

## LOCOMOTIVE FOR THE CANTAGALLO R.R.

The line for which this engine is intended is one now under course of construction by a Brazilian engineer, which will, when completed, connect the important coffee-producing district of Cantagallo, beyond the Organa mountains, with the port of Rio Janeiro. In some portions of the line the grades are very heavy, thus necessitating the use of the centre rail system. In a length of seven miles and three quarters, the mountain portion of the line rises about 3,000 feet, the gradient varying from 1 in 20 to 1 in 12, and being for the greater part of the length 1 in 13, while the curves are of forty metres, or about 140 feet radius. The gauge of the road is identical with that of the Mont Cenis Railway, viz., 3 ft. 7 5/16 in. The rails weigh 65 lb. per yard, the central rail being raised 9 in. above the ordinary carrying rails, and being bolted to wrought iron chairs, which are in their turn secured to a longitudinal sleeper fixed to the ordinary transverse sleepers. As in the case of the Mont Cenis Railway also, the mid-rail will, on the Cantagallo line, only be laid on the steep inclines, the ends of each length being tapered so that the gripping wheels may pass on and off easily.

Referring to the engraving—for which we are indebted to *Engineering*—it will be seen that the engine is carried on two pairs of coupled wheels 2 ft. 4 in. in diameter, these wheels being driven by a pair of outside cylinders 13 in. in diameter with a stroke of 14 in., while a second pair of cylinders 14 in. in diameter and 12 in. stroke, drive the two pairs of horizontal gripping wheels 1 ft. 10 in. in diameter. The wheel base of the engine is 7 ft., while the two pairs of horizontal gripping wheels are placed as close together as possible, and are situated midway between the axes of the vertical wheels. The pair of cylinders by which the horizontal wheels are driven are arranged on the centre line of the engine one above the other, the piston rod of each cylinder being attached to a long transverse crosshead, suitably guided, from the ends of which connecting-rods lead off to cranks on the axes of the leading horizontal wheels. The axis of each horizontal wheel has two cranks at right angles to each other, the two axes on each side of the centre rails being connected by coupling rods, while the leading axis of each pair so coupled is driven by the connecting-rods already mentioned.

The axes of the horizontal wheels are mounted in bearings carried by cast-steel cradles so arranged that by means of a right and left-handed screw the gripping wheels can be made to exert a pressure of any desired amount up to 40 tons on the mid-rail. The engines for driving the horizontal and vertical wheels are perfectly independent of each other, there being two regulators and two sets of reversing gear, while there are also independent ordinary and mid-rail brakes. The engine has 772 square feet of total heating surface, and is provided with a pair of wing tanks carrying 520 gallons of water, while the weight is 25 tons empty, or about 30 or 31 tons in working order.

The diameter of the vertical wheels being 28 in., while the cylinders driving them are 13 in. in diameter, with 14 in. stroke, it follows that these cylinders are capable of exerting a tractive force of

$$\frac{13^2 \times 14}{28} = \frac{169 \times 14}{28} = 84.5 \text{ lb.}$$

for each pound of effective pressure per square inch on the pistons. On the other hand, the inside cylinders being 14 in. in diameter by 12 in. stroke, and driving 22 in. gripping wheels, each pound of effective pressure per square inch on their pistons is equivalent to a tractive force of

$$\frac{14^2 \times 12}{22} = \frac{196 \times 12}{22} = 106.9 \text{ lb.}$$

This tractive force is greater than that capable of being exerted by the outside cylinders in the proportion of 5 to 4 very nearly, and it is possible that this proportion may have been decided upon in view of the fact that the pressure which it is possible to exert upon the horizontal wheels is greater than that exerted by the vertical wheels on the rails. However this may be, the engine appears to us to be deficient in cylinder power, and it is certain that, as matters stand, the outside cylinders are not capable of using up the adhesion of the vertical wheels unless the engine be worked at a much higher pressure of steam than is at present intended. With a clean rail, the adhesion may certainly be reckoned at 5 tons at least—while in many cases it would be much more—and to utilise this adhesion would require a mean effective pressure on the pistons of the outside cylinders of nearly 160 lb. per square inch, corresponding to, say, 190 or 200 lb. in the boiler, while at present the usual boiler pressure is but 130 lb. per square inch.

In making these comments on the cylinder power of the Cantagallo locomotives, it is only fair to Messrs. Manning, Wardle & Co., the makers of the locomotive, to state that they are not responsible for the proportions of cylinders adopted, although the general design and details of the engines have been worked out by them.

Several experiments have been made with this engine, in all of which it was found to answer satisfactorily. On one occasion it took a train load of 43½ tons steadily up a grade of about 1 in 12 at a speed of about eight miles an hour.

## THE SAND BLAST.

So much has been heard recently of the wonderful power of the simple contrivance known as the sand blast that any information as to its method of working and uses must prove extremely satisfactory. The apparatus was exhibited early in the year by the inventor, Mr. Tilghman, at the fair of the American Institute at York, where, as its fame had preceded, it attracted a great deal of attention. The perfect simplicity of the contrivance is no less remarkable than the extraordinary results obtained by it. Its object is to drill, cut, or grind hard substances, such as granite, metal, or glass, and its action depends upon the expulsion, at a considerable velocity, of quartz-sand by a steam or air jet passing through a tube, and striking the material operated on. The accompanying sketch will clearly explain the construction of the apparatus. The sand is fed from an elevated box through a flexible pipe, *a*, which is kept at an angle of about 45° to regulate the flow of the sand. Passing down through the tube, *c*, which terminates in a nozzle, as shown, and is enclosed in an outer cylindrical casing, forming an annular space, the sand encounters the steam or air which is admitted into the flexible

tube, *d*, and forms at *e* an annular steam jet, by the aid of which the sand is driven forcibly through the directing pipe, against the object to be operated on. To provide a regular, reciprocating motion of the jet over the surface of the material, a mangle rack movement is employed, by which the feed can be regulated, and the blast concentrated at will. In some early experiments made with this apparatus, a hole, 1½ in. diameter, and 1½ in. deep, was drilled through a block of corundum in 25 minutes, with a pressure of steam of 300 lb. Again, with 100 lb. pressure, a hole, 1 in. by ½ in., and ½ in. thick, was cut through a hard steel file in 10 minutes. And, at the American fair the other day, a diamond was sensibly reduced in weight in one minute, and a topaz was entirely destroyed. These and many other experiments are good tests of the capabilities of the apparatus, but the most interesting results are those which have an obvious commercial value. It is a very curious feature of the invention that, whilst hard substances are thus rapidly affected, soft and delicate materials are left untouched when exposed to the same influence. Thus, if a thin stencil sheet of india-rubber be laid over a block of granite or marble, and the blast turned upon it, the stone is cut or drilled, while the rubber remains untouched. Again, if a photographic film of bichromatised gelatine be placed on a sheet of glass, and the jet applied, a picture may be engraved, and in the same manner flowers and fern-leaves may be reproduced with the utmost delicacy.

For grinding glass a very slight pressure is sufficient, that produced by air under 4 in. of water being ample for the purpose.

The uniform success which has attended the use of the sand blast has sufficiently proved its reliability, and the numerous purposes to which it can be applied promises to render it one of the most useful inventions that have been of late brought into public notice. By simple modifications it can be made to supersede the present slow and costly process for shaping granite and other hard-stones, for rock drilling, and for polishing castings, or grinding and engraving glass. The cost of working it is of course extremely small, and there need be no loss of the sand employed, as it can be constantly restored to the feeding hopper, together with the particles driven from the material.

The action of the sand upon a hard surface appears to be due to the work performed by each angular particle that strikes, and which in striking carries away with it a particle, of course far smaller than itself, and the reason why the softer materials resist the wearing action is due to their elasticity, which repels the particles. As a further proof of this, it may be mentioned that while perforated shield plates of lace, gelatine, or rubber bear a prolonged exposure to the sand unharmed, stencils of thin sheet steel or brass speedily curl up, and are destroyed.

## PROGRESS OF THE INTERCOLONIAL RAILWAY.

The *Sackville Post* says:—In view of the contradictory reports respecting the probable date of the completion of the Intercolonial Railway in Nova Scotia, a reporter from this office visited the line last week, to observe the progress being made.

Commencing at Truro, he finds Salmon River Bridge (3 spans, each of 100 feet) completed.

Archibald Brook, (1 span 24 feet) completed.  
Barnum's Brook, (1 span 50 feet) completed.  
Ishgonish, (2 spans, each 100 feet) completed this week.  
Barnhill's Brook, (1 span 40 feet) completed.  
Debert River Bridge (2 spans, each 100 feet) yet to do.

Folly Bridge, one of the largest works on the Intercolonial Railway, in progress. It is 82 feet high, and has six spans. The largest pier is 22 x 11 on top, and smallest 18 x 18. Two spans are completed. The masonry of one abutment and part of a pier are yet to do.

Upham's Brook, (1 span 40 feet) yet to do.  
Wallace River, 50 feet yet to do.

West Branch of Wallace River, (1 span 50 feet) yet to do.  
River Philip Bridge (three spans of 100 feet) completed this week.

Little Forks, (1 of 100) completed.  
Nappan (1 of 100) completed.

The stone culverts of any consequence, are all done. Some few wood ones have to be put in.

The Earthwork is in a still more forward state. From Truro out it is completed, except two miles at the "Grecian Bend," at Folly River. There are other places along the line at culverts, etc., that are not ready for laying rails, but as nearly 1000 men are at work, this will probably be done in advance of the bridges.

The track is laid to Ishgonish, 8 miles from Truro, and the line is ballasted. A steam shovel powerful enough to shift 1200 cubic yards per day, is in operation, a mile from Truro, and ballasting is being rapidly carried on towards the Folly.

From Amherst out, the rails are laid 30 miles to River Philip, and 5 miles of ballasting is done. Good ballast is found near Truro, Folly Lake, and at Thompson's Mill.

To recapitulate: Five bridges are incomplete; 38 miles, or one-half of the track-laying is to be done. Thus it appears there is a very large amount of work yet to be done, but as ballasting is progressing from both ends towards the Folly, and as the bridges are also in progress, it may be possible for Mr. Shreiber to fulfil his promise, and have the line open for traffic in September.

Drs. Eulenberg and Wohl strongly recommend the use of animal charcoal made into pills with gum tragacanth, as an efficient remedy against the sad effects of phosphorus in the lucifer-match manufacture.

HINT FOR MECHANICS.—Ed. Skinner, Middleton, New York, says by rubbing chalk on a square the lines and figures are filled up, and can be much more plainly read. This is especially useful for near-sighted persons.

Prof. Wheeler, who turned his attention to the restoration of defaced writing and printing after the great fire at Chicago, has, it is said, discovered a process for restoring charred paper-money, which has been adopted by the United States Government.

A new style of barometer, composed of two slender strips of cedar and whitewood, glued together and attached by a pivot to a cross-bow shaped frame, is in use. Atmospheric variations cause the whitewood to expand or contract, thereby moving an indicator in directions corresponding.

## MISCELLANEOUS.

A tax on domestic servants is to be introduced into France. Foreign servants to pay double.

After a century of hard work, the Moravians have translated the Bible in the Esquimaux tongue.

Brigham Young proposes to tax his Saints \$1 a head on their wives, for the benefit of the poor.

A congress of "Philatelists" (collectors of postage stamps) is to be held at Lubeck on the 14th inst.

Mr. William Cullen Bryant proposes to build a public library in his native town, Cummington, Mass.

The Russian telegraph lines are supported across the step-pes on brick pillars, no wood being available.

Francis Joseph of Austria has been invited to visit Berlin in September, and has, moreover, accepted the invitation.

At a recent *Reu* at Taplow, the considerate and gallant host, when rain came on, telegraphed to London for quantities of india-rubber goloshes.

There are now moored in various points of the United Kingdom no less than sixteen training-ships for the merchant service, which accommodate unitedly about 3,500 boys.

Two velocipedists started from Rouen at 10 a.m., and the winner, M. Boïn, reached the Paris Place de la Concorde at 5 p.m., forty minutes before his competitor. The stakes were £200.

The Paris *Press* learns that "Monsieur Greeley, the great American farmer, was elected President of the United States at Cincinnati, and will be installed at Washington in November."

A bill has been introduced in the Imperial House of Commons prohibiting, under a penalty not exceeding £5, the employment of persons under sixteen years of age as a robot or gymnasts.

The memory of Harvey, the discoverer of the circulation of the blood, is to be honoured by the erection of a national memorial—viz., a statue in his native town (Folkestone), and a stained glass window in the parish church.

Her Majesty has been pleased to intimate her intention of conferring the honour of knighthood on Mr. J. Gilbert Scott, the eminent architect, on the occasion of the completion of the Prince Consort's National Memorial in Hyde Park.

It is said when Audubon, the distinguished naturalist, was a resident of Henderson, Ky., his inseparable companion was a petted wild turkey, that would follow the great naturalist in all his walks, and remain in his study as would a dog.

Few persons are aware that there is a society of the Mormons in Paris, who conform to the social and spiritual habits of Salt Lake City. It was only through the statistics of different religions, recently published by the Minister of Justice, that this fact became known.

The attempt of California to acclimatize the Cashmere goat promises success, the animal attaining a larger size and yielding a finer fleece than in its native India. There are estimated to be 40,000 Cashmires in the State, and the fleece, according to grade, is worth from 25 cents up to \$1 25 per pound.

Mr. Charles Geddes, President of the Montreal City Passenger Railway Company, is in England, and has purchased about twenty-five excellent horses for the company. He is endeavouring to procure others to replace the horses of the inferior race at present in use. Mr. Geddes will take seventy or seventy-five more, if he can procure them.

Herr Wachtel, while on his way home, gave a concert, with the aid of an American girl as pianist, to procure money for the family of a sailor who had been knocked overboard from the steamer and drowned. The receipts of the concert amounted to \$500, and the great tenor intends to give another concert in his own country for the same purpose.

A fly-proprietor at Twickenham (England), having a warrant of distress served upon him, adopted the original method of presenting the brokers with a hive of bees, and requesting them to make an inventory of that article of property. The officers were severely stung, and the offender was fined forty shillings and costs, with the option of one month's imprisonment.

Somebody else has seen the veritable sea-serpent. A passenger on the "Silvery Wave," from London to Russia, has seen the fellow, head up and tail in the air. This time he has the head of a bull, with large and glowing eyes. If the sea-serpent would only stay upstairs long enough to be photographed, it would save a great deal of speculation by sight-seeing mariners, and he would confer a favour upon the world in general.

Mr. William Beck states in the *Times* that on every 21st day of June a group, more or less in numbers, assembles on Salisbury Plain to watch for the rising sun at 3 a.m. As the hour approaches, they gather to the circles of Stonehenge, from the centre of which, looking north-east, a block of stone, set at some distance from the ruin, is so seen as that its top coincides with the line of the horizon; and, if no mist or cloud prevent, the sun as it rises on this, the morning of the longest day in the year, will be seen coming up exactly over the centre of the stone, known from this circumstance as the Pointer.

Mr. Henry Maudsley says: "The full and healthy development of all the lower natural forces are indispensably prerequisite to the existence of a sound and vigorous mind. Just so. Humanity requires the full equivalent of vital force, in order for the free and potent manifestations of the mind. When we consider that Fellows' Compound Syrup of Hypophosphites supplies the deficiency to unhealthy blood, restores the nervous element, and produces healthy action to the various organs and forces of the body necessary to sound mind, we wonder at the imbecility everywhere apparent.

As a deficiency of healthy blood, or a direct loss of this fluid, are causes for disorders of the senses, and also of the nervous system generally, we can safely calculate on the disappearance of such unpleasant and dangerous disturbances as the condition of the blood improves.