JACQUELIN AND CHEVRE'S STEAM EXCAVATOR.

In the accompanying engravings we illustrate a new type of excavator which has recently been experimented with at Fleurus, Belgium. It is the invention of two French civil engineers, Messrs. Jacquelin & Chevre. The experiments made with it, in the presence of a large number of engineers, contractors, and builders, gave so satisfactory results that we are warranted in giving a special description of the apparatus.

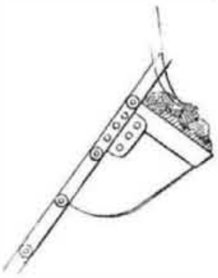


Fig. 5.

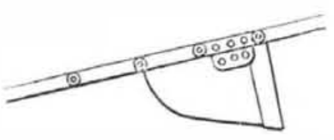


Fig. 6.

As well known, the buckets in the different styles of excavators are riveted to the links of the bucket chain, and consequently follow its inclination.

When the chain approaches the vertical (Fig. 5), the buckets are in a favorable position, and are capable of holding their contents; but, on the contrary, when it approaches the horizontal (Fig. 6), the material tends to drop out of them. For this reason, dredgers and excavators can perform their full effective duty only when the chain approaches the vertical, as in Fig. 5. For this reason, the excavators that are most employed and give the best results move over the natural ground along the margin of the cutting (Fig. 7). A bucket-frame, A B, whose inclination is varied by means of a jib, carries at its extremity two wheels over which the bucket-chains roll. The buckets empty their contents into a chute, which carries them to the cars. It will be seen that to employ such an excavator the natural ground must be leveled and prepared for the laying of tracks for the apparatus and cars. Now it is only in special cases that the ground permits of such a thing as this, and consequently of the use of this sort of excavator. In sandy regions the giving way of the earth at the edge of the ditch renders its use difficult. Supposing that the ground is naturally even, such apparatus can hardly be used for anything else than widening a trench that has already been opened in order to give the jib a proper inclination. If, in fact, it be desired to attack the ground

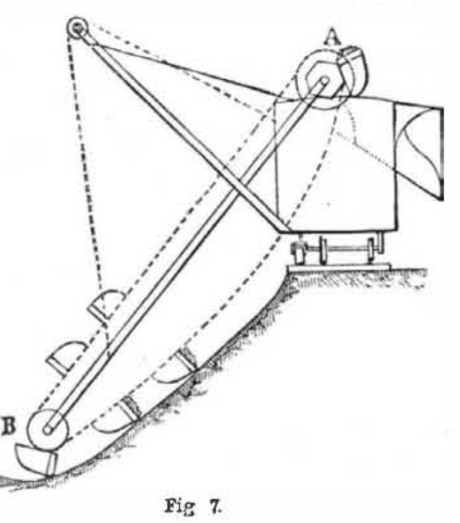


Fig. 7.

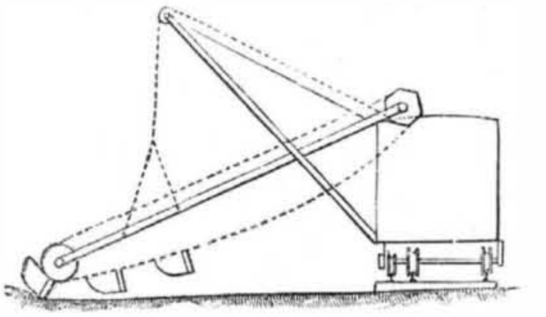


Fig. 8.

before a preliminary trench has been formed, the chain will take the position shown in Fig. 8; and the buckets, being in the position shown in Fig. 6, will lose a large portion of their contents. Supposing that a preliminary digging has been done, and that these apparatus are used as they should be, that is, in the position shown in Fig. 7, the bucket will act only as a consequence of the weight in general of the other buckets and the chain that hangs slack between the wheels. So when the ground is hard the edge of the bucket will slide over the surface, and the bucket will not fill well. The chain, moreover, is necessarily left slack between the bucket-wheels, so that when an obstacle is met with the bucket may jump it. If, in fact, an obstacle be met with at *a* (Fig. 9), the wheel, A, continuing to revolve, the chain, *m n o*, will tend to take the position *m n' o*, and then the bucket can go over the obstacle. It results from this arrangement, which is necessary in these apparatus, that the buckets do not attack the earth well, and that the chain is at every instant tautened and then suddenly slackened. Such shocks cause the material to fall from the buckets, and prove detrimental to their action. So these apparatus do scarcely more than fifty per cent of their effective duty.

As the apparatus just mentioned are scarcely able to operate except for widening, entirely new ones have lately been devised that work on the level of the ground that they are excavating (Fig. 6). These excavators are divided into two categories: those that operate sideways, and those that operate sideways and in a forward direction. The first of these, although ingenious, give but tolerable results, on account of the manner in which the bucket is attached to the chain. In fact, but a slight height can be operated upon under penalty of losing the excavated material *en route;* and if, in order

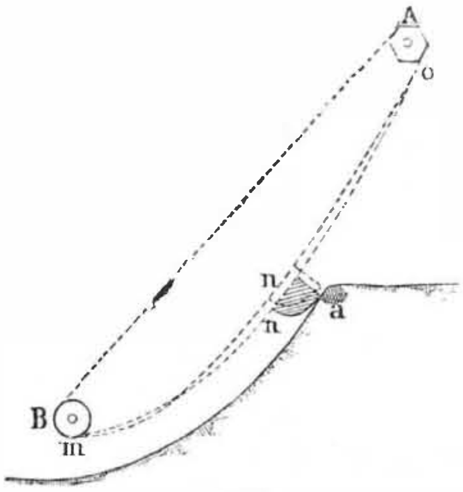


Fig. 9.

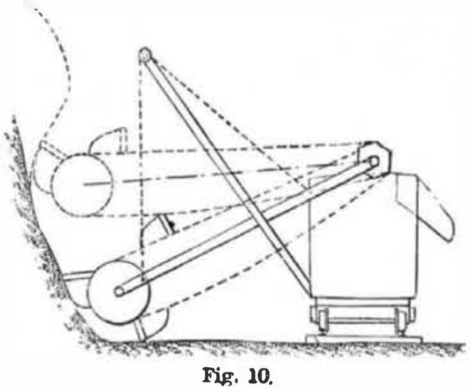


Fig. 10.

to attack a greater height (as is done in practice), we proceed to undermine the earth (Fig. 10), the jib becomes involved in the latter, and the apparatus comes to a standstill. The apparatus of the second category have the same drawbacks, but are nevertheless superior as regards their power of working in a forward direction.

Messrs. Jacquelin & Chevre's jointed-bucket excavator.—This apparatus can be employed in all cases where the exceptional hardness of the ground does not absolutely prevent the use of an excavator. The experiments with it at Fleures showed that it possessed the following advantages: It is capable of working sideways or straight ahead, and of moving over the excavated surface, thus permitting of laying tracks for it and the cars. Its work is continuous. The maneuver of the cars can be effected without loss of time. The arrangement of the bucket permits of excavating at a single operation a trench ten meters in depth.

These and other advantages are due in part to the mode of attaching the buckets to the chain—they, instead of being fixed to the links, being movable around a horizontal steel axis that connects the two chains, and consequently being able to assume different positions that are limited by two stops affixed to each side of them (Fig. 11).

Each bucket has at its lower part a roller that constantly revolves, during the work of excavation, over a strong guide fixed to the jib frame. Each bucket, upon passing over the lower wheel, begins filling, and finishes the operation upon reaching the upper wheel. The T-guide (Fig. 2 M'') terminates above in a cast iron piece which is connected with the axle of the bucket-wheel by means of a bearing, and is so curved that the roller, in revolving over this piece, successively lowers the bucket so as to cause the stops to rest without shock upon the projection of each chain.

When the bucket has reached this position it is carried along to the upper wheel, where, being stopped by the latter, it turns over and empties its contents into the hopper. When this motion has been effected, the bucket rests, through the aid of two projections, upon the links of the chain, and proceeds to the lower wheel to begin its filling anew. To facilitate the discharge of the bucket, and prevent the earth from falling, there is arranged, in front, a piece of plate iron that connects the two chains.

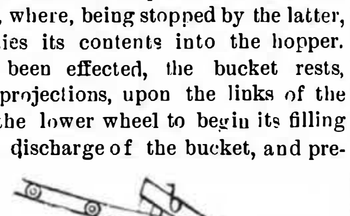


Fig. 11.

The arrangement of the track is shown in Fig. 3. Four cars are always being loaded while four full ones are being hauled away. The earth is successively sent to the right and left by means of a double chute provided with a valve that is actuated by a chain.

In the apparatus under consideration, the buckets have a capacity of 68 liters. The velocity of the chain, in the experiments at Fleurus, was 30 centimeters per second, and 15 buckets passed per minute. Theoretically, then, the apparatus should excavate about 56 cubic meters per hour; but practically the quantity has always been from 60 to 65 cubic meters.

The daily use of this apparatus, including cost of keeping in repair, interest, etc., involves an estimated expense of 90 francs.

Description of Figs. 1 *and* 2.—*y*, 25 H.P. engine for actuating the buckets and carrier; *v*, engine for actuating the jib and moving the apparatus forward; A, B, C, D, E, frame of the apparatus; W', jib; a^1, bucket attacking the earth; a^2, full bucket on its way to the hopper; a^3, full bucket about emptying; a^4, bucket on its way downward; E', hopper; F', carrier; I'', double chute, M'', bucket guide.—*Le Genie Civil.*

The Direction of the Wind.

That the changing of the direction of the wind is due to the shifting of the situations of greatest heat upon the earth is substantially proved by the fact that in certain regions of the terrestrial surface, where the situations of the greatest heat and cold do not alter the direction in which they lie to each other, the wind does not change, but always blows in the same direction from one day to another, and all the year round. This occurs in the great open spaces of the ocean, where there is no land to get heated up by the sunshine of the day, and to get cool by the scattering of the heat at night. In those spaces, for a vast breadth of many hundreds of miles, the sun shines down day after day upon the surface of the sea, heating the water most along the mid-ocean track which lies most immediately beneath its burning rays as it passes across from east to west. This mid-way track of the strongest sunshine crosses the wide ocean as a belt or zone that spreads some way to either side of the equator. Throughout this midway track the cooler and heavier air on either hand drifts in from the north and from the south, and then rises up, as it becomes heated by the sun, where the two currents meet.

In both instances, however, in consequence of the spinning round of the earth, the advancing wind acquires a westward as well as an equatorial drift. The air current, as it approached the midway equatorial zone, where the onward movement of the sea covered surface of the earth is performed with the vast velocity of 1,000 miles an hour, does not immediately acquire this full rate of speed, and lags back upon the ocean, so that it appears as a drift toward the west as well as toward the equator. On the north side of the equator the wind blows all the year round from the northeast, and on the south side from the southeast, both in the Atlantic and Pacific Oceans. These steady and unchanging ocean winds are called the trade winds, on account of the great service they render to ships carrying merchandise across these portions of the sea. In sailing

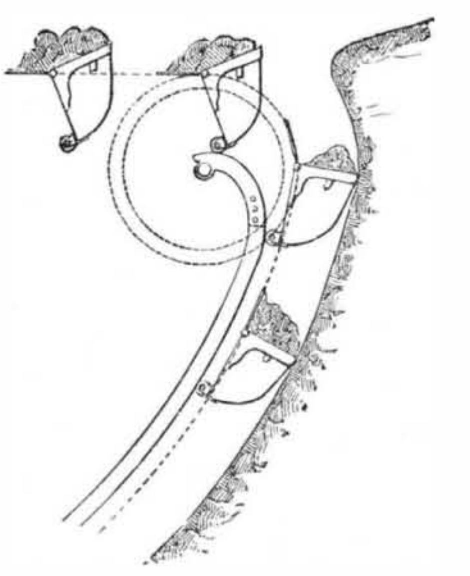


Fig. 12.

from England to the Cape of Good Hope, through the entire length of the Atlantic Ocean, ships, before they reach the equator, have to pass over a broad space where strong winds are always blowing steadily from the northeast. That is the region of the northeast trades. They then traverse a space near to the equator itself, where the northeast winds cease to blow, and where the air is very still and calm, and they afterward come to a region to the south of the equator, where strong winds are continually blowing from southeast. That is the region of the southeast trades.—*Science for All.*

The Precipitation of Gold.

If we compare the various processes for the precipitation of gold, it appears that the method with ferrous sulphate in an acid solution is simple in execution and complete, provided only the solution is free from chlorine, bromine, nitric acid, and from calcium, magnesium, and sodium hypochlorites. This is not the case with the mother liquors of chlorination processes, which may contain all the above mentioned bodies. Ferrous chloride has the same effect, but is dear, easily decomposed, and can be conveyed only in vessels of glass or porcelain. The precipitation with hydrogen is more complicated, as a special apparatus and a temperature of 50° to 60° are requisite. It is, however, applicable in all cases, if no copper is present in the solution. The precipitate settles quickly after the reduction of all the oxidized compounds.—*Chemiker Zeitung, Goethen.*

What Constitutes Good Mortar.*

Machinists and engineers often have occasion to use mortar, and will value the appended information: Good mortar is a solid silicate of lime, that is, the lime unites with the silica or sand to form a silicate of lime. In ancient days those who had some conception of the way the two things united superintended their mixing; but nowadays anybody is supposed to know how to make mortar, while nobody knows much about it. Dry lime and dry sand laid together or mixed and kept dry for a thousand years would not unite to form silicate of lime any more than acetic acid and carbonate of soda dry in a bottle would effervesce. To make silicate of lime just as good as was made by the Romans, all that is necessary is to proceed intelligently: Procure good caustic, *i. e.*, fresh-burned lime, and if you find it all powder, *i. e.*, air-slaked, don't use it; use only clear lumps. Slake this (if possible in a covered vessel), using only enough water to cause the lime to form a powder. To this while hot add clean sand—not dirt and loam called sand, but sand—and with the sand add enough water to form a paste. Then let it lie where it will not become dry by evaporation, if in a cellar so much the better; for as soon as you have mixed the sand and lime as above, they begin to react one on the other, and if not stopped by being deprived of moisture will go on reacting until silicate of lime (as hard as any silicate of lime ever was) is formed.

But if you take this so-called mortar as soon as made, and lay bricks with it, unless the bricks are thoroughly wet you stop the formation of silicate of lime, and might as well lay your bricks in mud. Lime and sand, after being mixed, might lie two years with advantage, and for certain uses, such as boiler setting, or where the whole structure of brick and mortar is to be dried, the mortar ought to be mixed for one year before use, and two would be better; but for house building, if the bricks are so wetted as not to rob the mortar of its moisture as soon as used, mortar that has been mixed a month will form good solid silicate of lime among the bricks it is laid with in ten years, and will be still harder in a hundred years. The practice of mixing mortar in the streets and using it at once is as foolish as it is ignorant, and would be no improvement. Silicate of lime is made only by the slow action of caustic lime and sand, one on the other—under the influence of moisture. Dry they never will unite, and mixing mortar as now mixed and using it at once, so as to dry it out and stop the formation that the mixing induced, is wrong.

* *Building and Engineering Times.*

Artificial Stone Masonry.

Of the work which is going on at the Little and Big Gunpowder Falls, on the Philadelphia branch of the Baltimore and Ohio Railroad, there are, says the *Baltimore Sun*, about 10,000 yards of artificial masonry, 7,000 of which will be at the Big Gunpowder and 3,000 at the Little Falls. At the latter there will be 84 piers and 6 abutments, and at the former 6 huge piers, each of which will be 10 feet thick, 70 feet high, and 30 feet wide, with spans of 23 feet between the arches. The work is being done by the Hoopes Artificial Stone, Cement, and Paint Company, of this city.

The field of operations is six miles from Magnolia. The stone is manufactured on the spot, and is moulded in any size and shape required. It is composed of sand, mixed with broken stone or gravel, and with cement and a chemical solution. The process is simple and rapid. Everything is done by machinery, including the breaking of the stones. When the mixture is ready for use, it is run into a square iron bucket, resting upon a hand car, which is then pushed over to where the work is in progress. The bucket is then hoisted by means of pulleys drawn by mules and emptied into a wooden mould, which is placed in position upon a previous layer. In twenty-four hours a fresh stone will be hard enough to bear another layer. Sixty yards are laid every day.

The machinery at the works is valued at $10,000. There are four engines, with ninety-horse power in the aggregate. At the Big Gunpowder Works there is a cable 800 feet long suspended over a deep ravine. It has a car attachment which can be lowered or raised at any point. This car carries stone and other material across the ravine. The cable was formerly used in the construction of the famous Brooklyn bridge. When stones are to be laid in the water-course, the water is first dammed and then bailed out. The work is going on day and night, one gang of men succeeding another. Thirty men are employed. Electric lamps light up the scene and give the place an oddly picturesque appearance. The masonry will be finished about the middle of December.

Each pier and abutment is really one solid stone, but for the purpose of giving it a finish it is moulded with grooves so as to resemble stone in blocks. Its monolithic character will be a great advantage in railroading, as it will prevent that jarring and rebounding which is always caused by trains running over tracks laid upon stone or brick foundations.

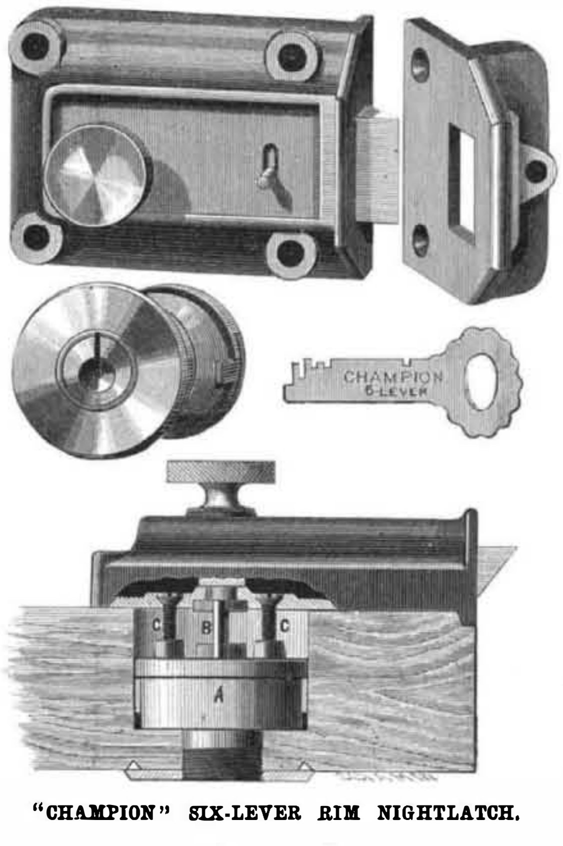
It is believed by many persons that the art of making artificial stones is prehistoric, and that the Pyramids were built of artificial blocks manufactured from the sands of the surrounding plain. In modern times a Frenchman named Coignet has accomplished some wonderful work with artificial stone. The most important and costly work that has yet been undertaken with Coignet's material is a section three miles in length of the Vanne aqueduct for supplying water to the city of Paris. Another interesting application of this material has been made in the construction of the lighthouse at Port Said, Egypt. It is 180 feet high without joints, and resting upon a monolithic block of beton, containing nearly 400 cubic yards.

THE "CHAMPION" SIX-LEVER RIM NIGHT LATCH.

Our illustration shows an improved night latch, which by an easy adjustment may be applied to doors of any ordinary thickness, opening either to right hand or to left, and to such as open inward as well as those opening outward.

As may be observed from the design of the key, the essential parts of the cylinder are placed as far removed as possible from the face of the door and from view from the outside. The cylinder contains six rotating disks or tumblers, having in their outer edges notches that may be brought into line by the proper key. The whole circumference of each disk being available for notches, the manufacturers have no difficulty in making as many combinations as may be required, so that no two sets of their latch keys will be found alike, unless made to order.

As most other latches and locks are constructed, it is well



"CHAMPION" SIX-LEVER RIM NIGHTLATCH.

known that they may be "picked" by any contrivance that will bring a strain upon the key hub or upon the bolt, and then picking up the tumblers in turn. This theory of picking is not applicable to this latch, because the key hub and tumblers all rotate freely, so that a strain cannot be brought upon them.

In view of the earnest and costly efforts by prominent manufacturers in both England and America, who have devised so many hundred different forms of keys, and of difficult keyholes, so many "wards," "drill pins," and the like, to cover over the weak spots in their locks, it seems strange that the chief defect should have been so long retained even in locks of high pretensions. But, in spite of the corrugated and complicated key and keyholes, in every instance in which a strain can be made to bind one or more of the tumblers, it is learned, sooner or later, and at the expense of consumers, that such locks cannot afford that degree of security nowadays required.

The principle applied in this latch is not a new principle of security. It has been used by the same manufacturers in their "Champion" six-lever padlocks, whose reliability is so well established that they have been adopted and for several years largely used by the treasury departments of the United States and of other governments, and have acquired more than a national reputation.

The escutcheon of the Champion latch is screwed upon the nosing of the cylinder, and is held in place by suitable claws upon its inner face. This method of securing the escutcheon permits an adjustment, adapting the cylinder to the thickness of the door, and thus renders it a very easy latch for the carpenter to put on.

For prices and further particulars see manufacturers' card, page 349 of our advertising columns.

Separation of Wool from Cotton.

Heddebault has succeeded in separating rags of cotton and wool, mixed, by subjecting them to the action of a jet of superheated steam. Under a pressure of five atmospheres, the wool melts, and sinks to the bottom of the receptacle; while cotton, linen, and other vegetable fibers stand, thus remaining suitable for the paper manufacture. The liquid mud which contains the wool thus precipitated is then desiccated. The residue, which has received the name of azotine, is completely soluble in water, and is valuable on account of its nitrogen. Moreover, its preparation costs nothing; because the increased value of the pulp, free from wool, is sufficient to cover the cost of the process.

Ornamental Hardy Shrubs.

After an experience of fifteen years with a great number of shrubs, Editor E. S. Carman recommends, in the *Rural New-Yorker*, the following as the best for the average country home:

Viburnum plicatum should be mentioned among the first as one of the most valuable and beautiful flowering shrubs, far surpassing the older varieties of Snowball.

Chionanthus Virginica, White Fringe, is a native shrub or small tree, notable for its large leaves and graceful, drooping panicles of slender-petaled flowers that seem almost to float in the air, so slight are the pedicels which hold them to stems.

Pyrus Japonica, the Japan Quince, should find a place in every garden. The leaves are ever bright and glossy, while the blossoms are almost unequaled for brilliancy by those of any hardy, early blooming shrub. The range of colors is from white through rose to dark red. In clumps or small clusters composed of several or all of the different colors, we have during May a brilliant effect indeed.

Forsythia viridissima and *F. Fortuneii*, Golden Bell, are the finest of the golden blooming shrubs. They begin to bloom about the middle of April, before the green leaves appear, and by May first are a mass of bright yellow. These plants are very effective trained to a single stem. Fortune's Golden Bell bears flowers rather larger in size and a few days earlier than viridissima.

Hydrangea paniculata grandiflora, the Great Panicled Hydrangea, has proved very hardy. Its panicles of sterile flowers are often a foot or more in length, changing from a greenish white to pink as the nights grow cold. It is a coarse but showy shrub.

Spiræa prunifolia, the Double Spiræa, commonly called Bridal Wreath. The little double white flowers appear in late May, and soon the shrub becomes a mass of white, which lasts until June.

Spiræa Thunbergii is one of the first of all hardy shrubs to bloom. It is a small bush, bearing white blossoms in great profusion.

Deutzias and *Weigelias* in variety may be selected from nurserymen's catalogues, since there is no great choice between them. All are pretty and floriferous.

Exochorda grandiflora bears white flowers resembling those of Crab Apples. The leaves keep green until after frost; the shrub grows to the height of ten feet, and is entirely hardy in this climate.

Cercis Japonica, the Japan Iudas tree, wreathes its naked branches in late spring with rosy purple flowers, and later clothes itself with shiny, thick leaves of a heart shape.

Halesia tetraptera, the Silver Bell, is a well shaped little tree, found wild in Ohio and southward. The white bell flowers droop from the stems in small racemes, leaving a winged seed, from which the specific name is derived. The stems of this little tree are clean and shapely, the wood very hard, the bark prettily striated with gray and dark brown.

These, says Mr. Carman, were we again laying out grounds, we should choose if confined to a few. For the rest, we may mention *Pavia macrostachya*, *Stuartia penagyna*, *Hypericum Kalmianum*, the Golden Nine bark, Rose of Sharon, Standard Honeysuckles, Smoke Tree, the improved kinds of Lilacs, and Purple Barberry.

Preparation of Magnesium.

A process patented by Gratzel, for the separation of alkaline metals by electrolysis, has been very successful in the reduction of magnesium. In Berlin there has recently been exhibited, as a product of this process, a ball of pure magnesium, of about five inches diameter. It was exceedingly brilliant, closely resembling silver; and had lost nothing of its luster since its separation. This preservation from corrosion is a sign of the high degree of purity of the metal, and forms a striking contrast to the magnesium hitherto obtained, which was always more or less alloyed with potassium, and consequently easily oxidized, especially in a damp atmosphere. The purer magnesium is considered to be destined to increasing maritime use, because the rays of the magnesium light appear to have a greater penetrative power in fogs and mists than the electric arc.

A New Hydrocarbon Mineral.

A new mineral hydrocarbon has recently been discovered near Seefeld, in the Tyrol. It occurs crudely in the form of a bituminous rock, of peculiar constitution; and the bitumen is believed to be composed of the decomposed remains of prehistoric marine animals. Treated with strong sulphuric acid, the bitumen yields a soft substance, which when neutralized is not unlike vaseline in consistence, but resembles coal tar in color. It differs from all known vegetable and mineral tars, however, by its odor, and by the possession of peculiar physical properties. It forms an emulsion with water; and is partly soluble in alcohol and ether. A mixture of these two liquids completely dissolves it. It is miscible in all proportions with vaseline and oils. The name "ichtyol" has been given to the substance, which is characterized above all by its richness in sulphur, of which it contains about 10 per cent. This element is so intimately mixed with the ichtyol that it can only be separated by the complete decomposition of the latter. Besides sulphur, ichtyol contains oxygen, carbon, hydrogen, and traces of phosphorus. In consequence of the high proportion of sulphur, the new hydrocarbon is regarded hopefully as a medicament or unguent.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LI.—No. 22. [NEW SERIES.] | NEW YORK, NOVEMBER 29, 1884. | [$3.20 per Annum. [POSTAGE PREPAID.]

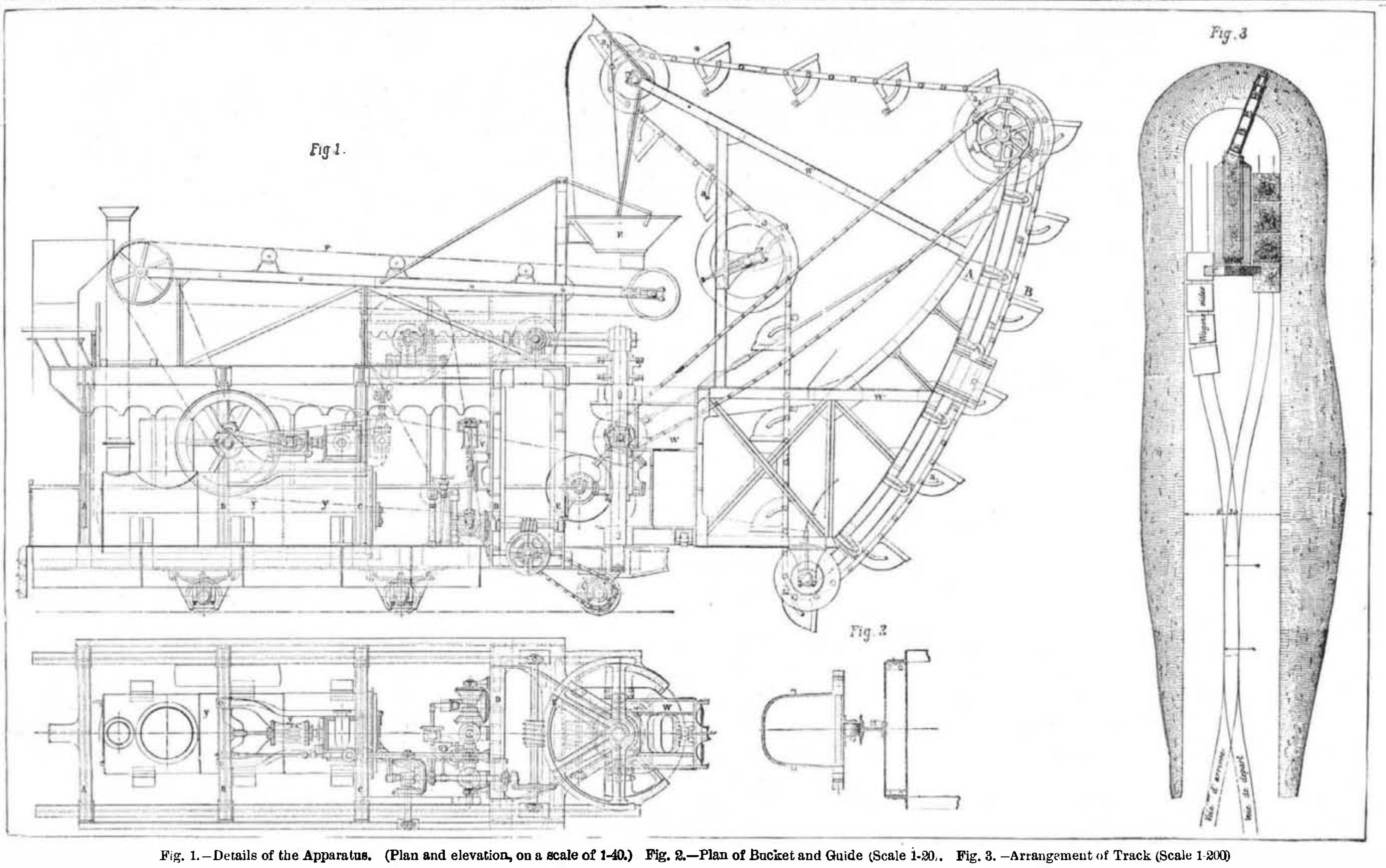


Fig. 1.—Details of the Apparatus. (Plan and elevation, on a scale of 1-40.) Fig. 2.—Plan of Bucket and Guide (Scale 1-20). Fig. 3.—Arrangement of Track (Scale 1-200)

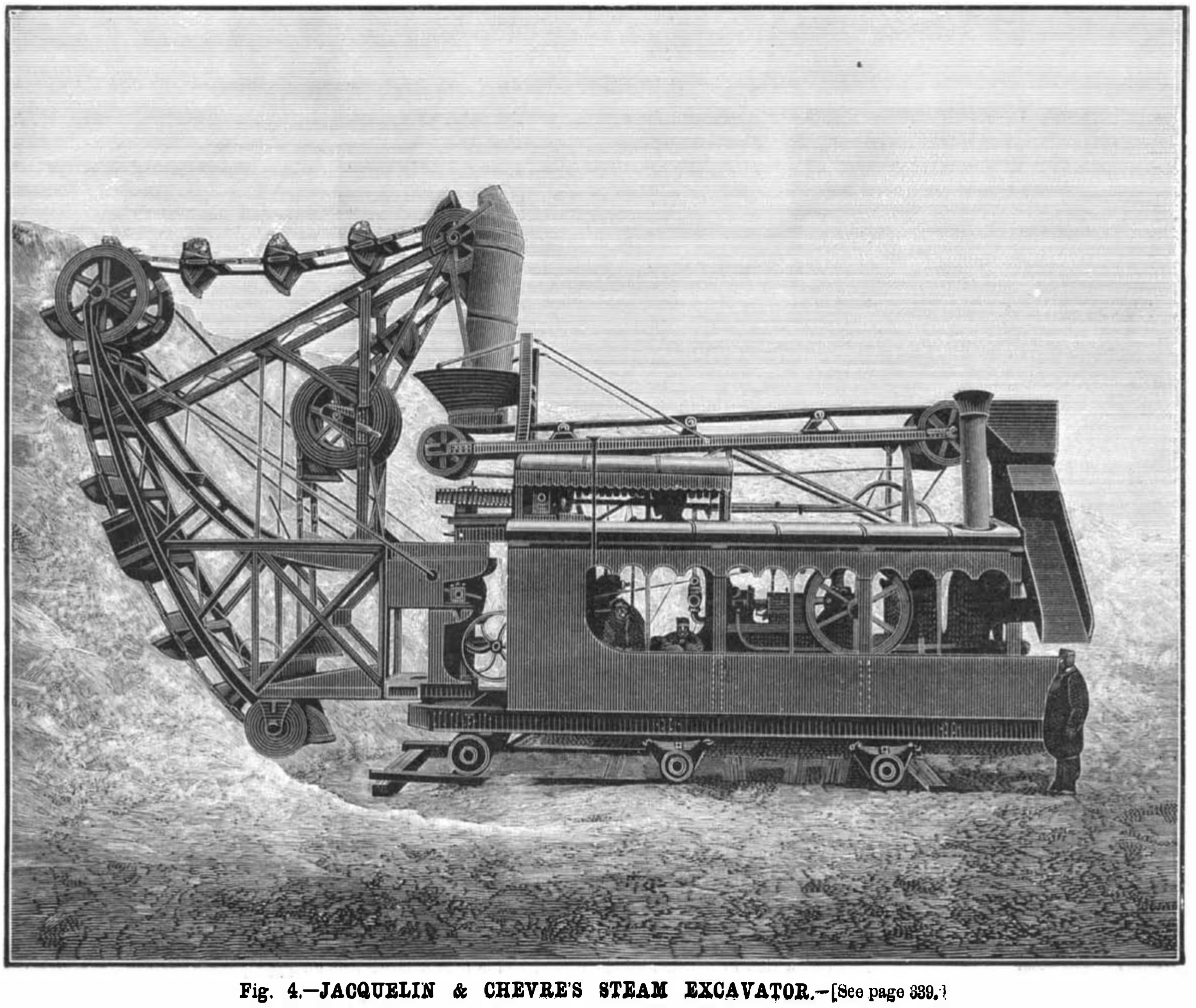


Fig. 4.—JACQUELIN & CHEVRE'S STEAM EXCAVATOR.—[See page 339.]