Effects of Jets.

In 1826 a French engineer discovered that when a jet of gas flows through an orifice or nozzle under pressure, and a plate be held normal to the axis of the jet at a certain height above, it is repelled, whereas if held lower it is attracted; and there is a neutral point at which it is supported on the jet, and emits an audible note as it oscillates about this position of equilibrium. M. Th. Vautier has recently succeeded in evoking very high sounds in this manner and registering them. With a jet of steam having a pressure in the boiler of 4½ atmospheres, and issuing from an orifice of 2·7 mm. in diameter, against a plate 6 mm. in diameter and 1½ mm. thick, held 0·2 mm. from the orifice, the note obtained was La^6 sharp=7,250 single vibrations per second. An electro diapason was employed to register the vibrations—by means of a sharp style tracing a line on smoked mica.

To Europe in Less than a Week.

QUEENSTOWN, May 2.—The Guion Line steamer Alaska, Captain Murray, which sailed from New York on Tuesday, April 25, at 1:12 P.M., for this port and Liverpool, passed Fastnet at 3:20 o'clock this afternoon, having made the passage in 6 days 21 hours 46 minutes. The company claim that this is the fastest passage ever made by several hours.

The Inspection of Foreign Passenger Ships.

A bill was recently passed by the House of Representatives requiring the inspection of foreign vessels carrying passengers from American ports; and it is to be hoped that the Senate will not fail to pass a similar bill, as it did at the last session.

The urgent need of such inspection was forcibly stated by the representative from this city, the Hon. S. S. Cox. In the course of his speech he arraigned particularly a steamship company whose practice has been to use in the West India trade vessels whose extreme age and rottenness made it impossible for them to pass inspection anywhere. Flying a foreign flag, however, they were free from inspection in the ports of the United States, and were thus continued in service long after they had ceased to be fit to go to sea. Of this class of vessels the Bahama, which went to pieces in a slight gale off our Florida coast last summer, was a fatal example.

Mr. Cox pointed out the startling fact that during the past year the loss in vessels flying the British flag was $900,000,000. There were 144 steamships lost—151,000 tons!—with a total loss of life amounting to 1,459. Every day last year 5 vessels and 4 lives were lost on all the seas by reason of such disasters. Many of these losses were from foundering, overloading, bad stowage, structural defects, and bad machinery. Six vessels were abandoned at sea because they were utterly unfit. "So long," he said, "as we allow English vessels to escape inspection in our harbors we share the responsibility of this terrific loss of life. No life-saving service of ours which concerns stranding can guard against the body of these losses."

The bill passed provides that Section 4400 of the Revised Statutes of the United States be amended and enlarged by adding thereto at the end of said section, as it now appears, the words:

"And all foreign private steam vessels carrying passengers from any port of the United States to any other place or country shall be subject to the provisions of Sections 4470, 4471, 4472, 4473, 4479, 4482, 4486, 4488, and 4489, of this title, and shall be liable to visitation and inspection by the proper officer, in any of the ports of the United States, respecting any of the provisions of the sections aforesaid."

Boiled Milk.

To distinguish boiled milk from fresh milk the smell and taste are called into requisition, but only the experienced succeed in this. Quevenne's assertion that boiled milk does not coagulate as soon or as completely as unboiled is frequently incorrect. According to C. Arnold, in the *Pharmaceutische Archiv*, if a little tincture of guaiac is added to fresh milk a more or less intense blue color will appear at once or in a few minutes, and last a long time. More than twenty different sorts of milk were tried, and all gave the reaction without exception. By carefully warming the milk to 40° or 60° C. (104° to 140° Fahr.) the reaction took place at once; and also at 70° to 78° (158° to 172° Fahr.) it took place, but more feeble. Milk warmed above 176° Fahr. (80° C.) remained uncolored when guaiac solution was added, either to the warm milk or after cooling. Milk once cooked did not show it, neither did condensed milk.

The reaction with tincture of guaiac is so delicate that one drop of milk added to a trace of the tincture on a watch glass, or a drop of milk on filter paper, turned blue when rubbed with a glass rod dipped in guaiac tincture. Sour milk also gives this reaction, but the addition of mineral acids and caustic alkalies destroys it.

According to some further experiments which he made

SECTION OF ENGINE CYLINDER.

this reaction must be due to ozone in fresh milk. It must also be mentioned that emulsions of olive, castor, linseed, and poppy seed oil, made according to the pharmacopœia, also blue the tincture of guaiac.

That this reaction agreed with that of other emulsive liquids caused the experimenter to examine whether milk and blood did not possess a common reaction. In fact, fresh milk, as well as boiled, acts as a carrier of ozone just like blood corpuscles, etc. If old oil of turpentine is added to a mixture of iodide of potassium starch and milk, a blue zone is formed at once where the layers are in contact, and rapidly spreads. Milk that has been boiled a long time does not give the reaction for several minutes, and at this length of time a mixture of turpentine and iodide of potassium starch frequently turns blue without any ozone carrier. Milk from which the albuminoid bodies have been removed no longer give the reaction.

If caustic potash and a trace of sulphate of copper solution is added to fresh milk, from which the casein has been removed by acetic acid, the violet color characteristic of peptones no longer appears. When the milk has been standing ten to twenty hours the continual increase of the peptones is indicated by the violet color growing all the time more and more intense.

COPPER IN BREAD.—The author concludes that wheat normally contains copper to the extent of 8 to 10 parts per million. He has experimented with grain, the seed of which had not been "pickled" with sulphate of copper (as is often done to prevent smut), and has satisfied himself that the copper was not due to any impurity in his reagents, or to the gas pipes and burners.—*Jules Van Dens Berghe.*

A NEW STEAM ENGINE.

We give engravings of several forms of an engine that marks a new departure in steam engineering. These engines are new in form, and embody features in their internal construction which distinguish them from all others. The principal novelty is in the valves and valve motion; the valves being located inside the cylinder, and the valve motion being such as to insure a quick opening and closing of the valve at the most favorable time. The ports communicate with the interior of the cylinder near opposite ends, and the exhaust and induction ports are, in the present case, placed diagonally opposite each other. In the future, however, it is designed in the larger sizes of engine to place two supply and one exhaust port at each end of the cylinder and on opposite sides of the valves, so as to insure a perfect equilibrium of pressure, and so to relieve the valves from friction.

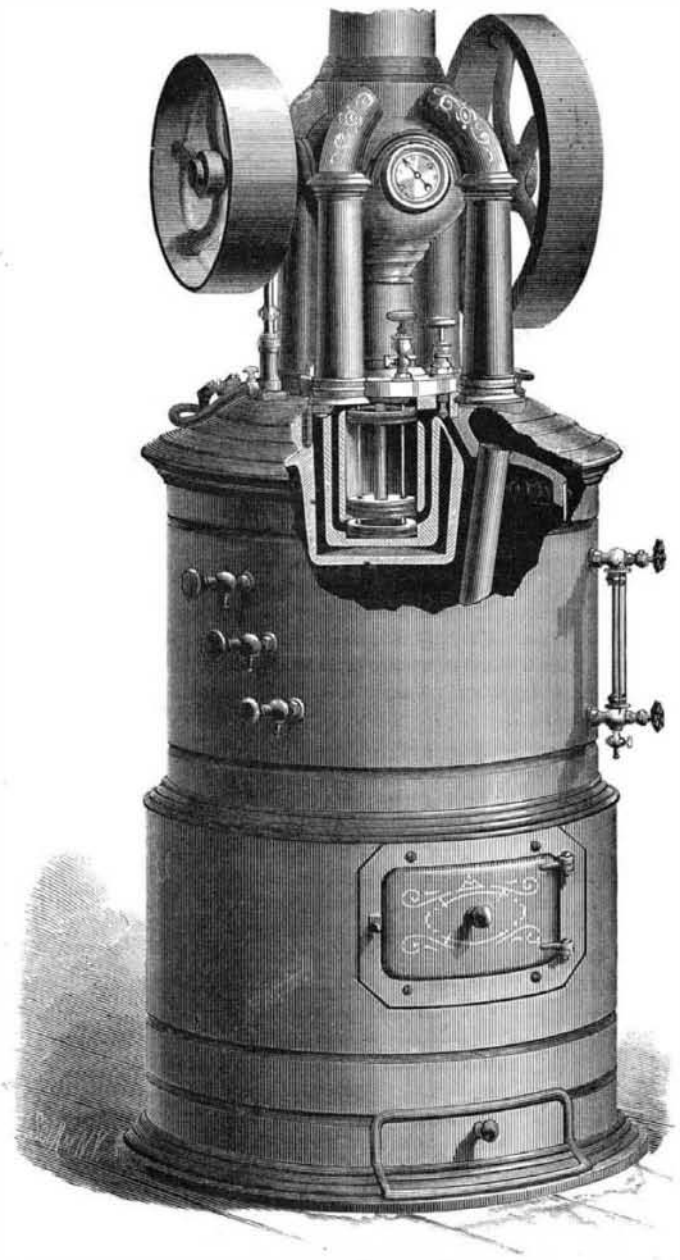
The valves consist of two rings, one placed at each end of the cylinder in an annular cavity between the inwardly projecting heads of the cylinder and the inner surface of the cylinder. The two valves are connected together by rods, which project through the top cover of the cylinder, and are connected with a rocking lever having forked arms, which straddle the engine shaft and carry rollers engaged by a cam on the main shaft, which moves the valves one way and the other.

The steam, at boiler pressure, is admitted by the valves directly into the cylinder without the loss due to steam contained in the ports and steam passages of engines as usually constructed. This is an important advantage, especially in quick running engines, since every half revolution of an ordinary engine is accompanied by the loss of a quantity of steam contained in the steam passages, and this loss, happening perhaps hundreds of times each minute, amounts, in the course of the day, to a considerable percentage of the steam used.

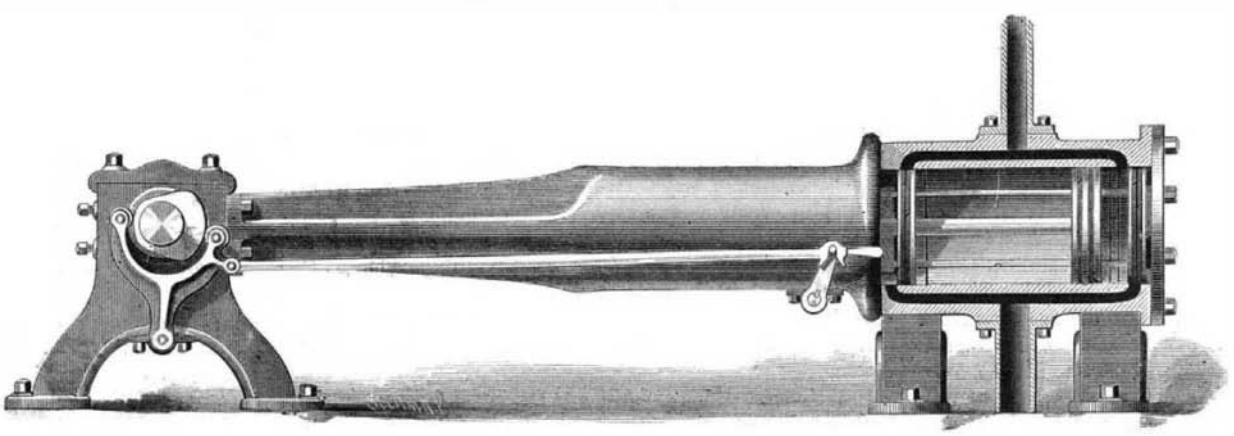
The ring valves are so related to the supply and exhaust ports that when the exhaust is open the supply will be closed, and *vice versa.*

In the engine shown in Fig. 1 the cylinder is seated on the top of the boiler and projects downward into a recess in the boiler top. By this means it is always kept warm, so that condensation is avoided. The screws and bolts are never brought into contact with steam or water; as a consequence all of the bolts may be readily removed when required.

The crank and valve gear of the engine are in a hollow globe having in opposite sides the bearings for the main shaft, and having cast together with its upper half, four flues communicating with the smoke chamber below and uniting at the top in a common flue, with which is connected the smoke pipe. The exhaust pipe of the engine extends upward through one of these flues, and discharges into the smoke pipe above, disposing of the exhaust steam and at the same time affording an efficient means of increasing the draught. The boiler of this engine has a number of flues leading directly to the smoke box, and several short flues leading from the fire box laterally to the jacket surrounding the boiler and communicating with the smoke box.



HUNT, HALSEY & BUDINGTON'S STEAM ENGINE.



HORIZONTAL ENGINE.

In the horizontal engine, shown in Fig. 3, the same general plan is followed, and in the locomotive engine, shown in Fig. 5, the construction of the cylinders and valves is substantially the same.

In the locomotive it is essential to provide a reversing gear; this consists

in this case of a spiral cam on the driving axle which is capable of rotating the valve actuating cam through a half revolution when moved longitudinally on the axle.

The advantages claimed for this engine are great simplicity in construction, an increased economy in the use of steam, and a consequent saving in fuel, and important saving in the cost of manufacture.

This improved engine is covered by several patents owned by Messrs. Hunt, Halsey & Budington. Further particulars may be obtained by addressing Mr. Thos. G. Budington, 542 Washington avenue, Brooklyn, N. Y.

CHRONOGRAPH FOR ENGINEERING PURPOSES.

BY W. R. ECKART, C. E.

In the chronograph illustrated the tracers, both for recording seconds as well as the velocity curve of the engine, are made of flat strips of spring steel, the axis of each being pivoted at the end on adjustable screw centers to prevent lost motion. By means of a small steel wire and weight extending to the opposite side, the tracers can be made to bear as lightly as desirable on the paper, and when properly adjusted the pressure is only sufficient to remove the lampblack with which the paper is coated without touching the paper, thereby leaving a fine white line on the dark background with the least possible interruption of motion. The whole is permanently set by dipping the face in shellac.

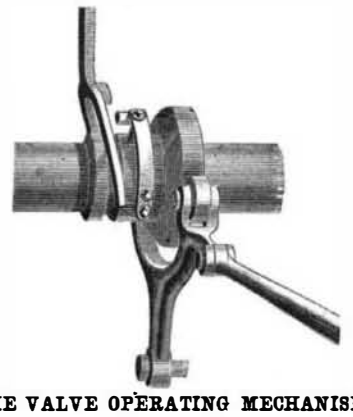
Instead of using a pendulum for producing (through an electro-magnet) the marks spacing seconds on the paper, some other method that would admit of compactness and portability was found necessary, as the chronograph was to be used not only on the surface where the pumping engines were situated, but had to be adapted to underground use.

After numerous experiments, the use of a chronoscope (or timer), such as is to be had for timing horse races, was made to give satisfactory results. (See Fig. 1, front page). A stand or base plate upon which the timer was placed had a brass stanchion suspending a fine platinum wire directly over the second hand; this wire, when at rest, bore on a piece of platinum inserted in a rubber insulator projecting from the stanchion, each of these wires being connected through the electro-magnet on the chronograph to a two-cell battery. A circuit was always formed, except when the hand of the timer, revolving once every second, swings the suspended wire free from its metal bearing at the apex of the triangular notch cut in the rubber guide piece; as contact was broken every revolution of the second hand, the armature of the electro-magnet recorded the same by a side movement of the steel tracer resting on the prepared paper of the drum. The suspending wire was made adjustable to suit the second hand, and the instrument was covered with a glass case.

Mr. Briggs states in a paper read before the Franklin Institute that Prof. Hilgard used a chronoscope for the Navy Ordnance Department, in which the second marks were 30 inches apart. I have found no trouble in speeding the revolving drum of 6" diameter, until the second marks were 20 inches apart, but for practical use, a length of three to ten inches (depending somewhat on the engine speed), was all that was desired, and by use of a standard steel scale with the inch divided into hundredths, changes of motion taking place in the one one-thousandth part of a second were easily read and recorded without trouble, and the crossing of lines due to the too frequent revolution of the recording drum during one stroke of the engine was avoided. The use of the small electro-magnet, on the tracer carriage, to raise for an instant the tracing pointer off of the drum at any desired point, was found necessary in determining the effects of elasticity in the interruption and variation of motion, where a *long* line of pump rods was used, and was also found useful in fixing, positively, the exact point of closing or opening of the steam valves of the engine independent of all reference to the indicator cards taken.

Two drawings giving different views of the chronograph as constructed and used, are attached to this article, exhibiting details of construction to complete what otherwise might be considered a defective description of the instrument.

The instrument has been successfully applied to several of the different types of large pumping engines found on the Comstock Lode, such as direct-acting flywheel engines, geared pumping engines, and the "Davy engines;" it has also been used to determine the motion and relative motion of pump rods, and pumps some 2,500 feet below the surface engine driving same, and at intermediate points. The results are exceedingly interesting and instructive, and as numerous indicator cards were taken from the engines and pumps simultaneously with the motion diagrams, nearly all conditions of motion and power, during the time under consideration, were definitely determined, and may hereafter form the subject of other papers when time will permit.



THE VALVE OPERATING MECHANISM.

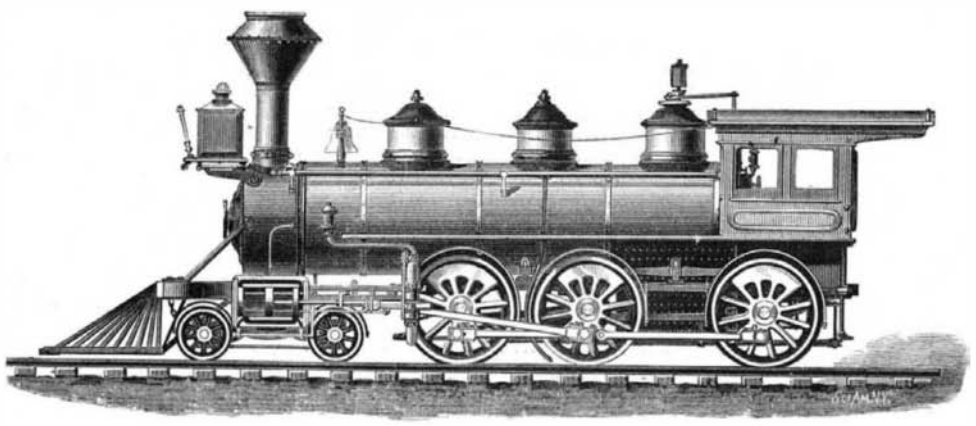
Some very important results of the elasticity of long pump rods are clearly set forth in one case: A rod at a point 1,800 feet below the surface showed a positive pause, while the engine driving it was nearly at its point of maximum motion, and pumps attached to the rods may have and do have strokes in excess of or deficient to the *stroke of engine driving same*, and to an *important extent*. Hence, I think, it can be definitely stated that any consideration of motion of pumps, or discharge capacity of same, driven by a long line of pump rods based upon the motion or stroke of a surface engine alone, will in no way be even approximate, unless the elasticity and effects of counter-balancing by balance bobs on that elasticity is also considered.

The effects of different degrees of compression upon the engines and motion of the pump rods in passing the centers have been considered, and the diagrams clearly show the importance of considering it in connection with the strength of the rods and balance bobs.

The latest use of the instrument in conjunction with an engine test has been to determine, if possible, the rate of condensation of steam per second, in the steam cylinders of a pumping engine, where the change of motion due to each fractional part of the stroke was determined. Also, a ten hour experiment trial, to show the economy of compression as compared with a ten-hour trial of the same engine on the succeeding day where no compression was used (otherwise all conditions being similar), has been made, when changes of velocity of piston were determined by the chronograph.

While it is well known that a Committee of the British Association applied a chronograph of Morin's type in 1843–4, to the determination of the velocity of piston for a Cornish Pump Engine, I believe there was no application of the instrument to the rods below ground, and, from published records at my command, I am led to believe that this is the first application of a chronograph of sensitive construction ever made to pit work, and the other purposes so briefly mentioned.

DESCRIPTION OF DRAWINGS. — C C, cast iron base plate, covered with sheet brass, upon which the mechanism is secured. B, metal frame containing gearing for driving drum, A, and escapement wheel, *b;* motion communicated by means of adjustable weights, D. A A, light brass drum, accurately balanced, revolving on friction rollers, 8, 8, at both ends. *f f*, parallel guide bars upon which the tracing point, h_0, and its carriage travel back and forth, receiving motion in one direction from the engine or other moving parts, through the cord, P, passing between the bars, *f*, and attached to the tracing carriage—the return motion is derived from a coiled spring in the spring drum, C. *e e*, small electro-magnets on tracing carriage for raising the tracing point, h_0, off of the paper and replacing it at any desired point to be especially observed. *d*, electro-magnets on separate carriage, *k k*, adjustable on parallel bars, *f*, operating the steel tracing point, *g*, attached to the armature of *d*, for the purpose of recording seconds on the margin of the paper or at other parts of same as required. *i*, chronoscope or watch supported on frame, X, the second hand of which swings the light platinum wire, J, breaking contact with the insulated wire, *k*, thereby breaking circuit with *d*, and recording seconds through the tracing point, *g*, on the paper. *g*, adjusting screw for the wire, J. *a*, steel spring of escapement. This spring is securely clamped in Y, its flexibility being controlled to a certain extent by means of the thumbscrews, *o* and *p*.



HUNT, HALSEY & BUDINGTON'S LOCOMOTIVE.

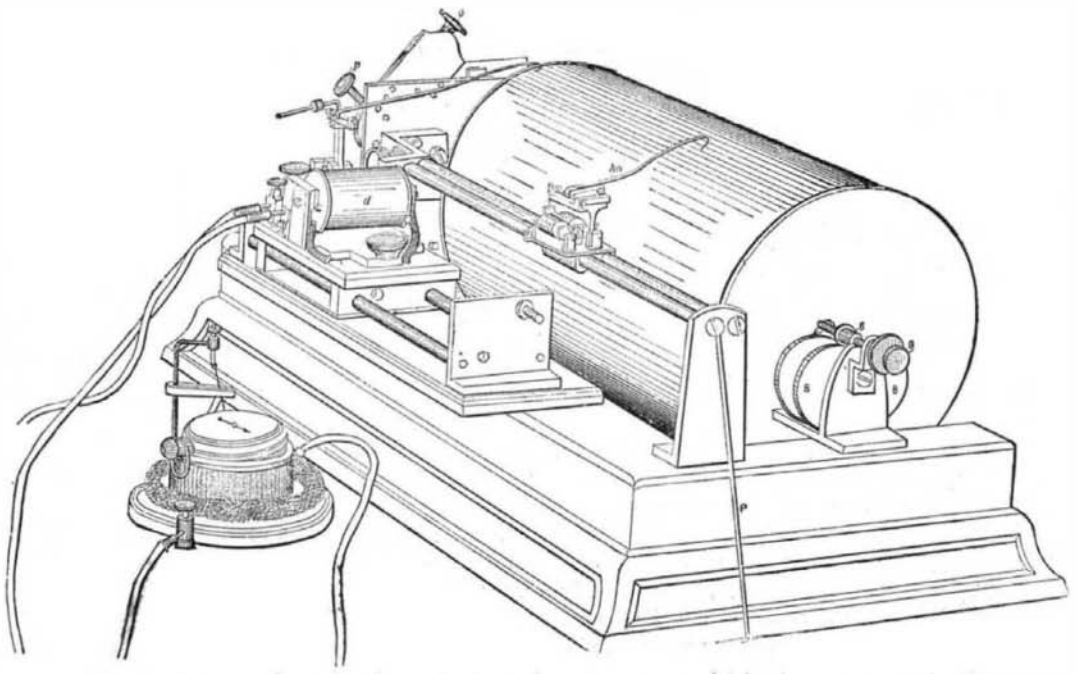


Fig. 2.—CHRONOGRAPH FOR ENGINEERING PURPOSES.

De Lesseps's New Project.

The French Cabinet Council has approved the scheme of M. de Lesseps for cutting a canal through the neck of land dividing the Gulf of Gabes from the salt marshes and low lying parts of the Desert of Sahara to the south of Tunis. It is expected that the sea will in virtue of this cutting once more fill up a considerable portion of the Sahara. The political advantage to be obtained by the scheme if it succeeds will be the insulation of Tunis and Algeria by creating a water barrier between them and Tripoli. The cost of the canal, it is estimated, will be 65,000,000f.

The Denver Mining Exhibition.

The National Mining and Industrial Exhibition to be held in Denver, Colorado, during the months of August, September, and October next, is intended to do for mining and related industries what the cotton fair at Atlanta, last summer, did for the industries there represented. The intention is to exhibit specimens of all the mineral products of this country, and especially the royal minerals, gold and silver, in connection with the machinery used in extracting and milling the ores, in such a manner that visitors may secure at a glance an idea of the vast mineral resources of the continent.

It is proposed to collect ores and minerals from every mine in the United States in such quantities that the exhibits will represent the average character of the mines from which they are taken. Accompanying the ores are to be charts of the mines, with detailed information of the assay value of the ores, the yields, process of milling, and the geological formation of the ground from which the ore is taken. The exhibits will be classified in States and districts, and each district will have its representative machinery on exhibition, showing the methods of working best adapted to different kinds of ore.

For the purpose of carrying this scheme into effect a company has been formed under the laws of Colorado, with a capital of $200,000, and of this amount $100,000 has been subscribed in the city of Denver alone. The company has purchased 40 acres of land in Denver, and a contract has already been made for the construction of a permanent exhibition building. This structure is to be 500 feet long and 316 feet wide, with large galleries and spacious windows, designed after the National Museum at Washington. It is to be constructed of stone, brick, iron, and glass, and the estimated cost is $135,000. An illustration of the proposed building was given in the SUPPLEMENT last week. The exhibition fund of $200,000 is now being raised.