GREAT LOSS IN THE DIAMOND FIELDS.

The late unfavorable news from the African diamond fields has been the cause for quite an advance in diamonds both in European and American markets. The excellent illustration of the great mine at Kimberly, which together with our facts is taken from the *Jewelers' Journal*, renders the description more graphic.

Mr. H. B. Joseph, one of the passengers by the Austrian bark, Lea, just arrived at New York from Cape Town, and who is a Cape commission dealer in diamonds, copper, wool, etc., tells most distressing tales of the great sufferings in Cape Colony. In parts of the country, he says, there has been no rain for three years, and the people are starving. The condition of affairs in Cape Town, at Kimberly, Du Toits Pan (the diamond fields), the Leydenburg gold fields, the Orange Free States, and surrounding country is worse than it has been for years. What adds to the general distress consequent on the failure of the crops, is a disaster at the great diamond mine at Kimberly, 600 miles up from Cape Town and 400 miles from Natal. The mine is 380 feet deep and 1¾ miles in circumference. The soft debris has fallen back into the mine in such quantities that it is estimated that eighteen months will be required for its removal.

Upward of 4,000 tons fell within twenty-four hours. The extent of the calamity can be judged by the fact that this celebrated mine has yielded $15,000,000 in diamonds a year. The effect at Cape Town has been most disastrous. The revenue has fallen off 50 per cent, and the mining shares have gone down to 75 per cent. It is estimated, said Mr. Joseph, that it will cost $1,250,000 to clear the mine. The fall in the prices of diamond shares has ended in a great tragedy. There are sixty-five diamond mining companies, with a subscribed capital of $35,000,000, and of these companies only fourteen are paying dividends. Most of these mines are within a radius of 150 miles, and at an average of 600 miles from Cape Town. The extent of the commercial convulsion is illustrated by the Great Central Diamond Company. It has a subscribed capital of $4,500,000, and paid taxes on $4,200,000. Two years ago the shares were rated $1,800 each, but to-day they are worth only $400. The Frerers' Diamond Mining Company at De Beers, a quarter of a mile from the Kimberly mine, with a subscribed capital of $650,000—$500 a share—has been sold out by the sheriff for $75,000 for rates owed to the mining board. Mr. Herm Wilegroot, a leading merchant, blew out his brains on account of all these troubles, and two weeks afterward Mr. S. R. Schonz, resident magistrate, killed himself. Altogether, there have been about ten suicides of leading men caused by the commercial depression. The most terrible stories of starvation come from the copper region, especially from the neighborhood of the Manamaculand mines. Capt. Segarich said that commercial circles in Cape Colony are so greatly depressed that many of the colonists are returning to Europe, especially to England. He said he could have brought many more passengers if he had had room.

If these reports prove true, there is no doubt but that the recent advance of from twenty-five to thirty per cent in diamonds will be followed by others, and those dealers who have bought before the rise will be among the most fortunate of the trade.

Perhaps there is no place in the world where wire rope tramways are employed to so great an extent as in the spot represented in our engraving. It will be seen that the ropes extend in great numbers to the banks on either side of the fields, where the earth is deposited in vehicles of various sorts, and from whence it is conveyed to more roomy quarters to be picked over or washed.

The engraving shows that some of the claims have been worked to a far greater extent than others, some of the miners having made deep excavations, leaving the mines of others actually above the average level.

VIEW IN THE DIAMOND MINES, SOUTH AFRICA.

Genius, Talent, Industry.

"Talent" is a quality which enables its possessor to acquire knowledge by learning from others and by unassisted study.

"Genius," on the other hand, is characterized by a great independence of instruction; it takes its own course, and originates new ideas and inventions never thought of before. It may of course enlarge its sphere of knowledge by reading, by observation, and by experiment; but it is by no means characteristic of genius to be apt to be taught; on the contrary, embryo geniuses are often dull fellows at school and idle to boot. It rather dislikes to follow in the track of others, and rises superior to obstacles of circumstances and deficiencies of education. Genius may safely be left to hew a path for itself. Talent is greedy of instruction. Hence the two have very different relations to education, a subject upon which I should much like to dilate, but the length into which I have been unintentionally betrayed warns me to avoid the temptation.

Arkwright perfected his invention of the spinning frame in the uncongenial atmosphere of a barber's shop, in the teeth of a scolding wife who more than once broke up his models on the eve of completion, and who habitually upbraided him for neglecting the profitable occupation of "an easy shave for a penny," with the elegant apostrophe, "Cuss the 'cheenery!" I believe she lived to be Lady Arkwright. Let us hope that she learnt to moderate the rancor of her tongue.

George Stephenson, inventor of the locomotive and the father of railways, developed his extraordinary engineering genius in the obscurity, physical and metaphorical, of a coal pit; eking out his slender earnings by mending the boots of his fellow workmen and occasionally a watch or clock.

Sir Humphry Davy, who was described as an "idle and incorrigible schoolboy," was apprenticed to an obscure apothecary in Penzance; he afterward became assistant in the laboratory of Dr. Beddoes, of the Hotwells, Bristol, well known to my father, who was then serving his apprenticeship at the same place, but I cannot discover that he knew anything of the Doctor's more illustrious subordinate.

Faraday's father was a Yorkshire blacksmith, who migrated to London, presumably in search of work, and Faraday himself was apprenticed to a bookbinder. A chance attendance upon four lectures by Sir Humphry Davy was the immediate cause of his directing his attention to science, and he was some time after introduced to the Laboratory of the Royal Institution through Davy's instrumentality.

Benjamin Franklin made his first entry into Philadelphia, a poor lad, with all his possessions upon his back and a dollar in his pocket. As Mark Twain depreciatingly remarks, "Anybody might have done that; the only difficulty is to have the dollar." But how few out of the millions who have begun life with a dollar, or even with less, have arrived to be Franklins!

On the other hand, it seems absolutely immaterial with what seemingly insuperable disadvantages genius may be oppressed; it *will* make its way to the surface and triumph over all.

Can industry then supply the place of genius? Emphatically, No! Industry may compensate for paucity of talent; for talent, as we have said, is a common heritage, and its presence or absence is a matter of degree, and whatever results are attributed to talent are the joint product of talent multiplied by industry.

"Genius" is as a living organism, instinct with its own life, performing its appointed functions spontaneously, as of necessity.

"Talent" is an elaborate engine, skillfully devised to move many wheels and to perform divers works, but wanting the motive power.

"Industry" is the motive power.—*R. W. Giles.*

The Captive Dolphin.

The whale which was found by a fisherman in Selsea Bay some six weeks since, and presented to the Brighton Aquarium, is, says *Nature*, a valuable addition to that establishment. Although undoubtedly belonging to the whale family, competent authorities have pronounced it to be a bottle-nosed dolphin, a creature rarely to be seen alive in an aquarium. It has been placed in a tank which holds 100,000 gallons of water, and is 110 feet in length, so that the animal, which is ten feet long, has some amount of freedom. It seems to be doing quite well, for not only has it not lost in bulk since its capture, but has even gained, weighing now more than eight hundredweight. It is very tame, taking its food from the attendant. At present it subsists upon mackerel, that being the food most easily obtained just now. Of these it takes five meals each day, and manages to eat some four hundred of them during a week. The mackerel season is, however, almost over, and some other diet must be found for the animal, perhaps herrings. When first placed in the tank, it retreated to one end. After a week's sojourn there, it sought the other end of the tank. Here it remains swimming in circles. When swimming it keeps close to the surface of the water, moving through it with a graceful undulating movement, coming now and again to the surface, and taking in a fresh supply of air about every third or fourth time it thus rises. The animal is certainly an interesting acquisition to the aquarium.

Substitute for Rubber.

A composition has been invented by MM. Dankworth and Landers, of St. Petersburg, which is reported to be tough, elastic, waterproof, insulating—in short, a nearly sufficient substitute for India rubber. It is composed of a mixture of wood and coal tar, linseed oil, ozokerite, spermaceti, and sulphur, which are thoroughly mixed and heated for a long time in large vessels by means of superheated steam.

Dowel Making and Doweling.

The method of putting things together by means of dowels, or doweling, as it is termed, is one of the utmost importance, and is required in some part or other of nearly all articles of furniture. I shall describe, first, the manner of making them, and then give a few directions for their use.

For making dowels you must select a *strong* and *tough* wood. The best for the purpose is *beech*, although oak or walnut will answer very well for some purposes; it must be *straight* grained, as straight as you can possibly obtain it, and *thoroughly dry*. The dowels are made in various sizes; those most generally in use are ⅛ in., ¼ in., ⅜ in., and ½ in. in diameter, according to requirements, a size very nearly ¼ in. diameter (about that of an ordinary lead pencil) being very useful. You must purchase or make a dowel plate. They are sold with holes in them for making three or four different sizes, but it is not a very difficult matter to make one out of a piece of iron ⅛ inch or so thick by punching a hole in it, and enlarging it to the size you require. You will want a brace and the necessary bits to correspond with the plate holes; now mark your wood out; about 10 in. or 11 in. lengths are the most handy to work, and the widths should be rather more than the diameter you intend the dowel to be.

Having cut out the lengths, plane them up *square*, then take off *each corner* of the square with the plane, so as to get them to correspond nearly with the holes. The best way to do this, which is rather an awkward job, is the following: Get a piece of pine ⅞ in. thick, 2½ or 3 in. wide, and about 2 in. longer than your dowel lengths; straighten one edge of it, and mark a ¼ in. margin each side upon it; from this cut inwardly on the *bevel* to a depth of ¼ or ⅜ in. This will give you a V-shaped groove. You may cut it out throughout its length, and put a screw or pin in one end to form a stop; but it is better to leave ½ in. *square* at one end, and to cut the groove the remainder of length. This placed in the bench screw, and you will find your length will lie in it while you plane off the corners; you can then reverse and proceed until all are completed. It is necessary to take a *little more*—about two or three shavings—off *one corner*, it is immaterial which, than off the remainder.

I shall explain the reason for this presently. Having done this, take the dowel plate. You will notice that the holes on one side of it are larger around the apertures than the other; rest it with this side upward, upon the bench over a hole, underneath the one you intend using, and drive the lengths *steadily* through. You must commence carefully, holding the length with the left hand *near* the *bottom*, while you tap it *gently* with the hammer with the right until you get it fairly entered. Then go on more firmly. When you have driven it through rather more than the thickness of the bench, you will find it better to hold the length from the *underneath* side, as this will prevent the plate from jarring. The lengths should not go through without a *moderate* amount of driving force, and on the other hand they must not require *too much*, or they will be likely to break without going through. A little practice will familiarize you with this; but it is better at first to use your lengths a little shorter than I have previously recommended, and you will be less likely to break them. You must take care to keep them as *upright* as possible, and hit them fairly on the top. When made, they should, when looked at endways, or in section anywhere, be circular in appearance, and fit the plate hole tightly *with the exception of that portion where the additional amount was taken off the square corner, which should now appear a trifle off.*

Before doweling anything, it is necessary that the various parts intended to be secured by this method should first be fitted *exactly* in the position they are to ultimately remain in. Suppose, for example, we have the head of a desk, the top of a cabinet, or anything of a similar nature we wish to dowel. It is first accurately fitted and placed in position. Now, take a marking awl and mark lightly—a small mark ⅛ in. long is sufficient—*on the outside edge of the carcass*, one or two or as many points as you require dowels. You must, of course, be guided by the requirements of your work; a distance of from 4 in. to 6. in apart answers generally very well; but use sufficient to make it *quite secure.* When marking these points on the carcass, mark the top to correspond at the same time, by simply drawing the awl *upward* and marking it on its *underneath side*, taking care that it does not *move or shift* at all while marking. Then *gauge* on each, setting the gauge so that it will mark in such a position that you can bore with safety, not *too near the edge* or where there is any likelihood of *splitting* anything. From the previous markings draw a line at *right angles* to the gauged mark until it *meets* it. This is done by running a square along it. The points where these *two lines meet* will be those for the center of the dowel and its corresponding hole. In some cases, you will easily be able to find examples. We can obtain the position in this way:

Take the piece of work to be doweled, and consider the most suitable place for them. Mark this, and bore a hole in it with a fine bradawl; now, get a needle point, or a tack with the head knocked off, insert it in this hole, and give it a gentle tap; carefully press it home, and it will mark the required spot. This method is more applicable where some part of the work acts as a support to the other, and you merely want a dowel or so to steady it; like a piece of carving or fretwork. Our points being now all marked, bore the holes with a centerbit the size of dowel you intend using. Do not use them *too large.* If you are doweling into ⅝ in. or 1 in. stuff, use *edgeways.* A ¼ in. or ⅜ in. is *quite large enough.* If you have not one the *same* size, use a *smaller*. You can then enlarge this with a *quillbit*, and remove the core produced by boring with a *nosebit.* Bore them *perfectly upright.* The depth will vary, according to circumstances, from ⅝ in. to 1 in. In some cases, it is immaterial how deep you bore; in others, this must be carefully attended to, because a hole bored right through might disfigure your work.

It is best to drive the dowels *first* into that part of the work where you *can bore deepest.* You must glue the *holes* well with good, hot glue. You will find a piece of iron wire very useful for this, and it can be used repeatedly, as the dried glue left on it after using will not adhere to the metallic surface. Now take your *dowel length*, and drive it into the hole, until it is home, and will go no further. You will notice while driving in, that the glue and air will escape from that portion of the hole where the dowel, as previously described, *does not quite fit.* If this were not so, the driving force necessary would, in all probability, split the wood around. You must saw the lengths off now, leaving sufficient to fill the other holes you have bored. If you cannot judge the requisite length sufficiently accurate with your eye, measure it, and do not get them *too long.* After sawing off, remove all the edges and *round* the top of the dowel with a rasp. It is best just to try that the holes are right, and the work in right position, by knocking it on temporarily. If so, glue the *holes* and put the parts together, press them firmly down to each other, and get a close join. If you have any difficulty in this, it is better to apply *gentle pressure* by using a hand screw or cramp to *force them together* than to *strike them* with a hammer or anything.—*Building News.*

The Wrinkling Strain of Pillars.

It is not often that pillars are made of thin plate iron; but as the failure of pillars of this kind is analogous to that of plate girders, the student of construction may profitably consider the question of wrinkling strain. A plate iron pillar may fail in one of three ways: (1) by crushing, (2) by flexure, and (3) by wrinkling, each of these modes being governed by laws peculiar to itself. It is seldom that a pillar fails by crushing, as it is generally made of a proportion in which simple compression does not come into play. More generally a pillar yields by both bending and crushing, but in plate iron pillars failure may take place first by wrinkling or corrugation. A pillar made of wrought iron plates of a size that would prevent failure by flexure ought to have the plates of sufficient thickness to prevent wrinkling. Let us imagine a stanchion of [section formed by plates. It is readily conceived that the unsupported edges would wrinkle. It is found by experiment that the edges of such a section would fail by wrinkling unless the distance of the unsupported edges is small.

Mr. T. Box, in his treatise on "Strength of Materials," illustrates this strain by an example of a rectangular pillar of thin wrought iron plates both ends flat, 8·1 inches × 4·1 inches external dimensions, with a thickness of 0·061, and a length of 2⅛ feet. By calculation, this pillar would fail with 1,173 tons, or 766 tons per square inch. But the absolute crushing weight of wrought iron in pillars is only 19 tons per square inch, or one-fortieth of the theoretical breaking weight by flexure. Even this reduced strain was not borne by the pillar, as it actually failed by wrinkling with 7·108 tons per square inch, or little more than one-third of the crushing strain; the ratios of the strains being, by wrinkling 1·0, by crushing 2·7, and by flexure 108. The actual breaking load in this case was only $\frac{1}{108}$ of the bending strength. By increasing the length of the pillar, flexure may become the principal source of weakness, its resistance to that being so reduced until it became less than the wrinkling strain. It often happens in practice that a pillar gives way partly by flexure and partly by wrinkling—a mixed result being obtained. Thus, in studying the laws of wrinkling strain, the experiments are made on short pillars, where flexure cannot come into play.

Mr. Hodgkinson's experiments may be expressed by the following rule for the compressive strain in tons per square inch, with which the plate will wrinkle: $W = \sqrt{t + b} \times M$, where W = the compressive strain in tons per square inch, t = the thickness of the plate in inches, and b the breadth in inches of a plate supported at both edges, as in a square pillar; M = the multiple found from experiment, the mean value of which is 80 for rectangular pillars. In a pillar of this kind the plates would be joined at the corners by angle irons, then the breadth is measured between the edges of the angle pieces. Hodgkinson's experiments have clearly demonstrated that the wrinkling strain is independent of the length of plate. Experience has also shown that in long plate pillars the plate often fails near the end. As Mr. Box observes, the crushing strain due to flexure is a maximum at the center, and at the ends it is *nil*; but the crushing strain of direct pressure is the same from end to end.

The best plan of strengthening plate iron against wrinkling is by the addition of angle irons or ribs, which practically reduce the breadth of plate. A center rib, for instance, reduces the width to half, and the wrinkling strain is decreased 41 per cent. Indeed, the object in all structures composed of thin plate iron, like pillars and beams, is to reduce the practical breadth of the unsupported plate by cellular arrangements, by ribs, or otherwise, such that the wrinkling strain shall be made equal to the crushing strain, or 19 tons per square inch. Those who wish to study the subject of wrinkling strain will find it handled in a masterly and exhaustive manner in Mr. Box's treatise. Thin plate iron pillars are seldom used by the architect; but the engineer resorts to them in the piers of bridges and other purposes, and he will find the addition of angle iron stiffeners increase the strength in a direct ratio.—*Building News.*

New Rules for the Shipment of Explosives.

Commissioner J. W. Midgley has issued the following circular, under date of July 21, for the use of the railroads in the Southwestern Railroad Association, Iowa Trunk Line Association, and Colorado Traffic Association:

Shipments of Hercules powder, Atlas powder, giant powder, and other explosives of which nitro-glycerine forms the basis, when subject to the above associations, except California, will hereafter be transported on the following conditions and at the following classification:

1. That, at the cost of shippers, the bottom of the car containing the above mentioned explosives must be covered to the depth of at least two inches with sawdust, to absorb possible leakage.

2. That the packages containing the explosives shall be so placed and loaded that the cartridges shall always lie on their sides and not on their ends.

3. That the cars shall be so marked, on both sides and ends, that those who will have charge of them will not do anything ignorantly to incur danger.

4. In less than car loads, this property will be received (when made into cartridges only, and not in bulk under any circumstances) on the following conditions:

Packed in wooden cases, in cartridges, each case not exceeding 100 pounds, nor less than 5 pounds of explosives, provided that such explosives are packed in dry sawdust, as follows:

Each cartridge shall be surrounded on all sides with dry sawdust, and all interstices between such cartridges and a space of at least one inch between the outer side of such cartridge and the inner side of the case shall be filled with dry sawdust. Each of these cases shall be plainly marked on at least three of its sides with the name of its contents and "Explosives—Dangerous," so as to be readily seen by those who are to handle it.

5. In no case must the caps, fuse, or exploders used for exploding these powders be loaded in the same car with the explosives, and under no circumstances will the cars be received if so loaded.

6. Any and all nitrate or other explosive preparations not in accordance with such specifications (except ordinary black powder) will in no case be received for shipment.

7. All loss or damage to such property that may result from explosion or from a disregard of any of the above conditions by shippers or by the agents of the lines comprised in the above associations must be assumed by the shipper or owner.

8. Under the above conditions, the rates will be: In quantities less than car loads, actual weight, twice first class; in car loads, actual weight, minimum 20,000 pounds per car, first class. No shipment will be rated at less than 100 pounds.

The right of any of the railroad companies comprised in the above associations to refuse to receive high explosives for transportation under any circumstances is reserved.

This circular is a most important one, as heretofore high explosives were not mentioned in the tariffs of these associations, being accepted by the different lines at special rates.

Mexican Railroads.

The *Mexican Financier* gives the following list from official sources of the railroads completed in Mexico up to the end of April:

		Miles.
Tlascala Railroad		2·50
Orizaba-Ingenio		3·00
Mitla		3 75
San Andres		7·00
Tlalmanalco		9 00
Puebla and Matamoras Izucar		19·00
San Martin		23·00
Tehuacan-Esperanza		31 00
Tehuantepec		31·00
Sinaloa and Durango		36 00
Vera Cruz-Medellin		39·00
Hidalgo Railroad		56·00
Puebla-San Marcos		57·00
Yucatan lines		68·00
Mexico-Tlalputalpam		75·00
Sonora Railway, Guaymas to Nogales		234·00
Interoceanic, Mexico to Cuantla and branches		183·00
Mexican National, Mexico to Acambaro	178·00	
Laredo southward	208·00	
Branches	87·00	
		473·00
Mexican Central, Mexico to Lagos	311·00	
Paso del Norte to Chihuahua	302·00	
Tampico to San Luis Potosi	62·50	
		675·50
Mexican Railway, Vera Cruz to Mexico	264·00	
Puebla and Jalapa branches	89·50	
		353·50
Total		2,379·25

The table foots 2,379¼ miles, although the *Financier* gives the total completed road at 2,437 miles. The Mexican National, the Interoceanic, the Hildago, and the Yucatan lines are narrow gauge, the rest standard gauge. A number of the shorter lines given above are worked by horse power, and some of them have been in existence a long time.

Hydrokinone, a New Developer for Gelatine Plates.

BY EDWIN BANKS.

Hydroquinone, or hydrokinone, or quinol—for it is known by all these names—partakes very much of the nature of and is closely allied to pyrogallol. Like pyrogallol, it is a derivative of benzine. The solution of it is neutral to litmus paper. It has a powerful attraction for oxygen, absorbing it when dissolved in water from the atmosphere, and more rapidly when rendered alkaline, though in neither case does it do so as rapidly as pyro; hence its solution will keep better, and, when mixed with alkali, retain its developing power a longer time than pyro. The chemical formula is also very similar. Pyrogallol has $C_6H_3(OH)_3$, and quinol $C_6H_4(OH)_2$; so that, it will be observed, while each contains six atoms of carbon and six atoms of hydrogen, which is the composition of benzine, pyrogallic contains three atoms of oxygen and quinol only two. Another resemblance to pyro consists in the fact that both exist in nature in certain vegetable productions; pyro exists as gallic acid in gall-nuts and oak bark, and quinol as arbutive in the leaves of the arbutus, or berberry, and other *Ericaceæ*.

Commercially, quinol is made from aniline and from carbolic acid, both also benzine derivatives. It is first obtained as quinone ($C_6H_4O_2$) by the oxidation of aniline. One part of aniline is dissolved in eight parts of sulphuric acid diluted with twice its bulk of water. After cooling, a saturated solution of two and a half parts of bichromate of potassium is added very gradually to avoid too great rise in temperature. At first a thick, pulpy mass of aniline black is formed, the reaction being the same as that which takes place in the aniline printing process. This shortly changes to a dirty brown solution. It is then treated with sulphurous acid in excess, when quinol or hydrokinone is formed. This is extracted from a solution by ether, and on evaporation crude quinol is left. Other methods are given, but sufficient has been said to give an idea of its nature. Its characteristics as a developer are of the most interest to photographers.

Captain Abney, who, I believe, was the first in this country to draw attention to its developing power, says that it is twice as powerful as pyro. It is very certain that it will bring out a fully developed picture with at least half the exposure necessary when pyro is employed. At first sight this appears strange when it is observed how much more powerfully pyro absorbs oxygen; but the explanation probably is in the fact that hydrokinone is more gradual in its action, and has a more "selective" power than pyro. With a collodio-bromide film, for instance, which is not so much protected from chemical action as a gelatine one, pyrogallic acts with such energy, when mixed with an alkali, that the whole film is reduced immediately, and no image, or only a faint one enveloped in fog, appears; hence there must be used a powerful restrainer to keep this action within bounds. A soluble bromide, which is usually used, has this effect, but, unfortunately, at the same time, partially undoes the work which the light has done, rendering it necessary to give longer exposure. But with hydrokinone no restrainer is necessary unless a great error in exposure has been made. It does its work rapidly and clean, in this resembling the ferrous oxalate; it does not discolor during development so much as pyro, and consequently does not stain the film so much, while full printing vigor is very easily obtained without having to resort to intensification. The color and general appearance of the negative are more like the wet-plate process, since the shadows remain so clear and free from fog. It seems almost impossible to fog a plate with it.

A collodio-bromide, or even a collodio-chloride, plate exposed in the camera will develop clean and rapidly without any restrainer. This property of developing a chloride is very surprising, and will probably be very important. I have tried a collodion containing all chloride, with no trace of iodide or bromide or of free silver, and in the camera it is nearly, if not quite, as rapid as a bromide when developed with hydrokinone and an alkali; while I think it has the advantage in roundness and vigor. One grain to the ounce is strong enough for most purposes. With some samples of hard gelatine it is advisable to use two; but with most kinds and with collodion one grain is quite sufficient. I prefer using it with a saturated solution of washing soda as an alkali. Two or three drops of this to the ounce of solution of hydrokinone rapidly develops the image, and the addition of a few drops more to complete development is all that is needed. A soluble bromide acts very powerfully as a retarder and restrainer. With a mere trace added, development is very much slower.

Although its cost per ounce is greater than pyro, an ounce of it will go as far as two of pyro, so the difference is not so much as it appears. No doubt, if a demand sprang up for it the price would also be reduced considerably. Many of you, I dare say, can remember the time when pyro was seven shillings and sixpence per ounce, and hypo two shillings per pound; but greater consumption, and consequent demand for them, soon brought these prices down. The same will doubtless take place when the value of hydrokinone becomes recognized.

I must not omit to mention, before concluding, another useful property of this developer—that is, its suitability for developing on paper either a bromide or a chloride film, whether it be produced by an emulsion, or by the older method of first brushing over the paper the haloid, and afterward the silver. The clearness with which it works renders it very suitable for this purpose, and for enlargement or printing enables pictures to be obtained with very short exposures.

Steel in its Relation to Modern Guns.

At a recent meeting of a number of artillery and naval officers at Karlsborg, Sweden, Captain John Bratt, of the Swedish artillery, read a paper on "The Steel Industry and its Relation to the Manufacture of Modern Guns." The author has for many years been the government inspector of Swedish gun factories, and has paid many visits to the gun factories of Russia, Germany, and France. In his paper, having given an account of the importance of iron in modern civilization, the author stated that there was no other raw material which had been subjected to such a successful process of refining.

It was in its most important and interesting form, viz., steel, that he intended to deal with it on this occasion.

Captain Bratt proceeded to show, by drawings and diagrams, the metallurgical processes and methods of refining in use at the present moment. Having referred to the various kinds of steel and their manufacture, the author urged the necessity of subjecting all cast steel, of whatever kind, to a mechanical process of treatment by which the cavities which are caused by the gases contained in every steel bath are entirely removed. The steel, he said, should be perfectly close and homogeneous in order to be suitable for manufacture.

The means of obtaining this indispensable quality was the steam hammer. The largest at present in use were those at Le Creusot, Essen, and Perm (Russia). The latter rested on the largest block of cast iron in the world. It had a cubic contents of 83 cubic meters, and contained 700 tons of pig-iron. The difficulties, the cost, and, in some instances, the danger of forging great blocks of steel made it a matter of moment to discover some method whereby the gases in the bath might be removed and a homogeneous steel produced.

Such a method was discovered in 1870, and had been perfected at Terre-Noire, and consisted chiefly in adding a flux of silicon in the Martin furnace immediately before the steel is tapped. The author showed some samples of steel made at Bofors, in Sweden, by that method. One was taken from the hearth immediately before, and the other just after, the silicon was added. The former had a surface similar to a fracture, and was covered with blisters, whereas that of the latter was perfectly smooth. The Bofors Ironworks were the first Swedish works which had procured the Terra-Noire patent, and thus the first producers of this kind of steel in Sweden; and the method had a special interest to those assembled by the fact that guns of Bofors steel had been manufactured with the most satisfactory result, which led him to believe that Sweden would very soon make her own guns.

The author next gave an account of Krupp's manufacture of forged steel guns. The Essen works had in 1845 employed 72 men; in 1882 their number was 16,000, while some years ago they had in five months turned out no less than 1,400 pieces of artillery. In twenty-four hours the works could roll sufficient rails for a Swedish mile of railway (six English miles). Captain Bratt then referred to his personal study of the Krupp method. He had been present at the casting of guns at the foundry which had been established by Messrs. Krupp near St. Petersburg. He stated that the ingots for some of the largest guns numbered up to 500.

He then described the heating of the metal for forging, and the difficulties attending this operation, the forging under the steam hammer, whereby the cast metal is compressed to under four times its original size, and, finally, how the gun, after being bored and turned, is made red-hot and hardened in oil. The author next gave an account of the experiments which had during the last few years been made in Sweden, to solve the question of producing first-class guns of close cast steel by the Terre-Noire method.

The trials made included the bursting of a smooth-bore 4-lb. muzzle loading gun. It had shown a very high degree of resistance, and had, in fact, only been burst by loading it right up to the muzzle. No less than 1,041 shots had been fired from a 12-centimeter rifled breech-loader, which was at last burst under the excessive pressure in the chamber of 5,500 atmospheres, while the normal one was from 2,000 to 2,100. The last experiment was the firing of three 8-centimeter guns of the new model gun of the Swedish artillery. Each of these guns had, without suffering in the least degree, fired 2,000 shots, with normal charges.

Two of them were then, after 152 and 154 attempts had been made, burst, under a pressure in the chamber of 5,000 atmospheres, the normal one being 1,800. The third gun could not be burst, but only cracked in the breech. All these guns had been cast at Bofors, and were finished at the gun factory at Finspong. In conclusion, Captain Bratt stated that lately a competition had sprung up between these two works, which had before worked in concord. This was caused by the fact that the problem whether first-rate steel guns could be made in Sweden had been solved, and that these two works desired in future to be independent of each other in gun making. At Bofors there was now erecting the plant required for finishing guns, and at Finspong a steel foundry. Both had received orders from the government, and he trusted that at no distant date they would receive them also from foreign governments.

PHYSICIANS say that ginger ale is a poor substitute for water, because the capsicum it contains irritates the lining of the stomach and produces dangerous inflammation.

The Pollution of Streams.

Possibly the matter will, some time, attain importance enough to question the present assumption of municipal and other corporations of the right to use any flowing stream as an open air sewer. In Hartford, Conn., this aspect of the question has assumed a serious character. A stream called Park River, an affluent of the Connecticut River, receives the principal portion of the sewage of the city of New Britain, the sewage of not less than ten manufactories within the limits of Hartford, and then courses the boundaries of the Bushnell Park, on which stands the Capitol, receiving in its course around the park the emptyings of several of the principal sewers of the city. The result is an open sewer of the vilest description in the heart of the city. In the light of the common law and of recent decisions on this subject, it is possible that a suit by any individual citizen might not lie against the city as a corporation for permitting the befoulment of the stream to the annoyance of passengers on the streets and visitors to the park.

A case was recently tried in the Supreme Court of New York, in which the plaintiff sued the city of Rochester for damage to him by reason of sewage poured into a stream that flowed through his land, the water being used for his cattle. The court gave him a verdict for damages. The judge decided that the plaintiff has a right to say that nobody shall increase the natural flow, nor can he be compelled to take any more drainage than flows by reason of the natural shape of the land, nor can the people above him turn anything into the stream which would not naturally flow there if left to its ordinary course. They cannot increase the area drained, the amount of the drainage, or send down into the stream any waters or things that would not naturally flow there.

The *Sanitary Engineer*, in summing up the common law on this subject, makes these points from authorities:

"The fact that the water of a stream has been polluted in a similar way for more than twenty years, does not confer a prescriptive right to continue it, particularly when the nuisance results from the *increase* of the pollution. The fact that a town has legislative authority to dispose of its sewage does not give it the right to discharge that sewage into a stream adapted for domestic use.

"The fact that a person owning property on the banks of a stream, and thereby owning an interest in the water, does not use the water for domestic purposes and has no desire to so use it, does not prevent him from bringing an action to protect himself against the acquirement by others of a prescriptive right to pollute the stream, and thereby depriving him of his right to receive the water unimpaired either in quality or quantity. The English precedents forbidding the contamination of streams by sewage are very numerous, and take the ground that the fact that the preservation of the health of a large city requires the removal of its sewage, and that this cannot be done except at great expense without discharging it into a stream, does not justify such discharge if there are even but a very few persons to be affected by the nuisance thus created. The city must either buy the rights of these few persons or compensate them for their violation."

Artesian Wells in Algeria.

In the south of the province of Constantine, Algeria, the boring of artesian wells, begun in 1856, was continued with renewed activity, after the interruption occasioned by the Franco-Prussian war, under the direction of M. Jus. At the end of 1879 the long line of wells following the Wady Rir, between Biskra and Tugurt, included 434 sunk by the Arabs, and yielding 64 000 liters a minute, and 68 bored by the French, yielding 113,000 liters. In the same decade, the number of palm trees in the oases had increased from 359,000 to 517,000; of fruit trees, from 40,000 to 90,000; of inhabitants, from 6,672 to 12,827. During the first half of 1880 twelve new wells were bored, yielding 22,000 liters, and, at the end of 1881, the total supply of water from these underground sources was 209,000 liters a minute.—*Rev. Geogr.*

A Bushel of Coal.

In consequence of the practice of peddlers of coal in Boston of selling by means of short measure, getting retail price for three pecks of coal for a nominal bushel, a law has been passed specifying that in the sale by measure of coal in quantities less than five hundred pounds, the baskets or measures used shall be of a cylindrical form, of the following dimensions: nineteen inches in diameter in every part, and nine inches in depth, measured from the highest part of the bottom, each of which shall be deemed to be of the capacity of one bushel; or nineteen inches in diameter in every part, and four inches and one-half in depth, measured from the highest part of the bottom, each of which shall be deemed to be of the capacity of one-half bushel. Such measures, in selling, shall be filled level full, and shall be sealed by a sealer of the city or town in which the person using the same usually resides or does business.

Artificial Filtering Stone.

K. Steinman, in *Tiefenfurt bei Gorlitz*, proposes filtering plates from the following mixture:

Clay	10 parts or	10 or	15
Levigated chalk	1	1	1
Glass sand, coarse	55	..	.
" fine	..	25	65
Ground flint	..	30	5

The ingredients are mixed thoroughly in water, moulded, and hard burnt.—*Dingler's Journal.*