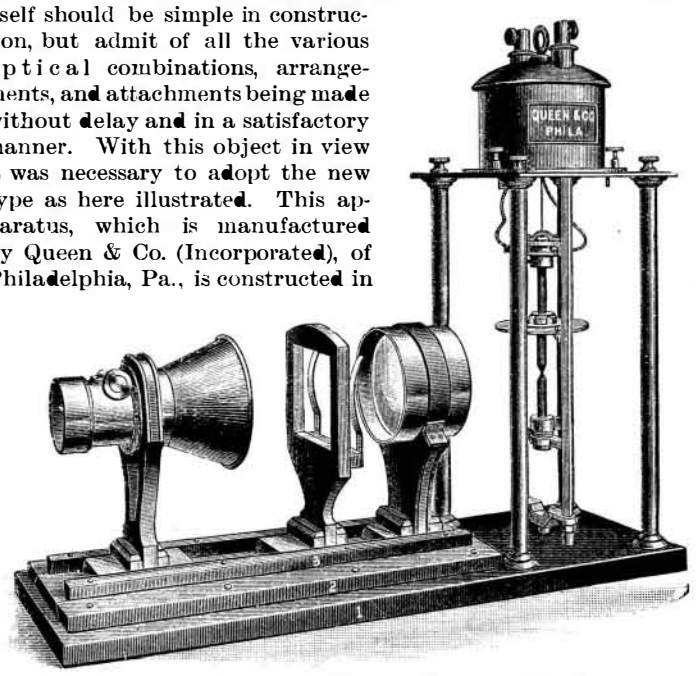
THE "PARAGON" PROJECTION LANTERN.

It is usually claimed for most projecting lanterns that they are suitable for educational purposes, and so far as the ordinary projection of diagrams and pictures are concerned, this may be the case to some extent.

That is, however, only a small part of the work that is expected to be performed with the educational projector; for the illustration of physical laws, for the performance of chemical experiments and for the projection of microscopic specimens; special facilities must be offered for each of these branches, the projector must be furnished with accessories and adjustments which shall enable an experienced lecturer to obtain the most complete results in all cases. The projector itself should be simple in construction, but admit of all the various optical combinations, arrangements, and attachments being made without delay and in a satisfactory manner. With this object in view it was necessary to adopt the new type as here illustrated. This apparatus, which is manufactured by Queen & Co. (Incorporated), of Philadelphia, Pa., is constructed in



THE "PARAGON" PROJECTION LANTERN.

two parts: the lamp and stand for the electric light, and an optical bench with sliding bases and standards which support the optical and other apparatus. So simple is this plan in its operation that the accessories can be exchanged in a few minutes, as, for instance, the vertical prism can be located on the base or taken off for the microscope to take its place, and so forth, with the absolute certainty that all parts required in the exhibition are perfectly in the optical center. A few of the more important accessories will here be described:

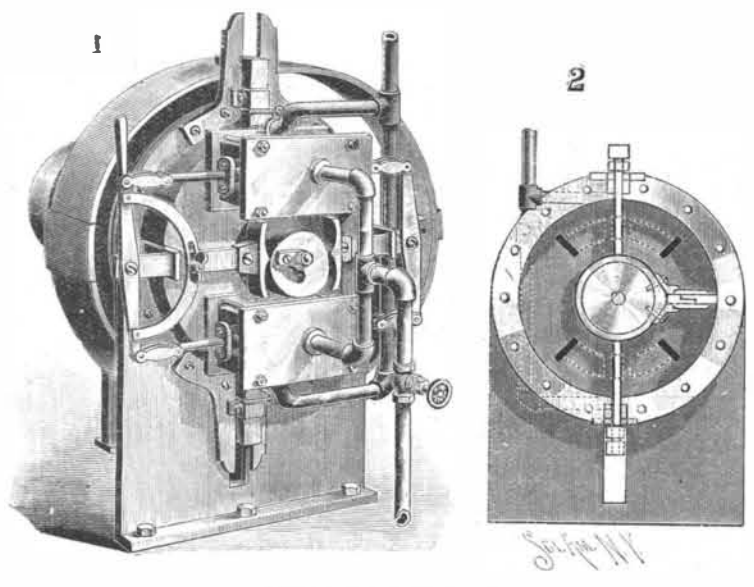
The vertical attachment is constructed with a plane reflector, condensing lens, upright stem with arm to carry the objective and right-angled prism. This apparatus is indispensable for the display of many physical and chemical experiments.

The microscope requires certain arrangements to bring a full course of light with as little heat as possible to the object to be exhibited. The distinguishing feature of this projection microscope is found in the application of an achromatic negative lens to convert the converging rays coming through the condensing lens into a cylinder passing to the secondary condenser; these are provided with rack and pinion, so that the illumination of the object can be adjusted with great nicety. Not only is the silvery whiteness of the arc light a great advantage, but as the radiant is comparatively a point, the definition given by a good objective is superb. Abundant light is at hand for obtaining a power of 1,000 to 3,000 diameters with perfect definition; a flea may be enlarged to fifteen feet in length.

The polariscope can be constructed in several ways. The refracting polariscope is composed of two Nicol prisms, one being used as a polarizer, the other as an analyzer; or a bundle of glass plates for a polarizer and a Nicol prism for an analyzer.

The reflecting polariscope is, however, more effective. It has two reflecting surfaces for the polarizer and a Nicol prism for the analyzer. The performance is perfect. All three of the above polariscopes are direct acting. The stage, or object holder, is furnished with a rotating plate in front and a separate slip holder back to facilitate the performance of plane and circular polarization.

The arc lamp employed is a very fine illustration of accurate workmanship, neat in appearance and perfect in its performance. Not only does it maintain a steady silvery white light, but it also automatically holds its position in the exact optical center until the carbons are finished.



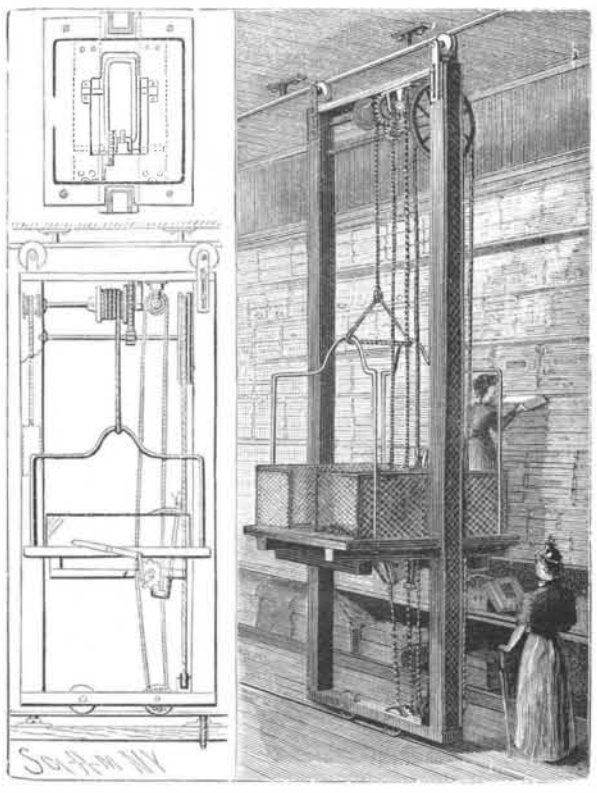
GOULD'S ROTARY ENGINE.

AN IMPROVED ROTARY ENGINE.

In this engine, which has been patented by Mr. O. O. Gould, of Copemish, Manistee County, Mich., the cylinder is preferably made in two parts bolted together and rigidly supported on a frame attached to a suitable foundation. Fig. 1 is a side view of the engine, Fig. 2 being an interior view of one-half of the cylinder. In the central bore of the cylinder are heads in which is journaled the main driving shaft, on which is a central disk supporting a piston, as shown in Fig. 2, the piston having suitable overlapping and spring-pressed packing plates engaging the sides and inner cylindrical surface of the rim of the cylinder. In suitable guideways arranged in the sides of the cylinder two opposite gates or abutments are mounted to slide radially, the outer ends of the gates having slotted heads engaging the continuous rim of a cam secured on the main driving shaft, so that the revolution of the latter causes the inward and outward sliding of the gates. The guideways in which the guides of the gates slide form part of the main frame, and the cam is so arranged that during one-half of the revolution one gate remains stationary in an innermost position, while the other gate is moved outward and back again. The two steam chests on the front of the cylinder, connected by pipes with a suitable source of steam supply and pipes to carry off the exhaust, are provided with slide valves, each having on its under side two cavities. These valves operate over the four elongated ports of the interior of the cylinder, as shown in Fig. 2, two of the ports being arranged diametrically opposite two other ports, and on opposite sides of a sliding gate. The valves also operate over exhaust ports midway between the live steam ports. The stems of the valves are connected by links at their right-hand ends with a lever centrally fulcrumed on a slide, and at their other ends with another similarly fulcrumed lever, which is also a hand lever. On the latter lever is a segment with segmental slot engaged by a bolt on the slide, so that when the nut of the bolt is loosened the lever may be moved to change the position of the valves and reverse the engine. A cam held loosely on the driving shaft, and carried around by a pin in a segmental slot of the cam, engages oppositely located arms on the slide to give to the latter a sliding movement, the arrangement permitting of changing the position of the slide when reversing the engine without disturbing other parts. Part of the peripheral edge of the cam is concentric, so that the valves are held stationary during part of a revolution of the shaft, and when in their outermost position in the steam chests, but each full revolution of the shaft imparts a full stroke to the right and to the left to each of the valves.

A MOVABLE ELEVATOR FOR USE ON STORE FLOORS.

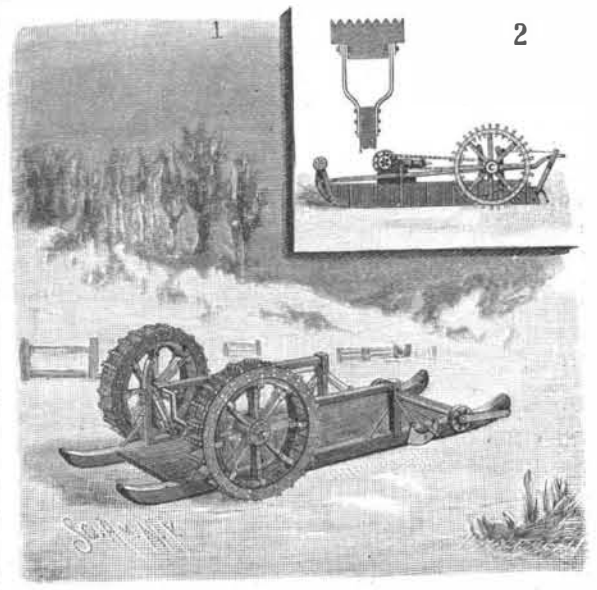
This elevator, adapted for use on one floor only of a building, and which may be readily moved to various positions, enabling articles at different elevations to be reached, has been patented by Mr. Robert W. Parmenter, of Yutan, Neb. The small figures represent sectional side and plan views of the improvement, the operation of which is shown in the large view. The upright posts of the frame are hollow, one side covered by screening, and adapted to carry a counterbalance. Rubber-lined, grooved wheels, journaled at the top and bottom of the frame, run upon parallel tracks on the floor and ceiling, the floor track being mounted on screws projecting through floor plates, whereby the height of the lower track may be regulated to cause the wheels to fit snugly at the top and bottom. The elevator car is suspended by bails to which is attached the hoisting cable, extending over a drum carried by a shaft journaled in the upper portion of the frame, there being on one end of the shaft a pulley to which is secured a cable by which a counterbalance weight is suspended to move up and down in one of the posts whereby the car is balanced. The shaft at the top has a gear wheel engaged by a pinion on a lower shaft carrying at one end a pulley, over which, and over pulleys at the bottom of the frame, passes an endless rope, by pulling on which the occupant may raise and lower the car. The lower pulleys are journaled in vertically adjustable supports, whereby the tension of the rope may be regulated. On the shaft with one of the driving wheels at the bottom of the frame is also a sprocket wheel, in line with a similar wheel in a vertically adjustable hanger at the top of the frame, and the sprocket chain by which these wheels are connected engages also a sprocket wheel on a crank shaft journaled in the car. The crank is connected by a pitman with a treadle, the working of which operates the sprocket chain and revolves one of the driving wheels at the bottom to propel the entire structure along the track. By a lever carrying a clutch, and journaled in the floor of the car, the upper end of the lever swinging opposite a notched quadrant and having a retaining latch, the sprocket chain may be held in such engagement with the sprocket wheel that the elevator will be locked in a stationary position, or so that the chain may be operated by the treadle to propel the elevator. The mechanism is such that the elevator may be easily propelled and perfectly controlled.



PARMENTER'S ELEVATOR.

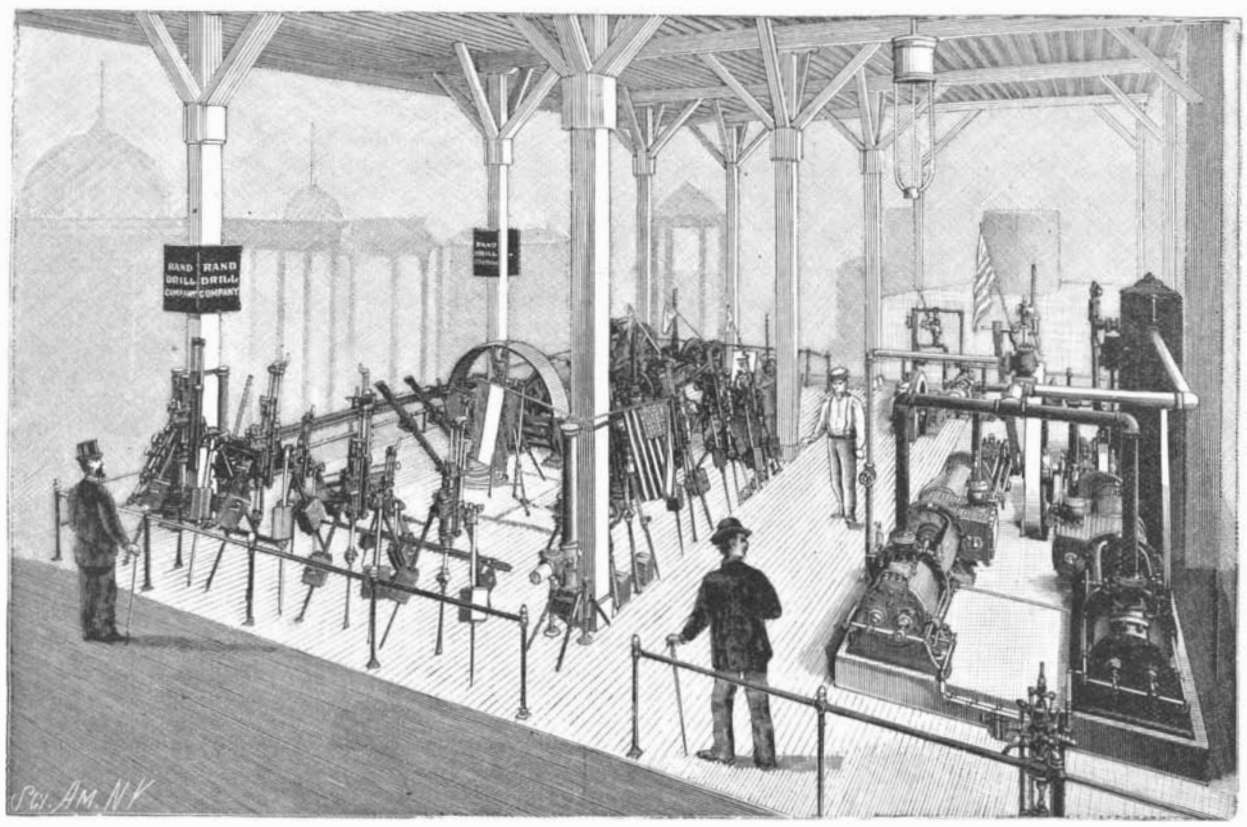
AN IMPROVED PROPELLER SLEIGH.

A sleigh designed to be readily propelled and steered over ice and snow, either by the occupant or by a suitable motor, is shown in the illustration, and forms the subject of two patents recently issued to Mr. Friederich A. Schaefer, of Truckee, Cal. On bearings which permit of vertical adjustment at each side of the sleigh are journaled short shafts carrying paddle wheels of novel construction, adapted to engage the snow or ice to propel the sleigh forward or to steer it. The shafts may have suitable crank arms, for propelling the sleigh by hand, or they may be connected by pitmen with a motor, and the paddle wheels have spokes, each having its outer end forked, as shown in Fig. 2, the transversely extending paddles being made of sheet



SCHAEFER'S IMPROVED PROPELLER SLEIGH.

metal, with their outer edges serrated. Near the forward end of the sleigh, on each opposite side, is a curved rudder held normally out of the snow by a spring, but by pulling on a rearwardly extending cord a downward swinging motion is given to one of the rudders to move its rear curved end into contact with the snow or ice, to steer the sleigh to the right or left as desired. To conveniently pass the sleigh over ground a pair of front wheels is provided, their axles journaled in pivoted side arms and locked in place by a pin, the arms being swung downward when it is desired to wheel the sleigh over the ground, the paddle wheels being at the same time locked in their lowermost position, whereby the sleigh is lifted entirely off the ground. When the snow or ice is again reached, the arms carrying the front wheels are swung into their upper position and the paddle wheels are raised to the height best adapted to effectively engage the surface of the ice and snow. The invention also provides for the convenient and ready attachment to the main runners of different forms of auxiliary runners specially adapted for running over ice or hard frozen ground or loose or wet snow.



THE RAND DRILL COMPANY'S EXHIBIT AT THE COLUMBIAN EXPOSITION.

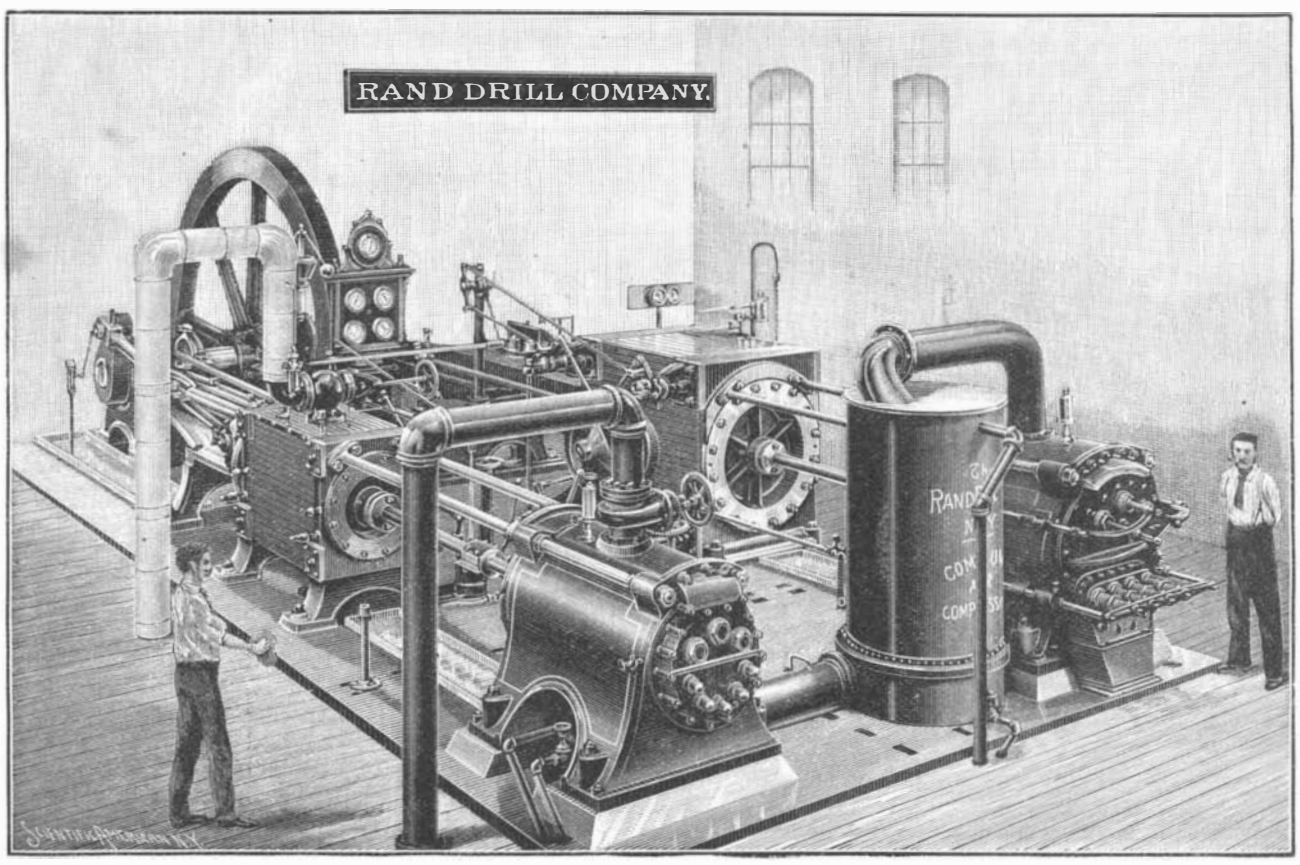
THE RAND DRILL COMPANY'S COMPOUND DUPLEX AIR COMPRESSOR AND ROCK DRILLS AT THE COLUMBIAN EXPOSITION.

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, of 23 Park Place, New York City, have been pioneers in meeting this demand for machinery of the most advanced type. An example of their latest construction was shown in their conspicuous exhibit in Machinery Hall at the Columbian Exposition. This machine, which is here illustrated, is the largest and most highly organized of any exhibited at the Fair. It has, in consequence, attracted a great deal of attention. It was 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 intercooler through which the air must pass in its progress from the low pressure to the high pressure cylinder. This intercooler 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.



THE RAND COMPOUND DUPLEX AIR COMPRESSOR AT THE COLUMBIAN EXPOSITION.

The diameters of the air cylinders of this machine are 22 inches and 34 inches, and the diameters of the steam cylinders 22 and 40 inches, while the stroke of 48 inches is common to all.

The Rand rock drills formed a noticeable feature at the Exhibition. There were shown drills for every variety of work, including mining, quarrying, sub-