

IMPROVED VERTICAL ENGINE.

This type of engine is one that is growing in favor in some sections as an agricultural engine for light work. It has advantages over the horizontal engines in several important particulars, one of which is its ease in being set in position to connect with grain separators for thrashing. Unlike the horizontal engine, it is not requisite that it be set perfectly level, and it can be much more easily placed in position ready for work. The engine is also motionless in running, as the truss-like shape of the mountings makes it so solid that there is no motion. This is an advantage that cannot be attained in a horizontal engine to the same extent.

This style of engine can also be built with less weight for the same power than a horizontal. The engine is made with a dome on the top, arranged so that all of the flues and top flue head are kept covered with water, making a steam chamber that superheats the steam and tends to produce dry steam. All the material used in the construction of this engine, with the exception of the door frame and grate bars, is of the best quality of charcoal boiler iron, with the best lap welded boiler flues. A large amount of heating surface is allowed for the cylinder used, so that the fire need not be forced. The boiler has a large number of flues, and a complete circulation, in consequence of which the amount of fuel per horse power developed is reduced to the very lowest point attainable with a slide valve engine.

It has been the aim of the builders to make an engine with as few parts as possible, and arrange it so that it could be

safety valve, and also with a spring valve, which insures safety, and is also very useful in filling the boiler. A steam blower and steam whistle are furnished; also a steam flue cleaner, which will instantly clean the flues.

As will be seen from the engraving, the engine is extremely simple, all parts being within easy reach of the operator. The boiler has good clearance from the ground; the mountings are so constructed that they give great strength, and likewise permit of easily turning the engine. A substantial brake is furnished with each engine. A strong seat, tool box, double trees, neck yoke, and fire irons are also furnished. This engine is built as an agricultural engine in three sizes, 6, 8, and 10 horse power; it is built on a base as a 5, 6, 8, and 10 horse power. Wherever it has been introduced it has gained many friends.

This company also manufactures in horizontal engines the Dry Steam portable, Climax portable, and the Tiger portable, varying from 2 to 40 horse power—three distinct styles; their cut-off engines, class A and B, from 12 to 250 horse power; the Climax and Tiger stationary engines, and five sizes of patent sawmills.

Further particulars may be obtained by addressing the Taylor Manufacturing Company, Chambersburg, Pa.

New Secondary Battery.

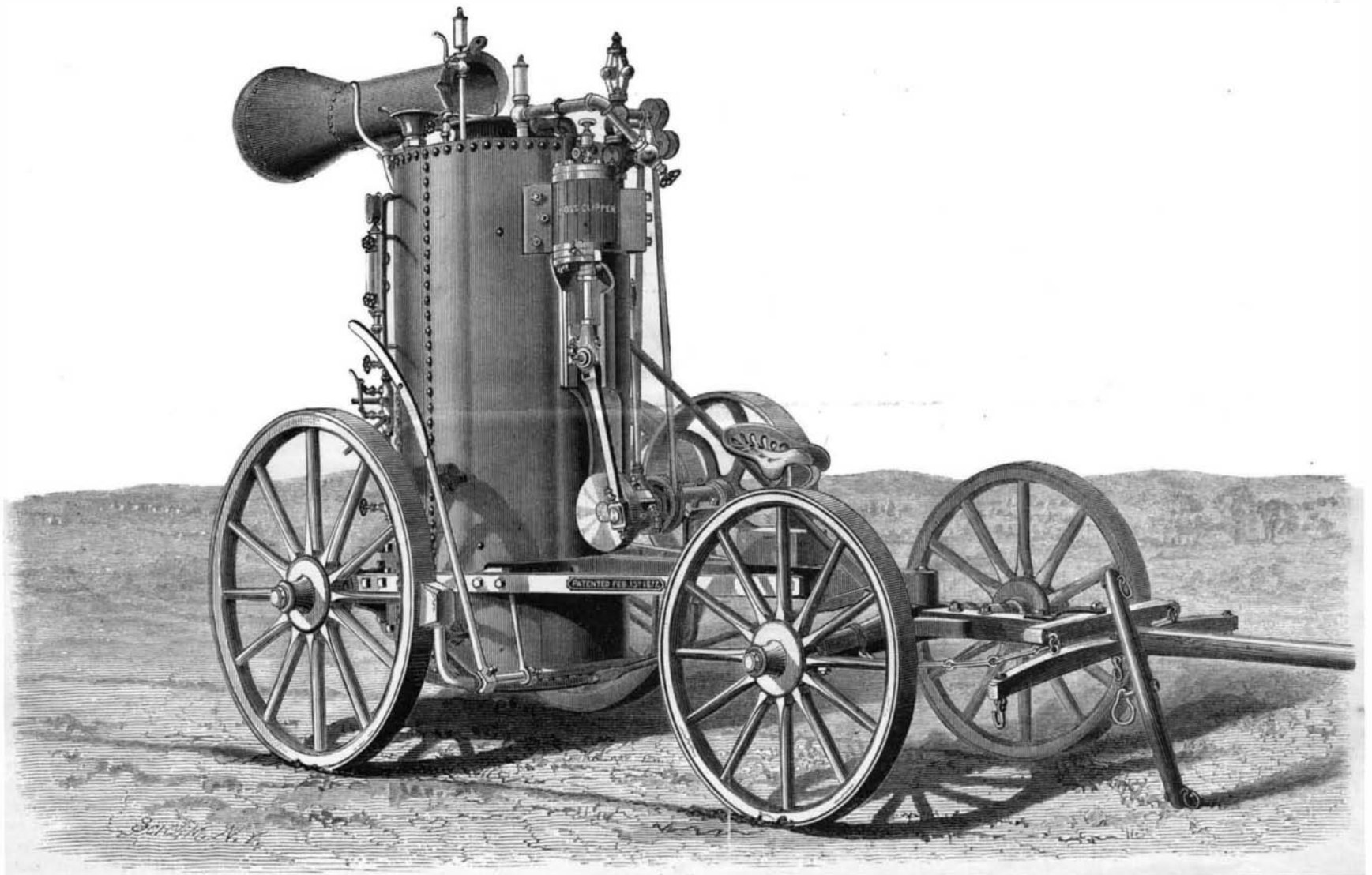
An important improvement in electrical apparatus, by Mr. George Grout, has recently been exhibited and explained by him before the students of the College of Practical Engi-

plained to the students the identity of the principles which govern the production and action of electricity with those which underlie the whole fabric of engineering science. Several electric lights were shown of absolute steadiness and great brilliancy, and it was explained that there is nothing to prevent electricity from now being supplied, like gas, by meter, not merely for the production of light, but for the convenient and economical generation of power.

Solutions of Salicylic Acid.

As the result of an extensive series of experiments with solutions of one liquid in another, Alexeff has established the law that all liquids which perceptibly dissolve in each other will mix under certain circumstances in all proportions.

Alexeff has recently extended his experiments, as described in the *Journal für praktische Chemie*, to the solubility of solids at ordinary temperature. When experimenting with salicylic acid, he found that this acid would dissolve in water in all proportions, if heated in sealed tubes to a temperature a little above the boiling point of water. When these tubes cool, the acid sometimes separates as a crystalline magma, sometimes as an oily liquid. The former is the case with all solutions when rapidly cooled, and in solutions containing over 66 per cent of salicylic acid, even if cooled slowly to 153° Fah.; while those which contain 61 to 4.57 per cent yield an oily liquid at temperatures from 194° down to 145° Fah. This seems to prove that



THE "BOSS CLIPPER" VERTICAL ENGINE.—MADE BY THE TAYLOR MANUFACTURING COMPANY.

more easily operated by persons inexperienced in the use of steam than the ordinary agricultural engine. It will be seen from the cut that the engine frame, guides, cylinder, and steam chest are cast in one solid piece in girder shape, giving the most strength with the least iron. This style of frame makes it impossible for the guides to get out of line with the cylinder, and avoids a complication of parts. The crosshead is made with adjustable gibs at the side, substantially held in their place by a bolt on each side of the crosshead; the crosshead is provided with a steel pin with taper ends, fitted so as to take up all lateral motion, and is fitted with a self-oiler that oils through the pin. The connecting rod is made of the best hammered steel, with solid ends fitted with phosphor-bronze boxes. The crank pin is made large, allowing plenty of surface and preventing the possibility of heating. The crank shaft is of steel, with a solid disk forced on shaft by hydraulic pressure to make a perfect and tight fit. The valve is the usual D-valve, proportioned on correct principles. Steam ports are large and distance to the cylinder short, insuring good results for a quick-acting engine. The cylinder is fitted with adjustable packing that requires no attention—a very desirable feature in an agricultural engine. The governor has a stop motion, speeder, and Sawyer's valve attachment, and is sensitive and very economical in the use of steam; if the belt breaks when under full headway, the governor shuts down and stops the engine. No pump or heater is used on this engine, but in their place the most improved steam feed is used, whereby the boiler is filled without running the engine. The boiler is fitted with a pop-

neering at Muswell Hill, Eng. This improvement consists of a new secondary battery, presenting several features of superiority over those of Planté, Faure, and others. It is well known that in an ordinary galvanic battery the electricity is generated by the oxidation of a metal—generally zinc—whereas in a secondary battery the metal is in the state of an oxide to begin with, but is deoxidized by a current of electricity, usually obtained from a dynamo machine, and by the subsequent oxidation of this recovered metal nearly the whole of the electricity expended upon the deoxidation is reproduced. In Planté's battery the metal employed is lead, which is allowed slowly to oxidize by immersion in diluted acid, so as to form the organism of the battery. But in Faure's improvement upon this a coating of oxide of lead is laid upon the metal, by which a great saving is effected in the time necessary for the creation of the battery. In Mr. Grout's plan a central core of lead is introduced into each cell, and this core is surrounded by a layer of enveloping charcoal, among which finely divided lead has been disseminated so as to pervade every pore, and the immense area of the leaden film thus presented for oxidation facilitates the process and correspondingly increases the quantity of electricity generated. The metallized charcoal may, if desired, be moulded into plates like those of an ordinary galvanic battery, or it may be applied in other forms; the only material point, in all forms alike, being the great extension of the oxidizing surface. Mr. Grout showed in operation a secondary battery of 26 cells deoxidized by a dynamo machine of the Brush construction, and he ex-

such solutions separate, as they cool, into two liquids; the upper one is salicylic acid dissolved in water floating upon the heavier and highly refractive solution of water in liquid salicylic acid.

Analyses of the solutions showed that water saturated at 54½° Fah. contained only 0.16 per cent of acid; at 151° it contained 1.27 per cent; at 179° it contained 2.44 per cent; and finally at 212° it contained 8.67 per cent of acid.

Hence there may exist at temperatures between 145° and 195° three different solutions, according to circumstances, namely: a solution of water in salicylic acid; a solution of the acid in water, from which the liquid acid separates on cooling; and finally a solution of salicylic acid in water, which deposits crystals on cooling.

The two last named may be called isomeric in so far as they have the same composition, but at one time deposit the liquid acid and at another the solid. It may also be assumed that all solutions made at temperatures below 212° contain the solid acid, while those prepared at higher temperatures contain the liquid.

Alexeff thinks that these observations prove the incorrectness of the idea that all substances are liquids when in solutions, and that their state of aggregation has no influence on the solubility.—*Erf.*

DURING the past three years ivory has risen at least 100 per cent in value, and pearl, which is also largely used in hafting cutlery and other goods, has advanced very materially in the same period.

Self-operating Wire Rope Tramway.

A description has recently been given in the German technical press of a wire tramway in connection with the coal mining industry established near the Hersteigg, the products of which it brings to the main line belonging to the Southern Railroad of Austria. In its alternating rise and fall during its distance of 3,000 yards, there is a useful excess of incline of about 142 yards, which, it is said, suffices to keep the line in self-acting working, after it has been started by means of the twelve horse power engine provided for that purpose. When there is no return load to be sent to the mine, the speed of the line can be regulated by a brake. Under these circumstances, the cost of working the line is estimated at about 4½ cents per ton of coal.

In its general arrangement, the tramway forms a straight line, and consists of two drawing ropes and the train rope. The line which is used for conveying the coal to the station is 1·10 inches thick, and is composed of nineteen steel wires, each 0·18 of an inch in diameter. The line on which the coal buckets are returned to the mine is only 0·66 of an inch thick, the nineteen steel wires of which it is composed being only 0·13 of an inch thick. Both ropes consist of wires about 765 yards long, coupled to each other, and for the ropes a breaking strength of 73 tons per square inch section is guaranteed. At the ends of the ropes, weights of 5 and 3 tons are applied in the usual way for obtaining the proper tension. The distance between the seventeen supports varies from 60 to 400 yards. The train rope is 0·6 of an inch thick, and consists of twelve soft steel wires, of 0·07 of an inch diameter, and runs at a speed of about 1½ yards per second. The buckets which convey the coal follow each other at a distance of about 83 yards; thus thirty-six are always on the way to and the same number coming from the station. Each bucket contains about 10 bushels, or about a quarter of a ton of lignite, the total quantity carried per hour being about 17½ tons. The cost of the line was about \$14,000.

Pile Driving by Dynamite.

In the course of executing some municipal works at Buda-Pesth, the piles already driven were required to stand a greater load than had been originally contemplated. It was, therefore, necessary to test them, and drive still deeper those that yielded. On account of the expense of bringing a pile driving machine successively over each pile for so little work, it was determined to try the effect of dynamite; and the city engineers applied to Colonel Prodanovic, of the Second Regiment of Austrian Engineers, to carry out the experiments.

According to the *Wochenschrift des Oesterröichischen Ingenieur und Architekten Vereins*, the piles were cut square, and a wrought iron plate, 15 inches in diameter and 4¾ inches thick, was placed on the top of each. On its center, and immediately over that of the pile, was placed a charge of No. 2 dynamite, in the form of a cake, 6 inches in diameter and three-fourths inch thick, and weighing 17½ ounces avoirdupois. This was wrapped in parchment paper, covered with clay, and fired. The effect produced was found on an average to be equal to five blows from a 14¾ cwt. monkey falling from a height of 9 feet 10 inches. The iron plates stood from twenty to twenty-four explosions. The system is not considered applicable to a pile standing considerably out of the ground, but saves a great expense when piles already driven have to be sunk deeper. In this country gunpowder has been used for many years, particularly in Philadelphia, for pile driving, though employed generally to drive the monkey upward.

DR. THOMAS TAYLOR, of Washington, has made some investigations, which convince him that the common house-fly, aside from being an annoying pest, is possessed of the capacity of transmitting disease by carrying the germs from place to place.

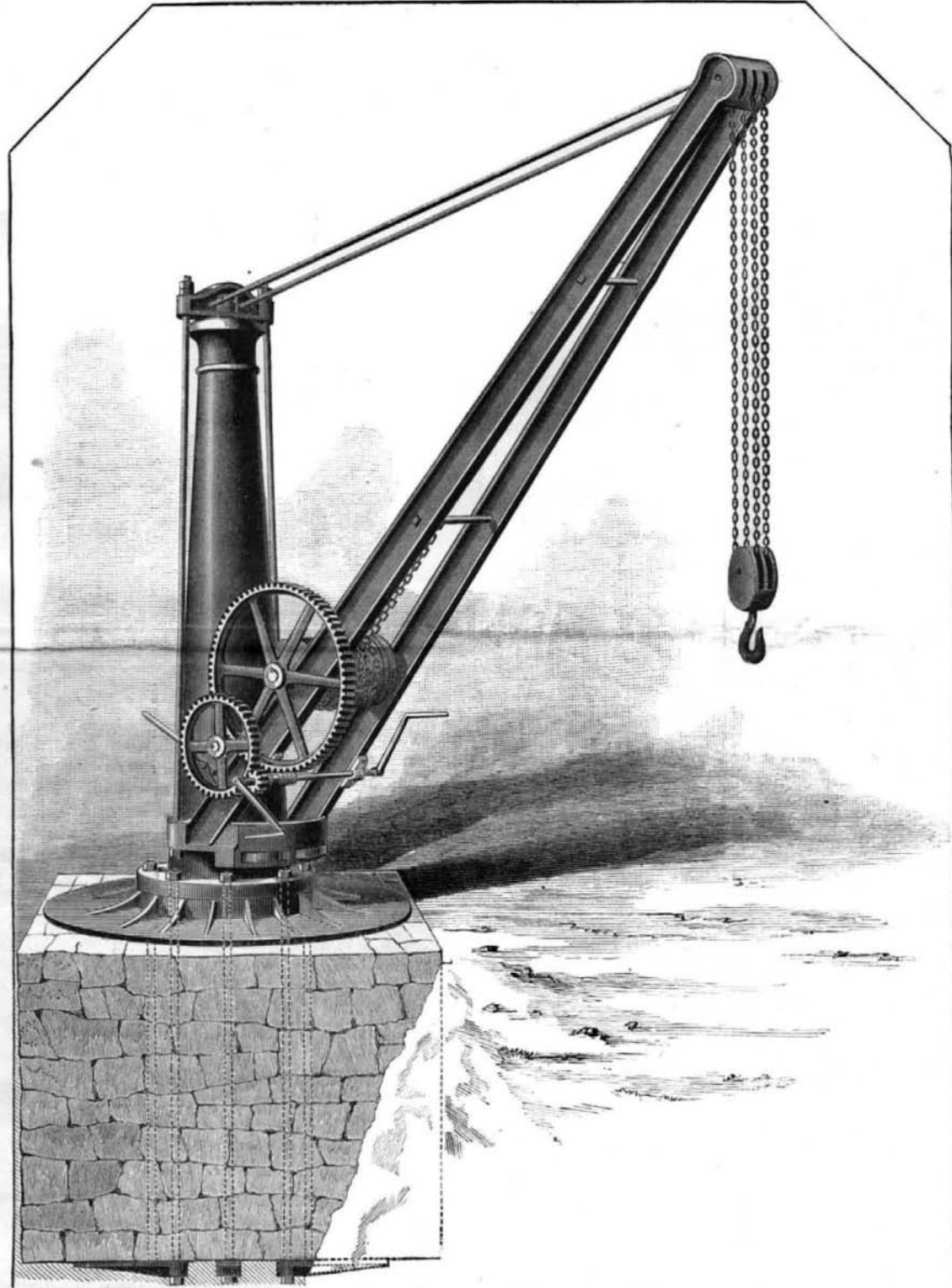
IMPROVED RAILROAD CRANE.

In the powerful crane shown in our engraving the post is a dry sand casting in one piece. The bottom of the post and the deck plate upon which it stands are carefully faced up, making a fitted joint, and they are held together by the foundation bolts, which extend through the stone foundation to the anchor plates at the bottom.

A hub is fitted into the top of the post with a large pin, on which the jib turns, the jib being secured by rods to the yoke, which turns freely on the pin. The yoke also takes two vertical bolts, which go through the shoe casting at the bottom. In the shoe are two turned cast iron wheels, which track around a turned belt on the post, so that the jib turns very easily, having the friction only on the upper pin and the wheels.

The jib consists of two wrought iron beams, which are bolted at the top and bottom to the bonnet and the shoe, and is provided with stay bolts between.

The gearing is double, with the pinion on the crank shaft, which works into either gear for fast or slow motion, or at



RAILROAD CRANE MADE BY THE FARREL FOUNDRY AND MACHINE COMPANY.

half way between both blocks, or the pinion can be slipped out of both, so that the load can be lowered by the brake without causing the crank to turn.

The chain barrel is a hollow casting with spiral grooves around the outside, in which the chain follows. All of the moving parts are so simple that they cannot get out of order.

BBB crane chain is used on all these cranes, and the sheaves in the bonnet have roller bushings, and require no oil. The crane is very simple, and may be used by anyone; and wherever it is in use it gives perfect satisfaction. They are made in the following sizes, viz., 4, 6, 10, 15, and 20 tons capacity.

Further information may be obtained by addressing the Farrel Foundry and Machine Company, Ansonia, Conn.

AN excellent soap-bubble preparation is composed of oleate of soda and glycerine, and from it bubbles two feet in diameter and of exceeding brilliancy can be blown. Some of these have been kept forty-eight hours under glass.

Phosphoric Acid.

The author proposes a method for the direct determination of phosphoric acid from the weight of the phosphomolybdic precipitate. The following conditions must be observed in precipitation: The solution must contain a sufficiency of free nitric acid. The molybdic solution added must be four-fold the volume of the phosphoric solution to be precipitated, and at least one-third of the molybdic acid added must be in excess of the quantity required for combination with the phosphoric acid. In every 100 c. c. of the volume of liquid after the addition of the molybdic solution must be dissolved 25 grammes ammonium nitrate. The precipitate of ammonium molybdic is filtered after standing for twelve hours, and is washed with a 20 per cent solution of ammonium nitrate, to which at the beginning of the washing one-thirtieth of its bulk of nitric acid is added. After removal of the greater part of the ammonium nitrate by means of water the contents of the filter are rinsed into a porcelain crucible, the matter adhering to the paper is dissolved in hot dilute ammonia, the solution is concentrated by evaporation, an excess of nitric acid is added, the solution is poured into the porcelain crucible, the liquid is evaporated away, and the ammonium nitrate expelled by gently heating over a flame placed below a wire gauze. The volatilization of the ammonium nitrate is found to be complete when a cold watch-glass placed over the crucible is not clouded. The ammonium phosphomolybdate is not decomposed if a needlessly high temperature is avoided. The residue is hygroscopic, and must be cooled in the desiccator over sulphuric acid, and quickly weighed in a covered crucible. The residue is said to contain 3·794 per cent phosphoric acid. O. Hehner, in the *Analyst* (iv., p. 23), criticises this process, and proposes a modification. A. Atterberg has determined the conditions in which the most rapid and complete separation of the ammonium phosphomolybdate can be effected. He finds that by boiling the solution with molybdic acid solution the phosphoric acid is precipitated in a satisfactory manner. The boiling is effected in a beaker of moderate size, stirring continually to prevent bumping. The heat is obtained from a naked lamp flame beneath a wire gauze. The precipitate settles very quickly, and can be at once submitted to further treatment.—R. Finkener.

Perils of Ballooning.

Information has been received in this city of the frightful death of two over-daring aeronauts in Madrid under peculiarly horrible circumstances. It appears that Captain Mayet and an assistant ascended in a balloon in Madrid, before an immense concourse of people, on January 28. When the balloon had reached a height of about 1,000 feet, Captain Mayet got out upon a trapeze suspended from the basket and began his performances. The trapeze was seen to break, and the performer lost his hold. While in the air he turned over and over many times. He struck the stone pavement an unrecognizable mass. A moment later the balloon containing the other occupant was seen to descend with meteoric rapidity, and it crashed with terrible force against the projecting eave of a house, tilting the basket and hurling the occupant out head first. Striking a veranda, the man was precipitated to the ground, torn, cut, and mangled to such a degree that he died in a few moments. Both the men were under engagement to Barnum, Bailey & Hutchinson, and were to perform in this city on March 26.

THE Canada-Atlantic Railway Company recently opened its line between Montreal and Ottawa for freight and passengers. An extension from Ottawa to Toronto is now in progress, and in less than a year will afford a competing line to the West. The company proposes to build a bridge across the St. Lawrence at Coteau Landing, so as to connect its line with railways to Boston and New York.