vessels, the tonnage in the latter case being 13.3 per cent. greater than in the former, whilst the cubical measurement would be 7.5 per cent. less than with the Turret type. It is claimed by the inventors that there are no special disadvantages in their new arrangement to set off against the advantages gained in this manner.

In the matter of strength it is doubtless unnecessary that we should say much, for the superiority in this respect is apparent at a glance; for the want of continuity in well deck steamers is naturally a great source of weakness in regard to provision for hogging and sagging strains, and this is well illustrated by the insistence of the classification associations upon local strengthening in the parts most affected. In Messrs. Doxford's design, what are known as the weather decks—*i.e.* the side decks—are continuous from stem to stern of the vessel. These decks are made of plating, of the same thickness as the shell of the vessel, and are in a straight line throughout, there being no sheer. The sides of the Turret Bay also afford a continuous line of plating, lying practically in the same vertical plane. We have, therefore, what may be described as a pair of continuous "angles" on each side of the ship, running for her whole length, and adding enormously to the strength of the structure. The turret deck extends at one level from the bow to a point considerably abaft amidships, where it is raised, and so continues to the after end, in order to provide sufficient storage capacity for cargo, so that the vessel may trim by the stern.

The dimensions of the "Turret Bay" are: Length between perpendiculars, 297 feet; extreme breadth, 40 feet; depth moulded ordinary deck line, 24 feet; depth in centre from keel to turret deck, 29 feet 11 inches; freeboard, 10 feet 4 inches; gross register, 2,198 tons; net register about 1,375 tons; register, horse power, 250 h.p.; dimensions of turret, 16 ft. 6 in. wide, 5 ft. high; dead weight capacity about 3,800 tons; cubical contents of hold about 180,000 cubic feet; capacity of main bunkers, about 250 tons.

The question of trim is an important point in the new design. The tendency of the partial awning deck steamers, which, it may be remarked, are the popular cargo carrying vessels of the day, is to trim by the bow when loaded with a homogeneous cargo. In order to meet this, they are invariably loaded leaving an empty space in the fore 'tween decks. With the Turret design the vessel can be filled up from the collision bulkhead to the machinery space, and she will yet be several inches by stern. This trimming by the stern is gained by the additional trunk space, due to the raising of the turret deck. The space thus gained is not large, but it is sufficient for the purpose. It will be understood that the raising of the turret deck involves a very different problem to the broken fore-and-aft line of the upper flange of the girder, which is entailed by the ordinary quarter deck in a cargo steamer of the usual type. As already stated, the weather decks of each side are continuous from bow to stern, and therefore the raising of the turret deck only necessitates provision for strengthening being made over one-third of the breadth of the vessel. The problem is, therefore, much simpler, and the danger of local weakness far removed. The main sheer strake, and main stringer, though not continuous in level, are continuous in regard to strength, the web of the girder being carried throughout at the turret deck level. A spar deck vessel, of the same general design as that illustrated, would have from 15 to 20 per cent. less depth of girder than a vessel of the Turret type; the exact percentage depending on the trade for which the Turret vessel was designed.

In the matter of taking in and discharging cargo, the Turret has the usual facilities. In the matter of steering gear some modifications have been introduced. A quadrant is keyed to the rudder stock, and this quadrant is actuated by a worm, it being geared for the purpose. In order to meet the shocks of the sea on the rudder, the worm is fitted on a feathered shaft, so that it has motion in line with the axis of the shaft, but this motion is restrained by powerful springs on each side. The shaft is actuated by an ordinary steering engine, fitted in the engine room, and thus near the steam supply. The Turret design affords exceptional facilities for the carrying of boats. It will be seen that the boats are at any time available for launching in a very simple manner. Access to the vessel is easily obtained by the usual ladder, operated in a manner similar to that adopted for the boats. An interesting detail in the design of this vessel is the arrangement for discharging ashes overboard. The usual ash hoisting arrangements have been abandoned. The apparatus consists of a flap discharge valve, upon the ship's side, above the water line. Leading from this to the hopper is a strong cast iron pipe. The ashes are placed into the hopper, which is connected with the cast iron pipe referred to, in the manner shown. There is also a branch connection from the ballast pump. When the apparatus is operated, the water is directed into the pipe, and the velocity with which it enters carries it up the pipe and overboard, the ashes being drawn in from the hopper by the induced current caused by the passage of the water. The lid of the hopper need not be closed when the apparatus is in use, as the velocity with which the water is discharged carries it directly up the iron pipe. The comfort to all hands obtained by this apparatus is very great, and the saving in labor is considerable.

Dominion Coal Company—Notable Introduction of Improved Air Compressor Plants at the Caledonia and Old Bridgeport Collieries.

Formerly, when the applications of compressed air were more or less tentative, and the whole system was little more than experimental, engines of a comparatively cheap type were naturally employed for driving the compressors, at the expense of course of economy of fuel. With the rapid development of recent years in the various uses of compressed air, the point was reached where users began to inquire carefully into the cost of production and a demand arose for compressors embodying the highest and most advanced construction, both as regards the compressors themselves and the engines for driving them.

The Rand Drill Company, New York, have been pioneers in meeting this demand for machinery of the most advanced type. An example of their latest construction has been supplied the Dominion Coal Co., and is here illustrated. This machine is driven by a Corliss engine of the cross compound condensing type. The air cylinders are compounded in order to make the compression in two stages, and between the two cylinders is an inter-cooler through which the air must pass in its progress from the low pressure to the high pressure cylinder. This inter-cooler has a function analogous to the intermediate receiver of compound steam engines, but in addition to that, it has a more important function, which is the chief reason for the compound system as a whole, viz., the cooling of the air at the middle of its compression. As is well known, the compression of air develops a large amount of heat, which by expanding the air consumes a portion of the power which is subsequently lost, in consequence of the air becoming cooled before use. The purpose of the compound system is to diminish this loss by taking the air from the first cylinder when partly compressed, and hence heated to a moderate degree only, and cooling the same down to its original temperature by means of a water jacket, after which it is discharged into the second cylinder and the compression completed. There are thus two stages of compression, the second of which is begun with cold air, whereas in the usual single cylinder system the compression is continuous, the latter half being done on air already heated during the first half.

If the indicator cards from the two cylinders be combined in the manner common with compound steam engines, the result would be to show a break in the compression line, that portion which represents the completion of the compression being set back nearer the end of the card, the results indicating a considerable saving in power.

The air end of this machine is fitted with the Rand Drill Company's well known mechanically moved air valves, which constitute a marked advance on the regulation spring valves heretofore almost exclusively used. The mechanical attachment to these valves operates upon the springs with which the valves are fitted. The ordinary style of compressor valve is in principle the same as the valves of pumps, being opened by the pressure of the air and closed by springs which constantly press upon their backs. In use, such valves, as is well known, have a chattering action due to the constant conflict between the air which is trying to open them and the springs which try to close them. The action of the mechanical gear is to retract the pressure of the springs from the valves, during the period when the valves are required to be open, thus leaving the valves under the influence of the air only and doing away with the chattering. The final result, however, is much more far-reaching than this description would at first indicate. The chattering of the valves necessitates a small lift, in order to limit the violence of the action, and this by reason of the accompanying small opening, necessitates a large number of valves to give the required total opening. With large compressors this multiplicity of valves becomes formidable and complicated. The action of the mechanical gear stops the chattering, as before mentioned, and the necessity for a small lift no longer remains. Consequently, the valves are given a high lift, so as to give a free and unobstructed opening, and the total number of valves is, consequently, very largely reduced. The machine is also fitted with the Rand Drill Company's differential pressure regulator, the operation of which attracts the attention of the mechanical eye. This regulator operates upon the knock-off blocks of the Corliss gear, much after the manner of the usual ball governor, with which the compressor is also supplied, and it is the combination of these two governors acting upon the same set of knock-off blocks which forms the interesting feature referred to. When the machine is started without pressure in the air pipes, the throttle valve is thrown wide open, and the machine runs up to the highest limit of its speed until checked and controlled by the ball governor, after the manner of ordinary Corliss engines for motive power. As the pressure rises, it soon reaches a point to which the plunger of the regulator is loaded; this plunger then rising shortens the cut-off and slackens the speed, when the ball governor drops, and the compressor remains under the control of the pressure regulator, which shortens or lengthens the cut-off as may be necessary to give the speed which shall maintain the air pressure, any drop of pressure being accompanied by an increase of speed, and any rise of pressure with a diminution of speed. Should, however, the demand for air exceed the capacity of the machine, the pressure will drop below that to which the regulator is set, when it will go out of action, and the speed will increase until the ball governor acts as at the start. At times, when the demand for air approximates the capacity of the machine, this interchange of action between the two regulators is constantly taking place.