

tunity of securing easily and in a cheap market all articles of prime necessity. The opinion of M. de Lesseps was inspired by proper notions of general equality and liberty, but on second thoughts it was better to endure the recriminations of the traders rather than the just complaints of the laborers who, exposing themselves each day, have a right at least to demand of the company a material existence as much as possible exempt from care. The running expenses of the general magazine amount each year to "several million francs."

The section devoted to workshops and to material receives all the heavy material sent from Europe and the United States, which must be set up before it can be delivered to the different sections on the line of the canal. A few figures will show the importance of the work done by this department. Of the 60 locomotives ordered in Europe, 27 have been sent to the Isthmus, and 20 have been set up and sent to their proper sections since the commencement of 1883. Of dirt-cars of 4, 5 and 8 cubic yards capacity, platform cars, carts, etc., about 2,000 have been ordered; of these 600 have been forwarded, and the greater number of these are in service. These cars are set up, some at Colon and some at Gatun, which is again becoming, as we foretold, a centre of labor. More than fifty excavators with endless chains or buckets (of the Couvreur or similar design) have been ordered; 18 have been sent to the Isthmus and are at work. Several American excavators of the "dipper" type have been ordered by the contractors, and some of them have arrived and are set up. The dredging plant comprises four dredges of 60 horse-power each actually in service; these machines were completely mounted, even to the riveting of the hulls, at Colon.

The boats for carrying material, lighters and dump-scows, to the number of 64, sent from Europe, have all been put together or are in process of erection here, excepting two large steam lighters, built in Scotland by Mr. Lobintz, which traversed the Atlantic complete in all respects. These last mentioned boats are about 138 ft. long and 25 ft. beam. Each carried on the voyage two steam launches. Mr. Lobintz has also sent from the same place a marine dredge intended to work in the harbor of Colon. This dredge left Gareloch (Scotland) April 10 last, passed Madeira on 21st of same month, the Isle of St. Lucie (Antilles) May 6 and arrived at Colon May 16. Its principal dimensions are, length 171 ft., beam 26 ft., depth of hold 12 ft. The two engines, one to work the chain of buckets, the other the propeller, are 250 horse power. Mr. Lobintz is constructing a second dredge, similar to the one described, and destined for work at Panama. We wish a happy voyage to the brave sailors who will have to traverse the Straits of Magellan and double Cape Horn in this novel ocean steamer. Of the two floating landing stages, one is in service, the other is being put together at Colon. The naval outfit is completed by a flotilla of steamboats, launches for exploration, and tugs for towing, of 50 to 150 horse-power. Two of these last have traversed the Atlantic by their own power. All the rest have been set up here, except the small steam launches carried complete.

For the general shops and the works on the different sections, 34 stationary engines, all from the shops of Mr. Weyher, at Richmond (England), have been sent to the Isthmus. We mention finally among the general plant, one floating crane of 40 tons lifting capacity, the hull of which was riveted and launched at Colon. This machine is actually in service. One crane of 5 tons capacity, upon an iron hull, is also ready; and about 15 cranes of 2 to 6 tons capacity, worked by steam and by hand, are either mounted or are in process of erection at Colon.

As the work advances the repairs of machinery will become an important item. At present Colon is provided with only one small shop devoted to this service. The tools on hand will be soon insufficient for the work to be done. The company, foreseeing the necessity of an extensive shop for the mounting and repairing of machinery, had originally intended to found such an establishment at Colon. But as the health of this city is not always reassuring, and as the sections which will require most of the material are near the middle of the Isthmus, they have decided to create three principal systems of shops instead of one. The first will be at Colon, the second and most important at Gorgona, near the middle of the Isthmus, and the third on the Pacific coast, near Paraiso. By this means they will avoid the transportation of material to too great a distance, and in case of an epidemic breaking out in one set of shops, two others will still be in service.

Coming to the works proper in the Colon section, they can be divided under three heads:

1. The building of the *Terre plein de Christophe Colomb*.
2. The excavation at the port of entry to the canal.
3. The excavation of the canal itself from its entrance to a point near Gatun, at Sta. Kilometer 9.

The next section has started shops at Bahio, Soldado, at Sta. Kilometer 20. The limits of the two sections will be fixed at some future time between the last point and Gatun.

*The Terre-plein.*—The construction of this work will require about 470,000 cubic yards of filling material. It would certainly have been more advantageous to have used in this portion of the work the material excavated from the canal or its entrance. But, especially nearest to Colon, this excavation would have been in mud, containing living madrepores or corals, and these spread over a large surface and exposed to the sun's rays would certainly have had a bad effect on the health of the workmen. And further, the dredging plant was less advanced than the dry-excavating plant. The first thing to do was to find a soil sufficiently dry and compact, and easy to excavate; this condition of affairs was discovered at the small Mindi hills on the line of the railroad, and about 4,000 ft. from the Island of Manzanillo. These hills rise to a height of about 50 ft. above the level of the sea, and are composed of a compact clay with a decomposed tufa.

The first excavators fitted up were put to work on these hills, attacking them at the base, on the level of the railroad. The material being very compact, it took a very steep slope, even overhanging sometimes. In this way the breaking off of the upper part would frequently catch the buckets and overstrain the driving drums, causing breakages. To prevent these accidents, workmen were stationed to throw down the earth a little at a time without waiting for it to break off of its own weight. At the commencement of 1883 the plant at Monkey Hill included two Couvreur excavators, two American excavators and several picking machines. All of this machinery was not at work at one time. The American machines, among others, have proved that they are not capable of regular and continuous work.

But this material had to be transported as well as dug out. To use the Panama R.R. was to be at the mercy of a company which would always find some obstacle to retard the movement of the earth trains. So in June, 1882, it was decided to build a second way alongside the one existing already. Thanks to this special line the work of Monkey Hill has been carried forward with all desirable activity; and up to the commencement of 1883, 20,000 to 25,000 cubic yards have been each month carried to the *Terre-plein*.

The exterior contour of the *Terre plein* being exposed to the action of the waves, is protected by rip-rapping; to procure the necessary stone a quarry has been opened on the west side of the Bay of Limon, at Kenny's Bluff. The working of this quarry was for some time in the hands of several American sub-contractors, but it became necessary to cancel these contracts, the parties failing to meet their obligations. The same thing was attempted at Monkey Hill but did not result in good. It is desirable that the canal company, taught wisdom by a series of similar disappointments, should end by recognizing the fact that they can with safety depend only upon the co-operation of its European employes, generally capable, devoted and carefully chosen, rather than upon strangers of whom it knows neither the aptitude, good will or antecedents. Kenny's Bluff under the company's direction sends each month about 1,600 cu. yds. of large stone blocks to the *Terre plein*. This is a small amount, but the difficulty of loading and transportation must be taken into account. The American contractors did not handle half this amount.

Having now seen where and how the material necessary for the construction of the *Terre-plein* is obtained, we will now describe the work itself.

The filling is almost completed, it covers an area of 74 acres reclaimed from a very low marshy soil, and from water almost 27 ft. deep. At the N.W. end the *Terre-plein* extends 660 ft. in length and has a mean width of 383 ft., forming a vast mole. The line of quay proper for the landing of ships, and which shelters this mole, is 3,070 ft. long, or rather will be when the necessary dredging is finished. At present there is upon the inside of the mole a wharf upon wooden piles, measuring 445½ ft. along the sea front, which is reached by depths of water from 16 to 26 ft.; its width is 41½ ft. This will be finally entirely covered to protect goods just landed. This wharf is made up of 270 piles in 54 bents of 5 piles each; the bents are about 10 ft. apart; the piles in each bent are a little more than 8 ft. apart. The piles are driven to a solid bottom in a bank of coral; they are shod, and covered with sheets of