PETROLEUM GEOLOGICALLY CONSIDERED.

It is impossible to trace the geological relations of petroleum, so as to show with what rocks it is liable to be associated, where we might find it, and where we may surely find it; it is not limited to any particular formation or age. It is found in almost every possible series of strata, from the lowest Silurian rocks up to the Tertiary and even Post-Tertiary formations. There are certain points in regard to the manner in which it lies in the rocks and is obtained from them that are full of interest. These, perhaps, cannot be traced out to better advantage than by selecting one single region and studying the petroleum as it exists there. The "oil belt," as it is called, from which the main supply of the world is now derived, is a good example. This has many peculiar features belonging only to itself, but it may be assumed to be fairly representative, so far as history and formation are concerned.

The oil belt lies entirely west of the Alleghanies, extending from Canada to Virginia, with a width of 70 miles and upward, but the part from which, practically, the entire product is derived is much smaller, being within the State of Pennsylvania and covering in round numbers 3,200 square miles, though in actual fact only 39½ square miles of even this limited space have really yielded oil in paying quantities. This is, properly, the "oil center." Throughout its extent the oil wells are gathered in groups, and this grouping is indicative of the relation between the rock oil and the rocks.

An oil well is simply a hole drilled down so that it may serve as a discharge pipe for a fluid that exists at a greater or less depth below the surface of the earth, and is held there as if in a reservoir under pressure. As the drill passes down, the "first sand rock" is struck and passed; nothing is found in it; further down comes the "second sand rock," like the first; further still, the drill strikes the "third sand rock," which is truly the oil-bearing stratum, that is, if the well "strikes oil," for a large proportion of the wells sunk are "dry holes." When the drill breaks through the oil-saturated sponge, as the sand rock may be called, the manifestations are sometimes wonderful. The fluid which permeates the rock is, of course, in intercommunication throughout its entire extent, and is always under more or less pressure. The mighty strain that the internal forces exert is graphically illustrated when a "spouting well" is struck.

Now the curious feature of this sand rock is that it is not of uniform thickness, neither does it lie horizontal. Each individual mass or bed is found to be irregularly circular in form, saucer shaped, and thickest in the middle. Within every part of this space oil may be found; outside of it there is none until a similar bed is found. Judging from the quantity of oil which flows and continues to flow from a given well or group of wells, it seems nearly certain that the source is not in the vicinity of the place from whence it is drawn; that these disks of sand rock merely indicate a region which, from its structure, serves as a sort of "chimney," through which the supply from beneath presses upward the pipe serving as a vent. This view of the distance of the source is of great interest and importance. If the supply lies near the surface only, at the level where we tap it, it does seem possible, and in fact probable, that the enormous output of the present day must produce exhaustion, and at no very distant date. But if the true source is in the profound depths of the earth, we need have no fear of reaching a limit.

The nature of petroleum may aid in forming some idea of its origin and the prospects of its continuance. Being a hydrocarbon intimately allied in chemical composition to coal, especially bituminous, it was entirely natural, from the first, to infer that the two had a similar origin, and this opinion is still maintained by many. As to the origin of coal, there can be no doubt; it was produced by the transformation of vegetable material, through the action of certain agencies of long duration, prominent among which have been heat and pressure. The rock strata in which these vegetable masses were deposited previous to transformation are almost universally concave, and we call them "coal basins," recalling to mind the disks of sandstone in which we find petroleum. The vegetable origin thus indicated necessarily demands for coal an abundant development of life, and no coal has been found in the rocks which are termed azoic.

In this respect it differs from petroleum, though both of them occur in strata of various ages in the later formations. It is very seldom, however, that they are found in juxtaposition. A petroleum spring is not a guide to a coal vein, and though they are so similar in chemical composition no other feature seems manifest which should lead us to infer that petroleum and coal have in any way a common origin. And though coal demonstrates the antecedent occurrence of life, we cannot say the same thing of petroleum. We know that, at the present time, the substances we call organic are composed mainly of carbon, nitrogen, oxygen and hydrogen. Petroleum is a hydrocarbon, but shows no signs of organic origin. The microscope shows no cells or fibers in it, as in coal. To say the least, it is entirely possible that it is of inorganic origin. The antecedent presence of life is not at all essential to effect a chemical union which will give us a hydrocarbon in either gaseous, liquid, or solid form.

No one probably thinks of demanding an organic origin for carbureted hydrogen, which issues from some of the borings in the oil regions, and there are reasons for believing that the same forces produced the two combinations. Wherever water exists, either as a liquid or as solidified by combination, we find hydrogen in abundance, and in the carbonates we find the supply of carbon, and the structure of the lowest rocks of which we have any knowledge shows plainly that when solid materials began to have place, carbon and hydrogen existed gaseously and separately. There is nothing to hinder their existing thus now; or if not thus uncombined at the present time, what is to hinder their being set at liberty from other unions by the forces of their environment, and, thus prepared, to form hydrocarbons when presented to each other? And if thus set free and thus uniting, it is entirely within the range of natural forces that they should form, and perhaps at the same place, the two which we find in juxtaposition—the gas and the liquid. It is true that, according to our ideas of chemistry, we rank these two hydrocarbons in different series; but that proves nothing except our inability to match the workings of the great laboratory in our small establishments. Recent researches have shown us that even we can begin to step from the one series into the other, and that the great internal forces should do it readily and constantly is certainly quite possible. If the supply of petroleum lies only at a small depth, there is little use in searching for a means of using it. But it is altogether probable that we must look deeper for its source, and as it is, perhaps, totally of inorganic origin, we may look to find the supply persistent.

A.

TONKIN.

The recent efforts in Asia of the French to obtain complete possession of Tonkin have attracted to that region some attention, and an account of its features and productions seems needed.

Tonkin is bounded on the north by the Chinese provinces of Kouang-Tong, Kouang-Si, and Yunnan; on the south by Cochin China; east by the Gulf of Tonkin; and on the west by a chain of mountains which separate it from the basin of the Me-kong, and the small States of Laos, which are tributary to the realm of Siam.

Tonkin forms with Cochin China the realm of Annam, which has Hué for its capital. Tonkin itself embraces 150,000 square kilometers (93 000 square miles), or more than one-quarter of France.

Its principal rivers are the Rouge, Claire, Noire, Thai-Bink, Song-Ma, Song-Mo, Song-Giauk. The most of these rivers have slow currents, and are easily ascended. The rainy season is from April to September; the temperature then does not exceed 35° Cent., and sinks to 16° Cent. During the dry season, from September to the end of March, the temperature falls from 15° Cent. to 7° Cent. above zero. The population is confined to the plains. Here are towns with 150,000 inhabitants, and others with 40,000 and decreasing numbers. The north and west of Tonkin is very mountainous. These mountains are covered with magnificent trees, and could be easily cultivated. They are occupied by Laotian races, who live upon them with few cares, and unsubjugated by the Annamite mandarins.

The principal river, the Red, forms at about 130,000 meters (100 miles) from its mouth an immense delta of alluvium of extreme fertility.

This delta is thickly populated. Rice is raised in abundance; two crops are harvested yearly. Maize is only cultivated in a few localities unfavorable for the production of rice. In the dry and sandy regions the Tonkins cultivate the *igname*, sweet potatoes, marsh roots, etc. Sugar cane is largely grown, and under skillful cultivation would yield enormous quantities of sugar. Unoccupied lands, which have never been planted and are gardens of fertility, would produce an immense amount of this necessary, and the rivers and streams afford on every hand water power and easy transportation.

The hill slopes bordering the Red River have been planted with coffee trees, and good results have been attained. The cheapness of labor and the abundance of land favor this enterprise.

Tonkin produces cotton, and of a fine quality. The fertile alluvial plains afford it a similar habitat to that which it enjoys in Louisiana and the Carolinas. Tea and tobacco find in Tonkin a very favorable home. Cinnamon is one of the principal products, and affords a large revenue. It is harvested upon the mountains of one district. The King of Annam monopolizes the best qualities. Among medicinal productions the most remarkable is the *Hoang-Nan*, a strychnine which grows in the mountains of *Bo-Chinh* and of *Nghe-An*. It appears to cure madness, paralysis, leprosy, the bites of snakes, and in general all forms of virus. Indigo, oils of various sorts, resins, gutta-percha, varnishes equal to the lacquer of the Chinese or of Japan, essences, perfumes, are all found in this rich country. Among precious woods the *calambac* is remarkable. It is a most odoriferous tree, and when buried a meter and a half (about five feet) under the surface of the ground its odor reaches the air above. Here grow rosewood, ebony, sapan, and sandalwood.

In Tonkin there are numerous gold mines, and even the streams carry down the mountain sides flakes of gold. There are cantons where ducks are raised for the purpose of gathering the gold from their excrements. In the mountains of high Tonkin, in the basin of the Red River and its tributary the Black River, the precious metal is found in large amounts, and in many other districts the clearest indications of its presence are shown.

Tonkin is equally rich in silver, of which however less is known. Copper is found in quantities which exceed those furnished by Chili and other American sources. Kettles wash basins, coffee pots, spittoons, are all made of copper.

Tonkin also possesses tin mines. The principal localities around Lao-Kai have not been explored, from need of capital, but those in the province of Yunnan are said to be the most important known. Here over 10,000 people find employment. But these valuable products do not complete the list of its mineral wealth. Mercury, zinc, argentiferous galena, bismuth, antimony, iron, and precious stones, besides the great deposits of coal, must be added to the dazzling list of its possessions.

There are but few horses; they are of a good stock, small but vigorous. The cattle are small but well made; they belong to the genus zebu, with a pad of flesh upon the neck at the head of the mane. The flesh is excellent eating. Pork is the staple article of diet; not a family can be found without its pigs. The flesh is flat. There are no sheep, but numerous goats.

Ducks, geese, chickens, and pigeons abound and sell at low prices. In the mountains and forests there are hidden tigers, panthers, bears, rhinoceri, and the elephant. The musk kid lives in the mountains, and here are encountered the deer, fawn, and roe buck, while on the plains the rabbit and partridges multiply.

There are many beautiful birds, whose plumage is a prize to the hat makers. Since the first year of Tonkin's commercial freedom, 15,000 to 20,000 skins of birds have been exported, the most of them to France. On the coasts are gathered tortoise shell and pearl.

The silk worm flourishes here, but the Tonkinese do not understand the unwinding of the cocoons, and their products are imperfect and inferior. No country unites perhaps in so marked a degree as Tonkin all these various riches. Add to that a healthy climate, a docile population, and it forms the most attractive colonial station in the world.—*M. Millot, in Revue Scientifique.*

Werdermann.

It is with extreme regret we announce the decease, on September 15, of the well known electrical engineer, Mr. R. Werdermann, at the comparatively early age of 55 years. The deceased gentleman had been resident in London since the year 1870, when he brought over from Paris and introduced into England the "Gramme" dynamo electric machine. Notwithstanding his long connection with the invention of M. Gramme, and the enthusiastic manner in which he championed this most successful machine of modern times, we understand that he sustained heavy losses in his business associations therewith. The recent decision of Judge Blatchford, in America, declaring the Gramme patent void, was, we believe, a most serious and heavy blow to him, as we are informed that he owned the American patent. In 1878 Mr. Werdermann's name was most prominently brought forward in connection with his so-called *semi*-incandescent electric light. We published at the time full particulars of his lamp, which doubtless gave a great impetus to electric lighting in England, and which has since been successfully imitated by other electricians.

The subjects we have mentioned are those by which Mr. Werdermann is best known, but the records of the Patent Office show very forcibly his great energy in other directions. For the past two or three years he had busied himself in perfecting a new dynamo and an incandescent lamp, referred to at various times in our columns. He was an eminently practical electrician, and his knowledge of many other branches of science was very considerable. It was our lot to be in almost daily communication with Mr. Werdermann for some years, and to assist in the numberless experiments which he made with dynamos of various constructions, arc lamps and electric candles, electro plating, the transmission of power by electricity, which is now attracting so much attention at home and abroad, electrical railways, and many other minor matters in which electricity played the leading part.

The results of these experiments will probably never be known to the world, but from our own experience we can truly say that many things which are now in successful operation were fully worked out by Mr. Werdermann in the early days of dynamos. His inventive mind led him to attempt too many things, the result being that before one subject had been fairly started toward a successful career it was abandoned for another. Like many others who have labored toward the advancement of science, it is to be feared that he has left his family, consisting of the widow, a son, and three daughters, without any provision for the future. Space will not permit us to dwell upon the many admirable personal qualities possessed by Mr. Werdermann. An affectionate father, and a stanch friend to those who possessed his confidence, he will be kindly remembered by those who gained his esteem.

We look back with satisfaction that in former days we were enabled to render him such assistance as lay in our power, but it is much to be regretted that his long and laborious toiling has been so ill rewarded.—*Electrical Review.*

THE Swedish and Danish Governments have decided to lay down a new submarine cable between the two countries. The cable, which will consist of four wires, will be laid from Helsingborg to Elsinore via the island of Hveen.

Irrigation on a Large Scale.

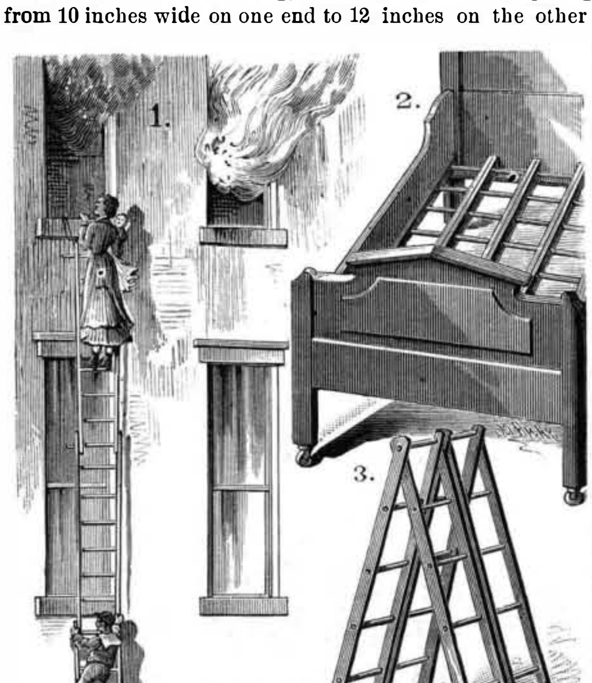
The most gigantic irrigation enterprise ever inaugurated in the State of California has been commenced in Fresno County, the canal for which will be the largest in the State, and fed by King's River. The water is intended to irrigate 30,000,000 acres of rich land, at present barren through lack of water. The source of supply of this canal will be higher than any other debouching from the same stream. Its dimensions are: One hundred feet in width at the bottom; levees an average of fifteen feet in height and eight feet wide at the top, broad enough for a wagon road. The depth of the water is expected to be five feet, with a fall of eighteen inches to the mile. The dam in the mountain cañon, whence the water is taken, will be a wonderful and permanent one. It is twenty-five feet high, eight hundred feet long, one hundred and forty feet wide at the base and twenty-five feet wide on top. It is rip-rapped on the inside with heavy rock, and every precaution taken to make it sufficiently strong to securely hold the great weight of water that must be supported. The water is led into the canal from a large headgate, constructed of heavy timber, one hundred feet in width and eighteen feet high. It is planked over so as to make a bridge for heavy wagons, and has wings to protect it from the floods. The canal is expected to carry thirteen hundred cubic feet of water per second.—*Los Angeles Herald.*

Railroads in Venezuela.

The first railroad built and operated in Venezuela began at Puerto Cabello and led to the westward. About ten miles were built and operated, but embarrassment followed, and nothing is now to be seen except a dim outline of the road bed. About the year 1870 an English company built a 2-foot gauge road from Tucacas to the mines of Aroa, a distance of 55½ miles. Poisonous reptiles, wild animals, malaria, and dense jungles combined to obstruct the building of the road. The largest bridge has a span of 90 feet. The ties, bridges, and even the telegraph poles are of iron. The road for its last five miles has a grade of 600 feet, requiring specially constructed engines. The freight cars carry from five to six tons and the passenger cars about 30 passengers. A road from La Guira to Caracas, a distance of 22 miles, has been in process of construction for several years. The track of the road is 3½ foot gauge. It is built on a series of reverse curves having a radius of 140 feet. Surveys have been made for other lines, and a small amount of grading has been done on a road 40 miles long from Puerto Cabello to Valencia.

BED BOTTOM FIRE ESCAPE.

The fire escape herewith illustrated consists of ladders which may be disposed so as to take the place of the slats in an ordinary bedstead, as shown in Fig. 2, or joined end to end and suspended from the window of a building, as in Fig. 1, or arranged as a step-ladder, as in Fig. 3. The ladders are made of white ash or other suitable wood from one inch boards; the side bars are 1 by 2 inches, and the rods are three-fourths inch thick, well secured. For general use the sections would be 6 feet long, and would be made tapering from 10 inches wide on one end to 12 inches on the other



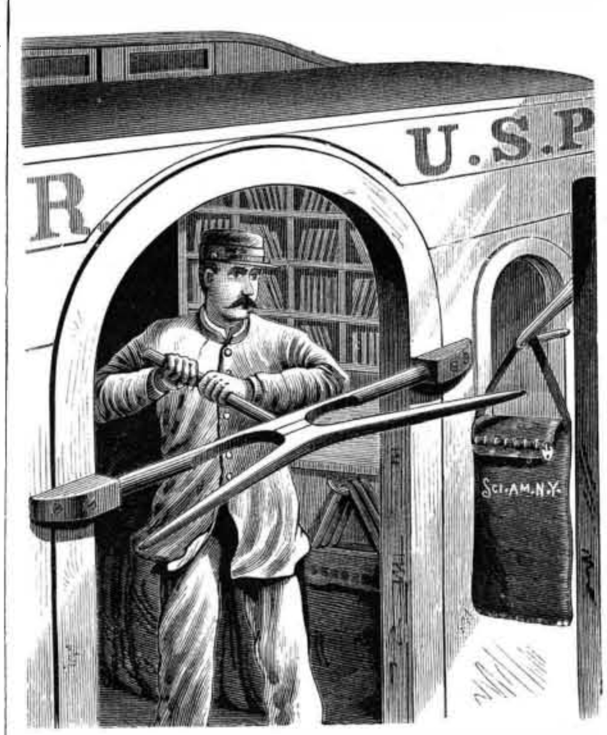
BLOEDON'S BED BOTTOM FIRE ESCAPE.

By this means the ends of the sections may be lapped and secured by rods and pins so as to form one long ladder. Holes are made in the ends for the connecting rod to pass through. Through holes in one end of one section is passed a rope fastened to a board of a length just sufficient to rest across an ordinary bed. This board is placed across the window, and makes a secure hold for the ladder when used as a fire escape. The parts are, practically, laid away when not needed, and yet may be easily and rapidly connected and hung from the window if circumstances so require.

This invention has been patented by Mr. Louis Bloedon, of Bay City, Mich.

MAIL BAG CATCHER.

This invention provides a simple, efficient, and cheap device which can be attached to a mail car for catching the mail bags hung from a crane at the side of the track, while the car is in motion. Across the door of the car horizontally extends a bar, each end of which is journaled in bearings fixed to the side of the car. The arm which catches the bags is heaviest at its center, and the two branches taper toward the ends and are slightly bent at the middle. This arm is attached to the cross bar by a tenon, and between the arm and bar is a shoulder, which may be a separate piece or which may be made as a part of either. The crossbar is



KELLOGG'S MAIL BAG CATCHER.

recessed at each side of the center in order to more securely grasp the mail bag after it has been caught from the crane. This method of construction, together with the shoulder, will facilitate the removal of the bag from the catcher by the mail agents. Projecting from the opposite side of the cross bar is a handle by which the bar can be swung axially. The arm being double, either end may be brought into position for catching the bag, irrespective of the direction in which the car is moving, or the speed. When not in use the catcher gravitates, by the weight of the arm, to an upright position, in which it is out of the way.

This invention has been patented by Mr. Joseph A. Kellogg, of Nashville, Tenn.

Brazilian Woods.

M. Thanneur, a correspondent of *Les Annales*, describes some of the timber to be found in abundance in the valley of the La Plata and vicinity, and claims high value for them for mechanical and engineering purposes. He says the "quebracho" is perhaps the most interesting of all and the most used. It is very abundant in Brazil and La Plata. Its diameter varies within the same limits as that of the oak, but the trunk is shorter. It is used for railway sleepers, telegraphic poles, piles, etc. It is very durable, especially when well seasoned. It is much heavier than water, its specific gravity varying between 1·203 and 1·333. Its color is reddish, like mahogany, but it becomes darker in time. On account of its hardness it is difficult to work, and it cannot be readily cut with an ax. It has been introduced into France on account of its richness in tannin. A large proportion of Brazilian leather is tanned by the sawdust of quebracho, but the leather is rather brittle. A mixture composed of one-third of powdered quebracho and two-thirds of ordinary tan gives very good results.

Another Balloon Experiment.

The St. Louis *Globe-Democrat* has the following item respecting M. Gentil, the inventor of the balloon, of which our Western contemporaries have lately had considerable to say: M. Gentil was a medical practitioner in France, but owing to political reasons he came to America in 1862, and settled in St. Louis as a locksmith. It has been his life dream to make an air ship, and he has constructed four different machines, each susceptible of improvement. The final effort is a cigar shaped balloon, with gas compartments, a rudder at the thick end, and screw shaped sails at each side to raise or lower the altitude. He claims that he can steer his air ship at will, work his pinions, and raise her when the lifting power of the gas is exhausted. The whole is inclosed in a network, from which depends the car supported by a series of guys, ropes, stays, and gaskets, having the look and gearing of the main deck and bulwarks of a full rigged ship. The model is suspended from the ceiling of his little shop in St. Louis, and is his idol. "It is for the scientific public," M. Gentil said, "the work of my life; and shall I, then, prostitute my grand work by putting it upon exhibition at ten cents a head, like a stuffed whale or petrified hog? I want no money. I give it to the people, and I am happy."

A Remarkable Ice Well.

Mr. Levi Allen, of Horse Plains, Montana, writes as follows: I have a well forty-five feet deep, situated under sawmill. In sinking the well, at a depth of thirty-five feet we encountered a strong current of air, strong enough to blow out a candle. Last September the well commenced to freeze up; we banked it with sawdust, but it did no good. The last of November it was frozen solid. I have a steam pump within fifteen feet of bottom of the well; went down last week to the pump to repair same, and found two feet of solid ice within four feet of the pump. The mill has been idle for three months. This well is dug through solid gravel, is situated on low ground, seems to have been the bed of the Pend d'Oreille River. The river is distant three-quarters of a mile.

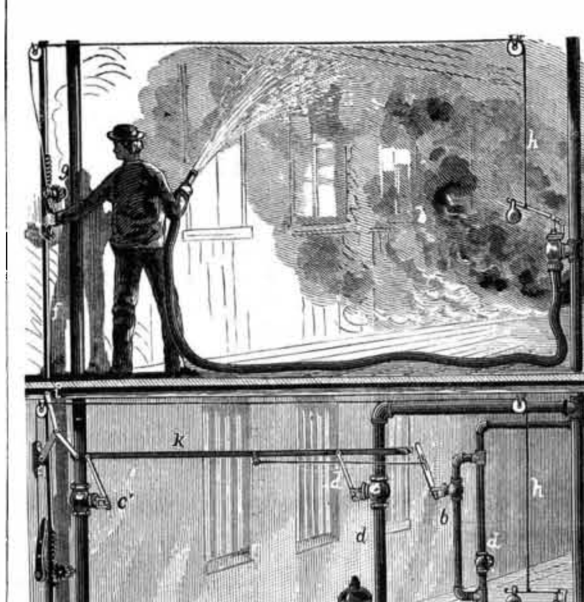
Can you explain the cause of the freezing of the water in this well?

FIRE EXTINGUISHING APPARATUS.

By means of this invention the extinguishing of fires in buildings is greatly facilitated, as on each floor there is a lever controlling the admission of steam to the steam pump, and the same motion opens the valve admitting water. Almost instantly the pump is set in operation, and a bountiful supply of water is received at the point where the fire is discovered. On the lower floor, or in the basement, is an ordinary steam pump receiving steam through a pipe from a boiler, not shown in the engraving. This pipe is provided with a valve placed near the engine, and also with a branch pipe, *b*, the ends of which are connected with the pipe, upon opposite sides of the valve, and by means of the valve in the branch steam can be admitted to the engine independently of the first mentioned valve. The inlet or suction pipe of the pump connects with a well or other suitable water supply.

The discharge pipe of the pump is shown at *c*, leading to a tank in the upper part of the building, and to this is connected a pipe, *d*, leading through the various stories of the building. These pipes are provided with valves, *c'* and *d'*, so that the water may be directed through either, as may be desired. Upon each story the pipe, *d*, is provided with a discharge cock, *e e*, to which is attached a hose. A bar, *f*, extends through the various stories, sliding vertically in guides attached to the wall, and has formed upon it a section of rack teeth, *g*, into which meshes a small gear wheel. One of the journals of the gear wheel projects and is provided with a tongue to fit in a grooved hole in the end of a lever, so that the bar, *f*, can be raised or lowered by operating the lever. To each lever is attached a cord, *h*, which passes over guide pulleys, and the other end of each cord is attached to a lever connected with the valve stem of the cock, *e*. To the valve lever is hung a weight sufficient to close the cock when the cord is slackened.

To the lower part of the bar, *f*, is hinged the upper end of a short bar, *i*, the lower end of which is hinged to the adjacent ends of two short bars, one end of one being hinged to the wall of the building and the end of the other being joined to the bar, *k*. The movement of the bar, *k*, operates the valves, *c'*, *d'*, and *b*. as shown in the engraving When



MOLENDO'S FIRE EXTINGUISHING APPARATUS.

the rack bar, *f*, is raised by the movement of a lever in opening a valve, as *e*, admitting water, it draws the bar, *k*, outward, thus closing the valve, *c'*, in the water pipe leading to the tank, opening the valve, *d'*, in the pipe leading through the building, and opening the valve, *b*, admitting steam to the engine. When the bar is lowered, the reverse takes place. To make the plan operative when steam cannot be furnished to the engine, the tank at the top of the building is provided, so that there may be a pressure of water constantly on hand.

This invention has been patented by Mr. Hermann Molendo, of 210 E. Ninety-third Street, New York city, who should be addressed for further information.